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# ENCEPHALARTOS

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# CYCAD SOCIETY OF SOUTH AFRICA BROODBOOMVERENIGING VAN SUID-AFRIKA

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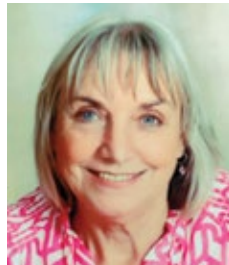
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# ENCEPHALARTOS

Tydskrif van die Broodboomvereniging van Suid-Afrika

## ON THE COVER:

*Encephalartos altensteinii* in habitat in the Kei River drainage system in the Eastern Cape. Photo by Cornell Beukes of Babylonstoren, 19 April 2023.

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# FROM THE COUNCIL / VAN DIE RAAD

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## VAN DIE PRESIDENT/FROM THE PRESIDENT

Dis tyd vir 'n uitgawe van ENCEPHALARTOS!

Dit bly 'n stryd om artikels, nuusbrokkies en briewe te kry om te publiseer in ons nuusbrief en die redakteurspos is reeds geruime tyd vakant. Die gedrukte media is onder druk en die internet neem oor met vinnige antwoorde en inligting, al is dit nie altyd nuttige antwoorde of inligting nie. Waar laat dit die Vereniging? Kommunikasie met mede versamelaars en entoesiaste gee waarde aan die Vereniging, asook die nuusbrief wat ons publiseer met nuus van lede, nuwe spesies, nuwe tegnieke en gebeurtenisse.

Daar word steeds gewerk om die konstitusie te moderniseer en dit word hopelik binnekort publiseer. Ons webtuiste kry aandag en ons moet bestuurprosesse en die betaal en kontroleer van ledegeld makliker maak. Lede wat wil help bly skaars.

Almal is bewus van die onlangs gepubliseerde nuwe wetgewing wat net so vinnig weer teruggetrek is. Ons net hoop die prosesse word gevolg en regstellings gemaak voor dit weer publiseer word!

Geniet ENCEPHALARTOS en dra asseblief by.

Beste groete  
Wynand van Eeden

An edition of ENCEPHALARTOS is due!

Getting articles, letters, and news to publish in our newsletter remains problematic whilst the position of editor is still vacant. The printed media is under pressure from the internet which provides fast answers and information, although not always useful. Where does this leave the Society? The value of any society lies in communication with fellow collectors, growers, and enthusiasts, as well as the newsletter we publish with news from branches, events, new species, and techniques.

A new more modern constitution still in being worked on and our website is getting attention too. We must make running the society easier, improve payment features and record keeping and find good people to help, if we want to survive.

Most, if not all local members, will know about the new regulations published recently and then quickly withdrawn. Hopefully the processes will be followed, and corrections made before it is published again!

Enjoy ENCEPHALARTOS and please contribute.

Kind regards  
Wynand van Eeden

## IN MEMORIAM:

### ART VOGEL (1949–2020)

It is not often that one gets the chance to meet a truly exceptional human being. I had this opportunity when I met Art in 2015. Art was the head of Greenhouses of the Hortus Botanicus, Leiden. He was a modest and friendly botanist, who knew plants very well.

I spend a fantastic week in the field with Art and other cycad friends in Colombia on the pre-conference tour before CYCAD 2015. To say Art was a walking plant encyclopaedia is an accurate description of him. He had an immense knowledge of plants in general and when a new species was stumbled upon, he was always ready with questions and answers to guide one to an identification.

The second field trip with Art was in South Africa after CYCAD 2018. I had the privilege to guide a group of people on the post-conference tour and Art was one of them. Days were spent hiking in cycad habitat, enjoying nature and in the evenings great friendships were forged. Always the gentleman, Art will be sorely missed on cycad tours!

Wynand van Eeden



Figure 1. Art Vogel in habitat, having lunch, at La Plata, Bahia Malaga, Colombia, during the pre-conference tour in 2015. Photo: Piet Vorster

### GEORGE SPARKMAN (DECEMBER 30, 1959–JUNE 5, 2020)

The post-conference tour group included another friend, one that was always found in front of the rest, doing his best to see everything there was to see. George Sparkman, also known as The Duke of Denim, had endless energy. A lasting memory of George is his denim clad silhouette disappearing over the horizon, in search of the next cycad to see, feel and inspect.

George was born in Florida, USA and grew up in Germany where he married his wife Gisela. They returned to the US and lived in Fallbrook, California. Amongst other endeavours, George was a farmer and cycad grower. Like most plant people, he was an interesting person, smart and knowledgeable, with a dry sense of humour. In the early days of synthesizer music, George made electronic sounds or tunes, used by bands in the 1970's and 80's. Kraftwerk, one such German band featuring his creativity, will always remind me of George.



Figure 2. George Sparkman talking to Philip Rousseau at CYCAD 2015 in Medellin, Colombia.

George was always willing to share his knowledge and experience and many gardens have cycads and palms that came from his nursery. George will be greatly missed by all his friends.

Wynand van Eeden

## DR. NATHALIE NAGALINGUM

Nathalie was a treasured friend and a brilliant, inspiring scientist. Her research has had an indelible impact on our field; it is no exaggeration to say that she fundamentally shaped the way we think about cycads and their evolutionary trajectory. Moreover, Nathalie's capacity to innovate - coupled with her openness to fresh ideas and new techniques - insured that her research was always at the cutting edge. This boundary pushing has in turn benefited so many of us through collaboration and inspiration.

While Nathalie took deserved pride in these scholarly achievements, I believe an even deeper satisfaction came from her work as a mentor and advocate. Nathalie was keenly aware of the many ways in which science remains an exclusive domain. With courage and wit, she challenged assumptions, broke barriers and enhanced opportunity and inclusion in botany. In keeping with this, Nathalie was an amazing mentor; even in the last months of her life, she summoned energy to continue serving in this capacity.

As anyone who has enjoyed her talks, videos or podcasts can attest, Nathalie was also a wonderful science communicator. I have watched her hold a packed conference session in rapt attention, dissolve a roomful of students into laughter and enthrall non-specialists with engaging botanical discourse. Nathalie was so passionate, so dynamic that she could inspire just about anyone to appreciate the exquisite diversity of the plant kingdom. She also infused interactions with her warm spirit and the endless curiosity that so defined her as a scientist. For the myriad people with whom she connected, Nathalie offered something far more than a fascinating science narrative; she offered a nudge,



Figure 3. Natalie Nagalingum.

a coaxing... a gift. She reminded us to slow down, to look around and to marvel at the astonishing beauty and complexity of the natural world. She encouraged us to ask questions, and to be guided by our own passions and curiosities.

Today I encourage you to take time to honor this remarkable woman.

In warmth and community,  
Vanessa Handley

## PAUL KENNEDY (1936–2020)

It is with a heavy heart that I must report the passing of a long time member from Australia, Paul Kennedy.

Paul was born on 20 October 1936 and passed away on 18 November 2020. Of those 85 years, the last 42 involved cycads in some way, whether it was growing, researching, corresponding or habitat visits, amongst other things. Paul introduced me to the world of cycads all those years ago and we remained friends to the end.

Paul's interest began when there was scant information on cycads available to the average person, which just fuelled his passion for finding out anything and everything cycad related. During these early years Paul, who worked for Australian Customs at the time, used the time productively to correspond with people around the globe after using the phone book to locate leads such as nurseries and/or gardens. This determination found many

contacts, which Paul followed up, resulting in seed and information trading across the globe. Then, globally, as more interest in cycads became the norm, books were written about them, and research was commenced in earnest by various botanists and authors. It was during this time that Paul accompanied many visiting cycad enthusiasts on outback tours of the cycads of New South Wales, having first made the localities known to him through his inquisitiveness. I was fortunate to accompany Paul on numerous trips and I am truly grateful for this experience.

Paul relished driving through the countryside, but I dare say, as long as there was the reward of locating another cycad along the way. Indeed, cycads were part of Paul's existence. I do recall some memorable moments on these field trips, where the goal was set to locate a particular plant and if something disrupted those plans along the way, then he wouldn't be fazed at all. Once driving on some remote fire trail, in a normal



Figure 4. Craig Thompson, Paul Kennedy, Cynthia Giddy and Elsa Vorster in Australia, 1990 (photograph: Piet Vorster).

car, the road degenerated into a two-wheel track that went up an incredibly steep mountainside, with the corresponding vertical drop on one side, only to be confronted with a fallen tree across the track. No way forward and the only solution to reverse. Not a problem for Paul, who just drove down backwards for kilometers, with one hand on the steering wheel and the other hand across the seat, whilst looking out the rear window. It was one of the scariest days of my life, but there were many more in the ensuing years.

Whilst Paul passed away during the pandemic of 2020, he did not die from it. Paul developed dementia during the last few years and finally succumbed to it whilst in care. He is survived by his loving wife Margaret, daughter Jo, son Glenn and his wife Amy and his two grandchildren Harry and Lucy. His other son Mark having predeceased Paul in a motorbike accident.

Paul was a friend, a generous soul, a fellow traveller who did what he did with passion, bravado and humility.

He will be sorely missed but his memory will live long with the words he has written and the cycads he helped mature. May he rest in peace.

Craig Thompson  
Australia

[Paul was for many years the representative of the Cycad Society in Australia and New Zealand and the editor had the privilege to visit Paul in 2006. A few interesting fieldtrips followed, and Paul impressed with his knowledge of Australian cycads. The most memorable was visiting huge stands of *Macrozamia communis*, growing so densely that it is impossible to walk between them, let alone take a photograph. I had to climb into a nearby tree to get above the canopy of leaves. Paul was also the person who discovered that *Lepidozamia* is insect pollinated. See "Cycad-insect relationships" in *ENCEPHALARTOS* 27, pages 22 to 25 (September 1991).

## WAT GEBEUR IN DIE WES-KAAP?/ WHAT IS HAPPENING IN THE WESTERN CAPE?

Kobus van der Walt

Covid het 'n groot impak op mense se lewens gemaak, soms negatief maar soms ook positief. Mense het gou hulle lewenswyse en behoeftes verander soos ons broodbome ook maar oor die jare moes aanpas om te oorleef. Dit het soms vir my gevoel asof ons Vereniging 'n "slaaptydperk" beleef het.

Gedurende die "slaaptydperk" kon die Wes-Kaap tak geen byeenkomste reël nie. ENCEPHALARTOS was nie gepubliseer nie en kommunikasie met lede het byna tot stilstand gekom. Aan die positiewe kant, was die lede meer by hulle huise as ooit te vore en kon meer tyd in hulle tuine tussen die broodbome deurbring. Daar is seker niks so kalmerend as om deur jou tuin te stap en waar te neem hoe die plante oornag nuwe blare stoot, of hoe keëls uit die stam verskyn. Mense se behoeftes gereëld met ander te praat, het gelei tot die skepping van 'n WhatsApp groep. As lede nie kon kuier nie, kon die groep ten minste met mekaar gesels oor broodboomsake. Die tak se uitdaging is nou om die lede uit hulle huise te kry en broodboombyeenkomste by te woon soos werkswinkels en tuinbesoeke. Gelukkig is broodboommense almal natuurliefhebbers, wat na buite leef.

In Januarie 2022 het die Wes-Kaapse tak 'n besigheidsplan opgestel met 'n **visie** en **doelstellings** vir die volgende twee jaar. **Die tak se visie is die aanplanting, bewaring en beskerming van wettige en geneties suiwer broodbome in elke tuin.** Daar is gekyk na die tak se sterk punte, swakhede, bestaande geleenthede en bedreigings vir die tak se voortbestaan. Die voortbestaan van die tak word hoofsaaklik bepaal deur sy lede. Vir dié rede is daar gekyk na wat die lede se behoeftes is, asook die werwing van nuwe lede.

Na aanleiding van die besigheidsplan het die takbestuur besluit om op die volgende areas te konsentreer:

1. Kennisverbreding van broodboomtipes deur werkswinkels te reël, wat gratis vir lede sou wees.
2. Die bewaring van broodbome deur te voldoen aan wetgewingsvereistes en slegs wettige plante bekom.
3. Ondersteuning van broodboom navorsing en geïdentifiseerde projekte wat voldoen aan BVSA doelstellings (indien fondse beskikbaar is).
4. Skryf van artikels vir ENCEPHALARTOS.
5. Effektiewe kommunikasie. Bou van verhoudings met ander takke van die Vereniging asook organisasies met dieselfde doelstellings as ons Vereniging. Gereelde kontak met lede deur e-posse en die WhatsApp-groep.
6. Opstel van 'n jaarprogram, gemik op die fokusareas van die besigheidsplan.

Covid made a major impact on people's lives, in a positive and negative way. People's lives changed, as well as their way of living. Like cycads had to adapt and change to survive, it seemed to me that our association went into a "dormant" period during Covid.

During this "dormant" period the Western Cape branch could not organise any gatherings. ENCEPHALARTOS was not published and all communication with our members came to a standstill. The positive side is that during this period the people were at home and could spend more time in their gardens with their cycads. Observing the sudden flush of new leaves and the developing of cones from the stem, have a most calming effect. Most people prefer to communicate on a regular basis with each other. This led to the development of a WhatsApp group. If members could not meet, they could still chat about cycads on the WhatsApp group. The branch's challenge is now to get the people out of their houses and attend gatherings i.e., workshops and garden visits. Luckily our members are all nature lovers.

The Western Cape branch developed a business plan in January 2022 with a **vision** and **mission** for the next two years. **The branch vision is the planting, conservation, and protection of legal and genetically pure cycads in every garden.** The Branch also considered its strengths, weaknesses, opportunities, and the threats that can prevent the branch from continuing to exist. The survival of the branch is determined by its members. It is therefore important to address their needs and to recruit new members.

To address the business plan, the branch management decided to focus on the following areas:

1. Broaden members' knowledge of the different cycad species through workshops. The workshops would be free for members.
2. Conservation of cycads by complying with all legal requirements and acquiring only legal plants.
3. Support research and identify projects which comply with the Society's objectives (if funds are available).
4. Write articles for ENCEPHALARTOS.
5. Build relationships with other branches of the Society and other organisations with the same objectives, through effective communication. Keep in regular contact with members through e-mails and the WhatsApp group.
6. Prepare an annual program which that is in line with the focus areas of the business plan.

**The annual program kicked off on 26 March 2022 with its first workshop.** The ladies, Helene van der

**Op 26 Maart 2022 skop die jaarprogram af met die eerste werkswinkel.** Die dames, Helene van der Westhuyzen en Leandi Wessels van Cape Nature lig die lede in oor die **wetlike aspekte rakende beskermde plante.** Hulle bespreek die Natuurbewarings-ordonnansie, hoekom permitte benodig word en hoe jy te werk moet gaan om dit te verkry. Die verskillende aansoek permitte en algemene foute wat aansoekers maak is ook bespreek. Die dames beantwoord ook vrae oor die talle probleme wat lede met hul permitaansoeke het. Die werkswinkel het hopelik daarin geslaag om die vertrouensverhouding met Cape Nature te verbeter. Die uitwys van foute wat aansoekers maak sal ook help dat die uitreik van permitte gladder verloop.

Dit was duidelik gemaak aan die lede dat die verantwoordelikheid berus by die aansoeker rakende die wetlike aspekte van handel, vervoer en besit van beskermde en onbeskermde plantmateriaal. Elke permit het 'n vervaldatum en dit is die permithouer se verantwoordelikheid om die permit te hernu voor die vervaldatum. Persone wat met hulle broodbome verhuis na die Wes-Kaap, moet bo en behalwe hulle TOPS (Threatened or Protected Species) permit ook aansoek doen by Cape Nature vir 'n invoerpermit.

**Die eerste tuinbesoek was op 7 Mei 2022 by JC Lotter se huis,** een van ons jonger entoesiastiese lede met die spreekwoordelike groen vingers. Hy het redelik geëksperimenteer met verskillende grondmengsels en voedingstowwe van veral plante in potte, en asemrowende resultate gekry. Daar is baie opinies oor die gebruik van potte, en veral die belangrikheid van addisionele dreineringsgate om verstopping te verhoed. Gebruik van potte/houers met 'n ligte kleur, verbeter ook die groeiproses, want dit hou die wortels koel. Vir plante met ondergrondse stamme, moet 'n diep houer/pot gebruik word. Oordadige toeding van water was voedingstowwe soos kaliumsoute mettertyd uit grond en gee aanleiding tot kaliumgebrek in potplante. Ongelukkig het nie almal die spasie in hulle tuine om hulle plante in

Westhuyzen and Leandi Wessels, from Cape Nature informed the members about **the legal aspects regarding protected and endangered plants.** They discussed the Nature Conservation Ordinance, why you need a permit and the procedure to obtain a permit. The different application permits, and general mistakes made by applicants were also discussed. They addressed all questions regarding the applicants' problems with the permit applications. The workshop hopefully our confidence in Cape Nature. The pointing out of mistakes made by applicants will help to streamline the issuing of permits.

It was also made clear to members that it is their responsibility to acquaint themselves with all legislation pertaining to the trade, transport, and possession of protected and unprotected flora, that every permit has an expiry date, and that the onus is on the permit holder to apply for the renewal prior to expiration. A person with cycads who relocates to the Western Cape needs to apply for an import permit from Cape Nature, in addition to a TOPS (Threatened or Protected Species) permit.

**The first garden visit was on 7<sup>th</sup> May 2022 at the house of JC Lotter,** who is one of our enthusiastic members with proverbial green fingers. JC experimented with different soil mixes and nutritious matter for pot plants, achieving astonishing growth results. There are many opinions about using pots/containers for plants and the importance to provide additional drainage holes to prevent clogging. It is also recommended to use pots of light colour, as plants tend to grow better when their roots are kept cool. Deep pots/containers should be used for species with subterranean stems. Care should be taken not to apply excessive amounts of water which will leach out soluble mineral nutrients, such as potassium salts, from the soil. This may induce deficiencies in the plants. Not everyone is so fortunate to have space in their garden to plant their cycads in the ground, while others prefer to plant them in pots/containers. See in Figures 1 to 8 how the plant growth in the pots improved over short period.



Figure 1. *Encephalartos altensteinii*, May 2020.



Figure 2. *Encephalartos altensteinii*, June 2022.



Figure 3. *Encephalartos longifolius*, May 2019.



Figure 4. *Encephalartos longifolius*, June 2022.



Figure 5. *Encephalartos lehmannii*, May 2021.



Figure 6. *Encephalartos lehmannii*, June 2022.



Figure 7. *Encephalartos lehmannii*, May 2021.



Figure 8. *Encephalartos lehmannii*, June 2022.



Figuur 9. Reenjas vir potplante – dit is Pieter Nieuwoudt van Exclusive Plants se oplossing vir kokerbome in 'n hoe reeval area.

die grond te plant nie, en ander verkies plante in potte. Sien in Figure 1 tot 8 hoe JC se plante in potte “oornag” verander het.

Tydens die tuinbesoek is kennis en ondervinding uitgeruil en lede het gesellig verkeer en mekaar beter leer ken.

**Ons tweede werkswinkel het handel oor broodboom identifikasie en was gehou op 21 Mei 2022.** Dit het bestaan uit 'n teoretiese en praktiese deel. In die teoretiese gedeelte is daar gekyk na die eienskappe van verskillende broodboomsorte eienskappe soos silhoeëtte, die stam, die blare, pinnae en hul oriënteringshoeke, keëls, saad en plante se natuurlike habitat. Die inligting wat gedeel was, is alles verkry uit ENCEPEHALARTOS en gepubliseerde boeke wat handel oor broodbome. Die vorige uitgawes van ENCEPHALARTOS bevat baie goeie inligting oor broodbome. Ek sou aanbeveel dat dit meergereëld gelees word!

Die spesies wat bespreek is, was *Encephalartos inopinus*, *E. princeps*, *E. lehmannii*, *E. nubimontanus*, *E. cupidus*, *E. dyerianus*, *E. dolomiticus*, *E. middelburgensis*, *E. eugene-maraisii* en *E. hirsutus*. Voorbeelde van die verskillende plante se blare is saam met die skyfies gebruik in die aanbieding. Die hoofdoel van die werkswinkel was om geneties suiwer plante te identifiseer.

During the garden visit the members exchanged knowledge, experience and built good relationships.

**The second workshop dealt with cycad identification and was held on 21 May 2022.** It consisted of a theoretical and practical part. The theoretical part covered characteristics of the different plant species, such as its silhouette, stem, leaf, leaflet and orientation angles, cones, seed, and the plants' natural habitat. The information that was shared was obtained from ENCEPHALARTOS as well as from published books on cycads. Former issues of ENCEPHALARTOS contain very good information on cycads. I recommend that you read them again.

The identification module covered the following *Encephalartos* species: *E. inopinus*, *E. princeps*, *E. lehmannii*, *E. nubimontanus*, *E. cupidus*, *E. dyerianus*, *E. dolomiticus*, *E. middelburgensis*, *E. eugene-maraisii* and *E. hirsutus*. Slides were not the only means of identification but also cut leaves of the different plants as examples during the presentation. The aim of the workshop was to identify genetically pure plants. Our members purchase plants at enormous prices only to find out later that it is a hybrid. Members need to be vigilant and do their homework before purchasing plants. Plants do not always have a cone for identification, Therefore one should consider the other plant characteristics.

Cycads are not normally identified their its seeds. The identification workshop could not obtain any photos of *E. hirsutus* seeds. If you have a photo of a *E. hirsutus* seed, please send it to us to show our members.

Our practical part took place at Babylonstoren where the members could identify the different plants. Many questions were asked. Members were not afraid to share knowledge and experience. The workshop was also a refresher for all the members attending. Years of experience was shared with new members, and good relations were built between members.



Figuur 10. Kobus vd Walt besig met sy aanbieding oor broodboom-identifikasie.

Lede koop plante aan teen groot bedrae geld, om later uit te vind dat in werklikheid 'n hibried is. Lede word dus bewus gemaak van die feit dat hulle hul huiswerk goed moet doen voordat hulle plante aankoop. Plante het nie altyd 'n keël as dit te koop is nie, kyk dus goed na die ander eienskappe.

Hoewel 'n broodbloom nie normalweg volgens sy saad geïdentifiseer word nie, kon vir hierdie aanbieding geen fotos van *E. hirsutus* sade bekom word nie. Die lede sou graag wou sien hoe dit lyk. Indien u dalk so 'n foto het stuur dit asseblief vir ons aan.

Die praktiese gedeelte was 'n besoek aan Babylonstoren waar die lede die plante kon identifiseer. Baie vrae is gevra, en kennis en ondervinding is tussen lede gedeel. Die werkswinkel het daarin geslaag om lede se kennis te verbreed en verfris. Jarelange ondervinding is gedeel met nuwe lede. Lede het mekaar op sosiale vlak beter leer ken.

Ons **derde werkswinkel het gehandel oor die instandhouding van broodbome en was gehou op 25 Junie 2022**. Daar is gekyk na verskillende grondmengsels wat lede suksesvol gebruik in die winterreënval-streek, en veral die noodsaaklikheid van goeie dreinerings. Die tipes kompos, kunsmis en ander plantvoeding wat lede algemeen gebruik was ook 'n punt van bespreking. Daar was ook baie insette oor die verplanting van broodbome, verwydering van ou blare, en die verwydering en plant van suiers.

Laastens is daar gekyk na die identifisering en beheer van plantsiektes, insekbestryding, blaarparasiete, keëlparasiete, stam en wortel-parasiete, asook middels teen swamme en virusse wat lede algemeen gebruik. Toedieningskoerse is ook bespreek en die feit dat dit verkieslik in die oggend tydens koeler toestande toegedien moet word.

Die werkswinkel het in sy doel geslaag, want baie lede kon nou die siektes en plae in hulle tuine identifiseer en behandel. Daar was vir etlike dae na die werkswinkel



Figuur 12. 'n Pragtige *Encephalartos inopinus* van die tuin by Babylonstoren.



Figuur 11. Die lede bespreek die rede vir die staalstruktuur om die *Encephalartos woodii* tydens die besoek aan Babylonstoren.

**The third workshop dealt with maintenance of cycads and was held on 25<sup>th</sup> of June 2022.** Due to the winter rainfall in the Western Cape, plant roots are exposed to wet conditions for long periods which cause rotting. The importance of proper drainage of soil and the different mixtures members are using, was discussed. The different types of compost, fertiliser, and other plant nutrition was also a hot topic. A lot of input was given on the removal of old leaves, replanting of cycads and removal and planting of suckers.

The workshop also included the identification and control of plant diseases, insects, leaf parasites, cone parasites, stem and root parasites, as well as bacterial, fungal, and viral diseases. The members shared their practical experience on the remedies used to combat these diseases. The application rate of the different remedies and its effectiveness during the coolest time of the day, was discussed.

The workshop achieved in its goals, as members could henceforth identify the different pests and control them



Figuur 13. Ferdie Endemann besig met sy aanbieding oor instandhouding van broodbome.



Figuur 14. JC Lotter besig met sy aanbieding oor instandhouding van broodbome.



Figuur 15. Lede sit aandagtig en luister na die aanbiedings rondom broodboom instandhouding.

nog baie gesprekvoering en deel in kennis tussen lede, alles deur middel van die WhatsApp groep.

Die **tweede tuinbesoek was op 9 Julie 2022 by Kirstenbosch**. Die tak is deur Phakamani Xaba uitgenooi vir 'n tuinbesoek met die doel om die lede in te lig oor hulle werksaamhede en projekte waarmee hulle besig is. Kirstenbosch is internasionaal bekend is vir sy plante en broodbome. Van ons lede was ongelukkig oor die toestand van sekere plante in die tuin weens swak instandhouding, waarmee Kirstenbosch saam gestem het, maar dit toegeskryf het aan die impak van Covid op hulle werksaamhede. Weens die inperkings kon die personeel nie die instandhoudingswerk doen soos normaalweg nie.

Die lede was hartlik ontvang deur Phakamani en sy student wat aanbiedings gedoen het oor hul werksaamhede en die hervestingsprojek van *E. latifons* in hulle natuurlike habitat. Daarna is ons op 'n toer geneem na van hulle kweekhuise, gevolg deur 'n wandeling in die

by applying the correct remedies and applications on the plants. For several days after the workshop there was still a lot of action through the WhatsApp group, where the members helped each other to address questions.

**Our second garden visit was on 9<sup>th</sup> of July 2022 at Kirstenbosch.** The branch was invited by Phakamani Xaba for a garden visit with the aim to inform our members of the activities and projects they are busy with. Kirstenbosch is internationally known for its plants and cycads. Our members were not happy with the condition of certain plants in the garden. Covid restrictions hampered the upkeep of the cycad collection immensely, as staff could not maintain the garden as they would normally do.

Our members received a warm welcome from Phakamani and his student. Both did presentations, showing the activities they are busy with i.e., the re-establishing in its natural habitat project of *E. latifons*. Afterwards we went on a tour to their greenhouse,



Figuur 16. Hierdie is nie 'Jurassic Park' nie, maar ons pragtige Kirstenbosch met *Encephalartos latifrons* en ander plante in die agtergrond.

tuin waar sekere aspekte van die broodbome aan ons uitgewys is. Dit was duidelik dat daar 'n verbetering in die instandhouding van die plante is, nou dat personeel weer voltyds werksaam is. Die Wes-Kaap tak wil graag met Kirstenbosch saamwerk en hulle ondersteun waar moontlik om standarde te handhaaf.

**Die vierde werkswinkel het gehandel oor broodboomidentifikasie en het plaasevind op 23 Julie 2022.**

Dit het bestaan uit 'n teoretiese en praktiese deel. In die teoretiese gedeelte is daar gekyk na verskillende plantspesies se eienskappe naamlik silhoeëtte, die stam, die blare, pinnae en hul oriënteringshoeke, keëls, sade en die plante se natuurlike habitat. Die inligting wat gedeel was, is alles verkry uit ENCEPHALARTOS tydskrifte en gepubliseerde boeke wat handel oor broodbome.

followed by a walk through the garden. Interesting aspects of the cycads were pointed out. Since the staff are back on a full-time basis there were noticeable improvements in the cycad garden. The Western Cape branch would like to support Kirstenbosch and work with them where possible to keep the garden to its former standard.

**The fourth workshop dealt with cycad identification and was held on 23 July 2022.**

It was divided into a theoretical and practical part. The theoretical part covered the characteristics of different cycad species such as its silhouette, stem, leaves, leaflets and orientation angles, cones, seeds and the plants' natural habitats. The information shared, was obtained from ENCEPHALARTOS as well as published books on cycads.



Figuur 17. Phakamani lig die lede in oor hulle werksaamhede in die kweekhuis. *Encephalartos latifrons* in die voorgrond.



Figuur 18. Lede geniet hulle tuinwandeling in Kirstenbosch saam met Phakamani en sy student.

Die identifikasie het oor die volgende *Encephalartos* spesie gegaan naamlik *E. transversosus*, *E. paucidentatus*, *E. heenani*, *E. woodii*, *E. longifolius*, *E. altensteinii*, *E. natalensis*, *E. lebomboensis*, *E. senticosus*, *E. msinganus* en *E. aemulans*. Voorbeelde van die verskillende plante se blare is gebruik saam met die skyfies gedurende die aanbieding. Daar bestaan redelike onduidelikheid wanneer dit kom by die identifisering van *E. natalensis* weens die baie vorme wat in verskillende habitate voorkom. Lede het omtrent almal 'n *E. natalensis* in hulle tuin maar is dikwels nie seker of dit 'n hibried of suiwer plant is nie, aangesien hulle nie sekerheid het van die oorspronklike afkoms nie.

The identification module comprised *Encephalartos* species i.e *E. transversosus*, *E. paucidentatus*, *E. heenani*, *E. woodii*, *E. longifolius*, *E. altensteinii*, *E. natalensis*, *E. lebomboensis*, *E. senticosus*, *E. msinganus* and *E. aemulans*. Not only slides but the actual leaves of the different species were used as examples during the presentation. A lot of confusion exists with the identification of *E. natalensis* due to the many forms found in different habitats. Most of our members have *E. natalensis* in their garden but are not sure if it is a hybrid or not. Most members are also not sure of their plant's origin.

Our module took place at Babylonstoren where the plants were identified by the members. Many questions were asked, and knowledge and experience shared. The workshop served to share knowledge, experience, as well as a refresher to informed members. Years of experience was shared with new members, and good relations built between members on the day.



Figuur 19. Willem Nel by die oorspronklike *Encephalartos woodii* wat aan Kirstenbosch geskenk was in 1916. Dit is jammer dat die pragtige plant beskerm moet word teen die mensdom deur 'n staalstruktuur, want van die broodbom se suiers is in 1960 afgesteel. Die plante word vandag ook beskerm deur kameras, beweging-sensors en mikro-skyfies.

**The fifth workshop dealt with cultivation of cycads and was held on 20 August 2022.** The presentation started off with the harvesting and storing of pollen and the pollination of cones (both wet and dry methods). The removal of cones, the harvesting of seeds, fecundation tests, and cleaning and storing of seeds were discussed. A lot of input was given by the members on the different methods for germinating seed. The presentation was followed up by short videos on the topics which were presented.

Members were cautioned to wear face masks and rubber gloves when handling pollen and the removal of the flesh covering (sarcotesta) the seed, as it is suspected to contain carcinogens.

Attention was also given to the removal of suckers and the treatment and rooting of the suckers. The early spring is the best time to remove cycad suckers. Any sucker larger than a cricket ball can be removed. The larger the sucker the greater the possibility of success.



Figuur 20. Kobus van der Walt besig om broodbooms spesies se blaar-vorme te verduidelik gedurende die aanbieding.

Vir die praktiese gedeelte was daar weer 'n besoek gedoen aan Babylonstoren, waar die lede die plante van naderby geïdentifiseer het. Baie vrae was gevra, en kennis en ondervinding is tussen lede gedeel. Die werkswinkel het daarin geslaag om lede se kennis te verbreed, ou kennis te verfris, en jare se ondervinding is ook gedeel met nuwe lede. Lede het mekaar ook op sosiale vlak beter leer ken.

Ons **vyfde werkswinkel het gehandel het oor die kweek van broodbome en het plaasgevind op 20 Augustus 2022**. Daar was 'n aanbieding oor die oes en berging van stuifmeel, en bestuiwing van keëls (nat en droë metodes). Die verwydering van keëls, oes van saad, skoonmaak, kiemkragtigheidsheids-toets en die berging van saad. Daar was ook baie insette oor metodes wat die lede gebruik met ontkieming van saad en plant van saailinge. Die aanbiedings is opgevolg met kort videos van die aspekte wat bespreek is.

Lede is gemaan om gesigmaskers en rubberhand-skoene te dra tydens hantering van stuifmeel en verwydering van die vlesige bedekking (sarcotesta) van sade wat karsinogene mag bevat.

Daar is ook baie aandag gegee aan die verwydering, die behandeling van die verwyderde suiers en die plant van die suiers. Die vroeë lente is die beste tyd om broodboomsuiers te verwyder. Enige suier groter as 'n krieketbal is geskik, maar hoe groter die suier, hoe beter die kans tot sukses. Die aanbieding is opgevolg met kort videos van die aspekte wat bespreek is.

Die werkswinkel se hoofdoel was om kennis en praktiese wenke te deel met die industrie. Daar was na die werkswinkel nog baie gesprekvoering en deel van kennis tussen lede, alles deur middel van die WhatsApp groep.

**Wat word beplan vir die res van die jaar?** Ons beplan nog 'n tuin besoek op die 17de September 2022 gevolg deur 'n plantverkoop op die 5 November 2022. Ons sluit die jaarprogram af met ons jaareindfunksie op 26 November 2022.



Figuur 21. Charles Vorster vergelyk die blaar-voorbeelde van *E. natalensis* x *E. woodii* F1 en *E. transvenosus/woodii* F1.



Figuur 22. Lede besig met besprekings tydens die identifikasie werkswinkel.

The presentation was followed up by a short video on the aspects that were presented.

The workshop achieved its goals as valuable knowledge and practical experience were shared between members. After the workshop there was still a lot of cultivation issues shared on the WhatsApp group.

**What is still planned for the rest of the year?** We are planning a garden visit on the 17<sup>th</sup> September 2022, followed by a plant sale on the 5<sup>th</sup> November 2022. The annual program will be concluded with a yearend function on 26 November 2022.



Figuur 23. Wynand van Eeden wys lede wat hulle beplan met verdere uitbreidings aan die broodboomtuin by Babylonstoren.



Figuur 24. Charles Vorster besig met sy aanbieding oor die verwydering van broodboomsuiers. Die bierbottel is nie vir drink nie, maar om die toerusting wat gebruik word in die verwyderingsproses te steriliseer.



Figuur 25. Ferdie Endemann besig met sy aanbieding oor die oes en berging van stufmeel terwyl die lede aandagtig luister.

**ZAMIA PYROPHYLLA CALONJE, D.W. STEV. & A. LINDSTR.**

Michael Calonje<sup>1</sup> & Roy Osborne<sup>2</sup>

**INTRODUCTION**

In various issues of “Encephalartos” we have published “Focus on...” articles on 47 species of *Encephalartos*, 19 species of *Cycas*, 17 species of *Macrozamia*, but only 9 species of *Zamia*. In this issue we return to South America to report on the relatively new and very attractive species, *Zamia pyrophylla* from Chocó, a Department (Province) in the northwest of Colombia.

**DISCOVERY**

With 78 species, the neotropical genus *Zamia* is the most speciose and broadly distributed genus in the New

World. The country of Colombia hosts over a quarter of all these taxa, making it the most species-rich country for the genus. A considerable amount of research on the Colombian zamias has taken place over the last decade, including the publication of several new species descriptions, one of which – *Zamia pyrophylla* – is the object of the article.

In his treatment of the cycads of Colombia Dennis Stevenson (2001) referred to several herbarium specimens from the Chocó Department, filed under the name

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Figure 1. Vegetative features of *Zamia pyrophylla*. A. Seedling with eophyll and apogeotropic roots. B. Side view of characteristic leaf. C. Frontal view of emergent leaf. D. Cataphylls. E. Median leaflet. F. Caudex of juvenile plant. Composite plate from photographs taken at type locality by the first author.

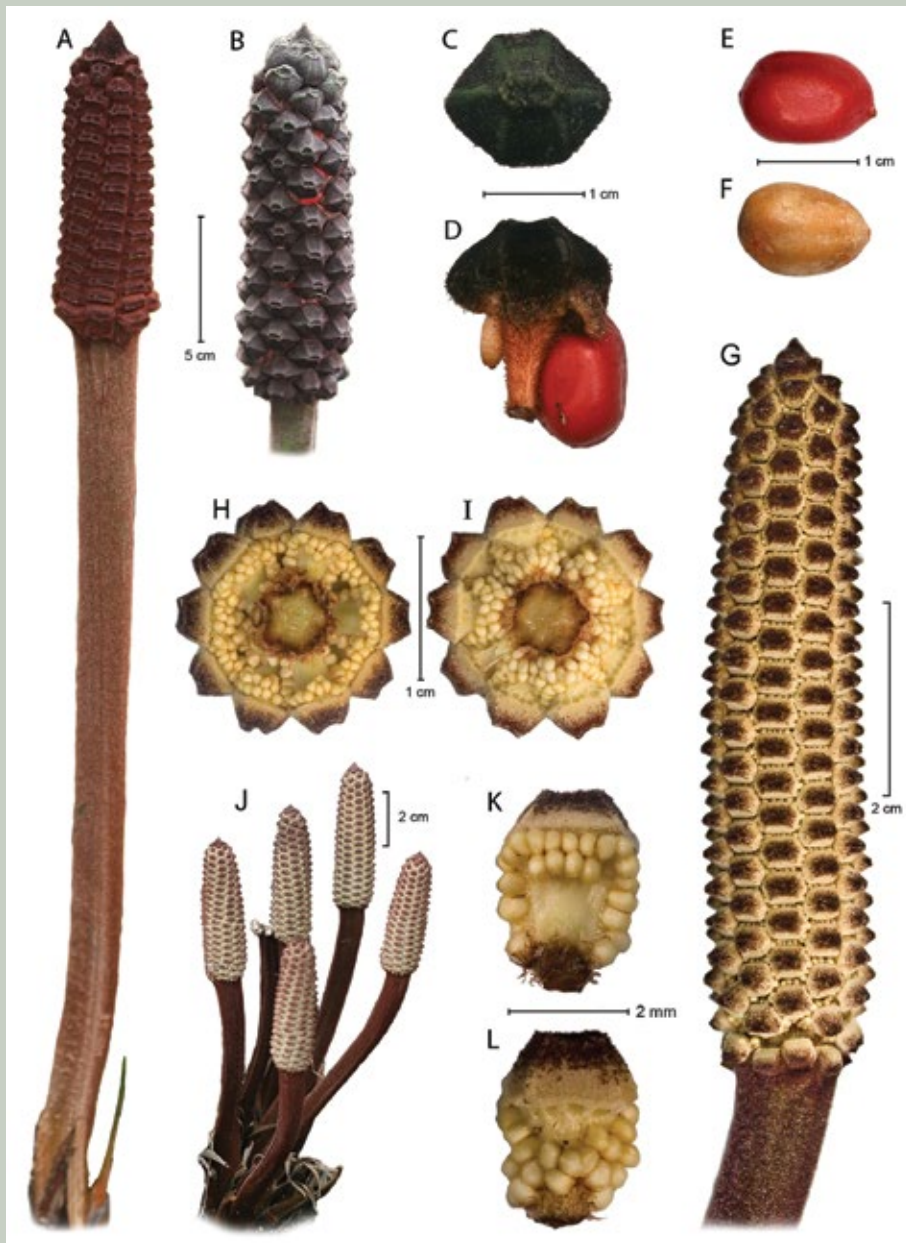


Figure 2. Reproductive features of *Zamia pyrophylla*. A. Ovulate strobilus at near receptivity stage. B. Mature ovulate strobilus. C. Mature megasporophyll face, frontal view. D. Mature megasporophyll, abaxial view. E. Mature seed with sarcotesta. F. Sclerotesta of mature seed. G. Pollen strobilus at dehiscence. H. Mature pollen strobilus cross-section, adaxial view. I. Mature pollen strobilus cross-section, abaxial view. J. Juvenile pollen strobili. K. Microsporophyll, adaxial view. L. Microsporophyll, abaxial view. Composite plate from photographs taken at type locality by the first author.

*Zamia amazonum*, where the material differed from typical; suggesting that further research would be necessary to confirm whether these plants represented a different species.

A research expedition led by the CHOCO herbarium of the Universidad Tecnológica del Chocó in Quibdó, in collaboration with Montgomery Botanical Center (Coral Gables, Florida), took place in March of 2009 to gain a better understanding of this relatively unknown *Zamia* from the Chocó. The detailed examination of several hundred plants across five different populations, including fertile plants with ovulate and pollen strobili, led to the conclusion that this cycad was indeed a new species. The taxon was then formally described as *Zamia pyrophylla* by Calonje and co-workers in 2010. The species epithet refers to the dramatic fiery appearance of the orange and red emerging leaves that subsequently turn green from the apex to the base.

The holotype for the species (M. Calonje *et al.* COL09-014) is lodged at the CHOCO herbarium.

## DISTRIBUTION, HABITAT AND ECOLOGY

At least five populations of *Zamia pyrophylla* have been located in rainforest in the Atrato Valley in the municipalities of Quibdó and Atrato, Chocó Department, in Colombia's northwest. The area where the plants are found, at altitudes 45–100 meters above sea level, has a rainfall exceeding 8500 mm annually, making it one of the wettest places on earth. The rainy season is from April to December, with August being the wettest month; the drier season is from January to March. Temperatures range from 15 to 41°C, averaging about 28°C.

Very little is known about the reproductive phenology of this species. All the early herbarium specimens examined were of sterile material and there was no mention of reproductive structures in the label notes. During the 2009 expedition, both seed and pollen cones were seen at different stages of maturity.

Pollen strobili at the time of dehiscence harboured numerous clavicorn beetles of the genus *Pharaxonotha*,



Figure 3. A single green leaf on a *Zamia pyrophylla* in typically dense rainforest near Quibdó. Photo: Michael Calonje.



Figure 4. Claudia Calonje (Montgomery Botanical Center) holding an approximately 2 m long single leaf of *Zamia pyrophylla* from a rainforest habitat near Quibdó, Chocó. Photo: Michael Calonje.



Figure 5. Claudia Calonje and botanists from the Universidad Tecnológica del Chocó inspecting a stand of the *Zamia pyrophylla* in an area of cleared rainforest near Quibdó. Photo: Michael Calonje.

a known pollinator of *Zamia* species. Larvae of *Eumaeus* were observed feeding on emergent *Zamia* leaves and butterflies were seen laying eggs on new leaves and emergent pollen cones.

Herbarium vouchers of a different cycad population about 100 Km northwest of Quibdó differ from the *Zamia pyrophylla* type in having leaflets with toothed margins at the distal end. In addition, a specimen label mentions that leaves of adult plants typically carry four pairs of leaflets whereas *Z. pyrophylla* typically carries 8–16. Recent field work has shown this population is most likely a toothed leaflet margin variant of the newly-described *Z. paucifoliolata* (Calonje *et al.* 2018).

## DESCRIPTION, VEGETATIVE STRUCTURES

Data from the description by Calonje *et al.* (2010).

Stems of *Zamia pyrophylla* are hypogeous, rarely branching, globose to cylindrical, and 10 cm or more in diameter. *Cataphylls* are chartaceous, triangular to narrowly triangular, to 8.5 × 3.0 cm, tan-tomentose with brown papyraceous wings. *Ptyxis* is inflexed. The 1 to 2 leaves are 1.1–3.4 m long; *petioles* are 0.75–2.4 m long with an abruptly swollen base to 4 cm wide, densely covered with stout, sometimes branching, prickles to 5 mm long; the rachis is 0.3–1 m long, curved outward, with prickles in lower half, the petiole and rachis both brown tomentose when emerging, gradually becoming glabrous. *Leaflets* are in 8–16 pairs, chartaceous to coriaceous, median ones are 2–5.8 cm apart,



Figure 6. An emergent leaf of *Zamia pyrophylla* showing the dark maroon colour of the juvenile leaflets and the early protrusion of numerous prickles along the leaf stalk. Photo: Michael Calonje.



Figure 7. A young leaf of *Zamia pyrophylla* showing the start of the colour change from the apex of each leaflet towards its base as the leaf reaches maturity. Photo: Michael Calonje.



Figure 8. Leaves of *Zamia pyrophylla* lose their initial red, orange and yellow tones to become a glossy mid-green at maturity. Photo: Michael Calonje.

inserted onto the rachis 6–10 mm apart, lanceolate to oblanceolate and straight to slightly falcate, alternate to subopposite, with the apex acute to acuminate, the margins entire, and the basal leaflets 28–51 × 2.2–7.2 cm; the median leaflets measure 24.5–55 × 4–7.1 cm; the apical leaflets are 19–34.5 × 2.1–6.6 cm, maroon at emergence, turning to orange or reddish tones, and gradually becoming green from the leaflet apex to the base as they mature. *Eophylls* are 19–25 cm long, with unarmed petioles and with rachis to 1 cm long, typically carrying four leaflets of 6.1–6.5 × 1.7–2.2 cm.

### DESCRIPTION, REPRODUCTIVE STRUCTURES

Data from the description by Calonje *et al.* (2010).

*Pollen strobili* of *Zamia pyrophylla* are conical-cylindrical, erect or slightly spreading, 5–15+ in number, 7.1–8.1 × 1.5–1.7 cm at pollen shedding, the strobilar axis and proximal section of microsporophyll villous with mixed white and rust-brown hairs, the *peduncles* tomentose, emerging white to cream and maturing maroon to brown, 14–25 × 0.8–1 cm. The *microsporophylls* are spirally arranged in 8–10 orthostichies each of 13–20 sporophylls; these are obtrullate, 5.9–6.3 × 3.5–4.3 mm at dehiscence, the sterile apex encompassing 1/4 to 1/2 of total length of a microsporophyll, tomentose, tan to cream coloured in proximal half, speckled maroon to brown in distal half, the face hexagonal to oblong hexagonal, 2.7–3 × 3.5–4 mm, extruded downward to a narrow horizontal facet, the abaxial side of microsporophyll with 15–20



Figure 9. A *Zamia pyrophylla* with nine early-stage pollen cones on their characteristic long maroon-tomentose peduncles. Also visible are the numerous stout prickles on the leaf petioles. Photo: Michael Calonje.

microsporangia limited to the proximal half and along the margins, the adaxial side with 12–15 microsporangia limited to the distal half.

*Ovulate strobili* of *Zamia pyrophylla* are cylindrical, typically solitary but up to 3 per crown, erect at maturity, 8–15.5 × 4–4.5 cm, with an acute to acuminate sterile apex 0.5–4 cm, the strobilus axis is villous with mixed rust-brown and white hairs. The *peduncle* measures 15–50 × 1.2–2.7 cm, emerging white to cream tomentose, progressing through maroon to brown tomentose, finally appearing green at maturity due to loss of tomentum. *Megasporophylls* are arranged in 7–10 orthostichies of 5–11 sporophylls each, the stalk 8–10 mm long, villous with mixed rust-brown and white hairs, the sterile apex 19–20 mm deep with hexagonal to oblong-hexagonal distal face 12.5–13.2 × 15.5–16.2 mm, extruded to a small, depressed terminal facet 2.5–3.4 × 5.7–6.3 mm, the megasporophyll face tomentose, burnt amber in new strobili, rust coloured when near receptivity, at maturity black with some exposed areas a glabrous green. *Seeds* are ovoid, 10–15.6 mm × 9.5–13.2 mm, the sarcotesta red and fleshy, eventually becoming evenly papyraceous when mature.

## DISTINGUISHING FEATURES

The bright orange and red-emergent leaflets, which turn green from the apex to the base as they mature, are unique to *Zamia pyrophylla*. It closely resembles the Panamanian species *Z. cunaria* and *Z. ipetiensis* but is easily differentiated from these as it has leaflets with entire margins while the Panamanian species have margins that are distinctly toothed on the upper half. Other differences – in leaf length, tomentum colour, prickle shape, microsporophyll colour, morphology of the ovulate strobilus and its megasporophylls, and the length of the plants' leaves – are as detailed in the species description.

The more recently-described *Zamia paucifoliolata*, from the Valle de Cauca Department of Colombia, is also closely related to the three taxa above, but it produces fewer and larger leaflets, sporophylls and seeds than the other species. All constituents of this group are readily distinguishable on quantitative and qualitative characters; details of these are provided, together with a key, in the description of *Zamia paucifoliolata* (Calonje *et al.* 2018).

As mentioned in the paragraph describing its discovery, *Zamia pyrophylla* shares some morphological similarities with *Z. amazonum*, a species from Brazil, Colombia, Ecuador, Peru and Venezuela. However, *Z. amazonum* can be distinguished from *Z. pyrophylla* because it carries 2–6 leaves with up to 30 leaflet pairs, it has brown-emergent leaflets that turn green from the base to the apex, and there are significant differences in vegetative and cone morphology.

Although the relationships of *Zamia pyrophylla* to the other *Zamia* species are not completely resolved,



Figure 10. A seed cone of *Zamia pyrophylla*, the fertile area approximately 11 cm long by 3 cm wide, with the red sarcotesta of seeds just visible between some megasporophylls. Photo: Michael Calonje.

substantial progress has been made. In a recent comprehensive phylogenetic study by Calonje *et al.* (2019) *Zamia cunaria*, *Z. ipetiensis* and *Z. pyrophylla* align within one clade and it is likely that *Z. paucifoliolata* would fall within the same group.

## ETHNOBOTANY

While we have no knowledge of any ethnobotanical usage or local names specific to *Zamia pyrophylla*, other cycads in the northern parts of Colombia are sometimes generically referred to as *chigua*, *maicito* (little maize) or *piña de monte* (pineapple) by the local people (Bonta & Osborne 2007) and there is an awareness of cycad toxicity.

## CONSERVATION STATUS

*Zamia pyrophylla* is provisionally listed on the World List of Cycads as being Critically Endangered (CR); but it is not yet formally entered on the IUCN Red List. Although the plants are relatively common in some areas and seedling recruitment has been noted in the forested sites, the populations are restricted to an area of only about 25 Km<sup>2</sup> and the habitat is threatened by

agricultural expansion. One positive aspect is that, after forest clearing, exposed plants appear to thrive in full sunlight.

## CULTIVATION

*Zamia pyrophylla* is not known in horticulture. The remote location, small numbers and conservation status of this cycad mean that seeds are unlikely to be available to growers.

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# LIVING DEAD: ON THE TRAIL OF A FEMALE

Dr Laura Cinti

## ABSTRACT

*Living Dead: On the trail of a female* is a biodiversity focused art-science project using drone technology and aerial mapping to locate a female partner for one of the rarest plants in the world, the *Encephalartos woodii*. Although an *Encephalartos woodii* was not located, it highlighted the promising possibility of using drone technology to locate rare and endangered species. Future scopes include expanding the search area, aerial mapping and analysis with machine learning. The outcome was a series of maps and a documentary of the process that was used to create a video artwork to highlight the impending biodiversity crisis (using this species as an example). It is hoped that the work and the process behind it will be beneficial for species conservation in the future.

The project is inspired by the story of the loneliest plant on Earth, the *Encephalartos woodii* and draws attention to plants unable to survive in the wild. Isolated from their habitat; these 'extinct in the wild' plants are no longer reproductive members of their population - they are the 'living dead'. Cycads are the oldest surviving seed plant that appeared before the age of dinosaurs around 300 million years ago. In spite of their incredibly long legacy, cycads are now the most endangered living organisms. Rare cycads have also become subject to a thriving illegal market worth millions of dollars annually.

In 1895, a single male tree was discovered in the Ngoye Forest Reserve, South Africa by John Medley Wood. No other specimen could be found and though several expeditions have since explored the forest, this lonely male remains the last of its wild ancestors. It was feared that this plant would be destroyed so it was removed and propagated in botanical gardens. All existing specimens are clones of this plant and all are male. As both sexes are needed for reproduction, without a female, it may never naturally reproduce again. It is one of, if not the rarest, and possibly most sought after species of cycads.

The Ngoye Forest is vast with many areas inaccessible by foot leaving acres and acres uninspected and a possibility for a female to be hiding amongst the dense canopies. Historical archives, research papers and correspondence with those who have themselves been on the trail of the female revealed a diverse set of approaches from forest expeditions, to hopes of creating a female through induced sex change and hybridisation with closely related species.

Starting with the idea of accessing inaccessible parts of the Ngoye Forest, I wanted to explore how remote sensing technologies could provide an alternative approach to mapping this space.

While sourcing papers where remote sensing technologies had been specifically used in cycad identification, I came across an interview with Dr Debbie Jewitt who expressed an interest in using drones to count threatened



Figure 1. *Encephalartos woodii*, Temperate House, Royal Botanic Garden, Kew, September 2021. Photo: Laura Cinti. The *Encephalartos woodii* in Kew Gardens is an offset of the only plant of this specimen ever found in the wild. It was sent to Kew in 1899.

species, mentioning cycads as one example. Jumping on this opportunity of using drones as a visual search and mapping tool I immediately got in touch, which was the seed for our collaboration. Debbie works as a conservation scientist and drone pilot for Ezemvelo KwaZulu-Natal Wildlife, a provincial conservation agency that manages both the Ngoye Forest Reserve and 120 other protected areas in KwaZulu-Natal.

To conduct the drone search, the project was officially registered as a research project with the organisation and an application was also put forward for a manned flight with The Bateleurs, a non-governmental organisation who provide aerial support services to environmental missions in South Africa. One of the pilots, Steve McCurrach, offered to fly over the Ngoye Forest. An initial aerial search provided a view of the forest from above and allowed us to assess the viability of future missions and define search areas for drone flights. Larger tracks of the forest were covered using aerial imagery taken from a manned aircraft (Cessna 182) by using two camera operators: one east and the other west facing.

The drone mission took place over two days in the North East area of the Ngoye Forest Reserve. On one of



Figure 2. Drone Mission Search for *Encephalartos woodii*, DJI Matrice 210 in flight over Ngoye Forest, South Africa. Photo: Dr Debbie Jewitt, Ezemvelo KZN Wildlife.



Figure 3. Drone Mission Search for *Encephalartos woodii*, Map over Ngoye Forest, KwaZulu-Natal, South Africa with search boundaries. Image: Google Earth / Airdata.

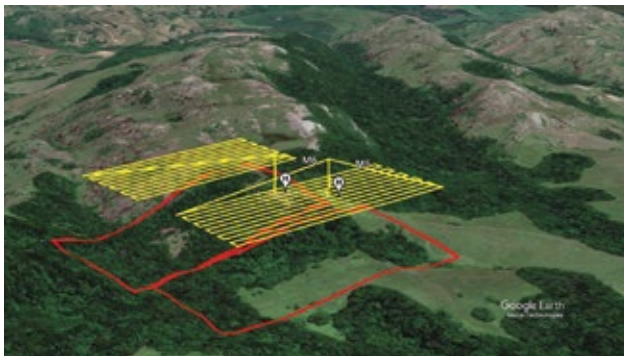


Figure 4. Drone Mission Search for *Encephalartos woodii*, Drone flight paths. Image: Google Earth / Airdata.



Figure 5. Drone Mission Search for *Encephalartos woodii*, Ngoye Forest, South Africa. Mosaic map: Dr Debbie Jewitt, Ezemvelo KZN Wildlife, 2022.

the days, the weather conditions had worsened due to strong winds and the spectral sensor could not be used. It was replaced with a powerful integrated aerial zoom camera, DJI Zenmuse Z30, which allowed us to scan the south facing slope of the forest, a natural habitat for cycads. It gave a closer view of the trees, and these footages were analysed to search for cycads.

On the day when the weather improved, a DJI Matrice 210 drone was deployed and equipped with a Micasense RedEdge-MX multispectral sensor and programmed to fly in a grid over two selected areas, each around 40 acres collecting a total of 4000 images.

Flying 80 metres above the takeoff point allowed us to capture imagery with a ground resolution of 8.44 cm. However, uneven terrain such as hilltops and valleys created some challenges as multispectral imagery is ideally photographed over flat terrains. In addition, the weather was partly cloudy causing changes in the light conditions which can be seen in the final stitched image mosaic.

The multispectral camera takes five photos, one for each wavelength band - red, blue, green - visible to the human eye and additionally Red-edge and Near Infrared which can only be seen using false colours to the final image. A natural colour composite closely resembles the colours as we normally see them. When applying false colours using the red-edge band, photosynthesising vegetation can be seen and also provides information about dying vegetation (seen as blue in the above image). The near infrared band provides powerful ways to classify healthy vegetation, and discriminate between dead trees, roads and geology types. Moreover it can be used to discriminate between different plant materials and distinguish tree species. In addition to using colours, we were also searching for different structures and viewed from above the cycad would have a palm-like structure to its canopy.

Together the drone missions and aerial flights provided a wealth of photos that were each combined by stitching them together to form a mosaic that could be analysed. This is the first time these methods have been used to search for *Encephalartos woodii*.

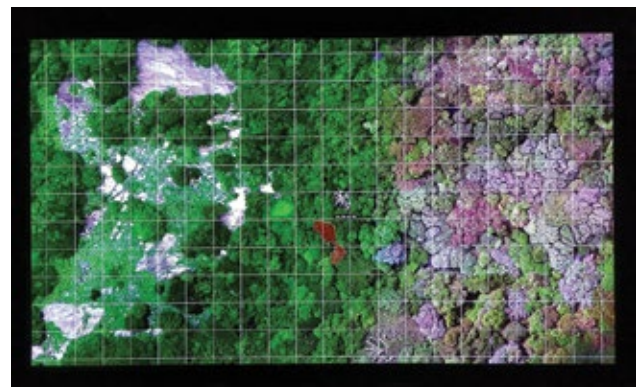


Figure 6. Video still: *Living Dead: On the trail of a female*, Ars Electronica, Austria, September 2022. Photo: Dr Howard Boland, C-LAB.



Figure 7. Video installation of the project, *Living Dead: On the trail of a female*, was exhibited at Ars Electronica, Austria in September 2022. Photo: Dr Howard Boland, C-LAB.

And while the search continues, the story of the enigmatic *Encephalartos woodii* and the elusive female, its discovery and subsequent disappearance from nature, reminds us just how easy it is to lose a species and lose biodiversity.

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- Sharon Louw, District Ecologist, Ezemvelo KZN Wildlife
- John Craigie, Control Research Technician, Ezemvelo KZN Wildlife
- Steve McCurrach, Pilot & Director, The Bateleurs.
- Library, Art & Archives Team, Royal Botanic Gardens, Kew
- Project website: [https://www.c-lab.co.uk/projects/living\\_dead](https://www.c-lab.co.uk/projects/living_dead)

# JOHANN GEORG CHRISTIAN LEHMANN (1792–1860) – AUTHORITY OF THE GENUS *ENCEPHALARTOS*

Roy Osborne<sup>1</sup> & Dennis Wm. Stevenson<sup>2</sup>

Editorial note: This article is a preview of one of the pioneering cycad botanists whose lives and works are being treated in a comprehensive volume entitled “The Cycad Biologists”, presently in preparation as a publication by the New York Botanical Garden.

Johann Georg Christian Lehmann, son of Pastor Johann Gottlieb Lehmann and his wife Maria Elisabeth, was born in the town of Haselau in Schleswig-Holstein, Germany, on 25 February 1792. He had an elder brother, lawyer and naturalist Martin Christian Gottlieb Lehmann (1775–1856), and one other sibling.

Lehmann studied medicine in Copenhagen and Göttingen, graduating as a medical doctor in 1813, after which he obtained a Ph.D. from Jena University a year later. In February 1818, he was appointed Professor of Physics and Natural Sciences at the Academic Gymnasium in Hamburg, also taking on the role of Chief Librarian, positions he held for the rest of his life. Lehmann was an active member of some 26 learned organisations including the *Academy Leopoldina* (the Royal Society of Natural Historians), the Prussian Society (Berlin), *Academy Lipsiae* (Leipzig), where he held the post of Rector, and the Russian Academy of Sciences in Saint Petersburg.

In 1821, Lehmann established the Botanical Garden of Hamburg (*Alter Botanischer Garten*). The garden and its structures were greatly damaged during WW II and the present greenhouses (*Schaugewächshäuser* or *Tropengewächshäuser*) were erected only in 1963. Remarkably, at least one of the original plants brought to Hamburg by the Danish plant collector Christian Ecklon in 1832, a large *Encephalartos altensteinii*, remains an impressive specimen in the greenhouse complex.

Lehmann wrote widely on botanical matters over the period 1818–1856. His interests and publications prior to 1820 addressed such diverse groups as the family Boraginaceae, the genera *Nymphaea*, *Nicotiana*, *Potentilla* and *Primula* and the liverworts. However, his most extensive, multi-volume work was his *Novarum et minus cognitarum stirpium, Pugillus*, Vols 1–10 (1828–1857). It was in Vol. 6, Part 1, that he devoted his attention to cycads in a section entitled *De plantis cycadeis praesertim Africae Australis*. Some copies of this work were illustrated with beautiful hand-painted colour plates but it seems that the only extant copy is now under safekeeping at the New York Botanical Garden.



Figure 1. “D. Jo. Christian Lehmann”. Image of a copper engraving, artist with initials “M.B.”, housed in the Diocesan and County Library, Skara, Sweden.



Figure 2. The title page of Lehmann's *Pugillus* 6 (1834) in which he names the genus *Encephalartos*.

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Figure 3. *Encephalartos friderici-guilielmi*. Colour plate 1 from Part 1 of *Pugillus* 6 of 1834.



Figure 4. *Encephalartos friderici-guilielmi*. Colour plate 2 from Part 1 of *Pugillus* 6 of 1834.

Lehmann was not the first botanist to write about cycads from the southern hemisphere, and he never visited South Africa or Australia; instead, he relied on information from Thunberg, Ecklon and Zeyher, Preiss and other botanical collectors. Early and somewhat confused names were Thunberg's *Cycas caffra* of 1775, Linnaeus' *Zamia cycadis* of 1782, Jacquin's *Zamia cycadifolia*, *Z. horrida*, *Z. lanuginosa* and *Z. longifolia* of 1801 and Ecklon's *Zamia lehmanniana* of 1833. But it was Lehmann who, in his 1834 *Pugillus*, reviewed and amended these names when he coined the genus name *Encephalartos*. He derived the name from the Greek phrase anglicised as "en-cephal-artos" meaning "in head, bread" and referring to the natives' habit of harvesting starch from the cycads in order to make a crude bread. The derivation is similarly related to the Afrikaans word *broodboom*. Lehmann described two new species in the *Pugillus*: *Encephalartos friderici-guilielmi* (in honour of King Friedrich Wilhelm III of Prussia) and *E. altensteinii* (to honour the King's statesman, Karl Altenstein). At the same time, he transferred earlier names from *Cycas* and *Zamia* to *Encephalartos caffer*, *E. cycadifolius*, *E. horridus*, *E. lehmannii* and *E. longifolius*.

When Lehmann erected the genus *Encephalartos*, he did so without indicating a type; it was Engler *et al.* (1926) who nominated *Encephalartos caffer* (Thunb.) Lehm. as the type for the genus. Much later Stevenson (1992) designated *E. friderici-guilielmi* Lehm. as the lectotype in view of the accurate illustrations in the *Pugillus* – although that recommendation was not supported by Vorster (2004).

Of relevance to the Australian readers, Lehmann's concept of *Encephalartos* also included taxa we now

know as species of *Macrozamia* and *Lepidozamia*. Lehmann collaborated with several other workers to publish *Plantae Preissianae* (1844–1847), an extensive compilation of the botanical work of Ludwig Preiss, a German-born British botanist and zoologist who



Figure 5. *Encephalartos friderici-guilielmi*. Colour plate 3 from Part 1 of *Pugillus* 6 of 1834.



Figure 6. Cone material of *Encephalartos friderici-guiliemi* (left) and *E. altensteinii* (right) collected by Ecklon & Zeyer in South Africa and stored by Lehmann in a leather-bound carton since 1832. These are still present in the Hamburg Herbarium and are reproduced by permission.

explored and collected some 200,000 plant specimens in Western Australia during 1838–1842.

Some of Lehmann's colleagues seem to have found him difficult, perhaps quarrelsome, but he was clearly

a person of letters, literature, learned societies and science. He married Dorothea Baltzer in 1824 and the couple had one son, Johannes Christian Eugen Lehmann, later a senator and mayoral candidate of Hamburg. Lehmann the botanist was nominated Knight of the Red



Figure 7. *Encephalartos altensteinii*. Colour plate 4 from Part 1 of *Pugillus* 6 of 1834.



Figure 8. *Encephalartos altensteinii*. Colour plate 5 from Part 1 of *Pugillus* 6 of 1834.



Figure 9. *Encephalartos lehmannii* on a steep granite cliff in the Suurberg, near Addo Elephant Park, Eastern Cape, South Africa. Photo: Gerhard van Deventer.

Eagle Order, 3<sup>rd</sup> Class, by Kaiser Friedrich Wilhelm for his contributions to medicine and science. His name appears in the authorship of 25 cycads, *Eucalyptus lehmannii* and several other plants, in *Lehmannia* (a genus of air-breathing land slugs in the family Limacidae) and also in the cycad weevil *Platymerus lehmannii*.

After a lengthy and debilitating illness, Lehmann died in Hamburg at the age of 68 on 12 February 1860. His herbarium material was distributed to botanical institutions in Stockholm and Melbourne, with the algae going to Hamburg and the mosses to Leiden, Stockholm and Paris.

### NAMES OF CYCADS WITH LEHMANN'S AUTHORSHIP

Data from the World List of Cycads

- *Encephalartos spiralis* (Salisb.) Lehm. (1834) = *Macrozamia spiralis* (Salisb.) Miq.
- *Encephalartos tridentatus* (Willd.) Lehm. (1834) = *Macrozamia* sp.
- *Macrozamia preissii* Lehm. (1844) = *M. riedlei* (Gaudich.) C.A. Gardner.
- *Encephalartos altensteinii* Lehm. (1834)
- *Encephalartos brachyphyllus* Lehm. & de Vriese (1838) = *E. caffer* (Thunb.) Lehm.
- *Encephalartos caffer* (Thunb.) Lehm. (1834)
- *Encephalartos cycadifolius* (Jacq.) Lehm. (1834)
- *Encephalartos elongatus* Lehm. (1838) = *E. lehmannii* Lehm.
- *Encephalartos friderici-guilielmi* Lehm. (1834)
- *Encephalartos horridus* (Jacq.) Lehm. (1834)
- *Encephalartos lanuginosus* (Jacq.) Lehm. (1834) = *E. longifolius* (Jacq.) Lehm.
- *Encephalartos latifrons* Lehm. (1834)
- *Encephalartos lehmannii* Lehm. (1834)
- *Encephalartos longifolius* (Jacq.) Lehm. (1834)
- *Encephalartos nanus* Lehm. (1838) = *E. horridus* (Jacq.) Lehm.
- *Encephalartos pungens* (L.fil.) Lehm. (1834), *nomen dubium*.
- *Encephalartos spinulosus* Lehm. (1838), *nomen dubium*.

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# IN VITRO TISSUE CULTURE: TOWARDS CONSERVATION OF THREATENED DESICCATION SENSITIVE ENCEPHALARTOS SEEDS

Thembeke Sebenzile Desiree Malwane<sup>1</sup>

Approximately 62 % of the 355 cycad species in the world are classified as threatened with extinction. The African genus, *Encephalartos*, has a total of 65 species, approximately 70 % of which are threatened. This status emphasizes the need to conserve these species; however, the recalcitrant nature of cycads seeds makes it difficult to conserve using conventional seed banking methods. Recalcitrant seeds have a short lifespan and cannot be dried or stored for prolonged periods; as they become nonviable when they lose moisture. While studies on cryopreservation for conserving cycad germplasm and banking these desiccation-sensitive seeds has made some advances, cycad conservation is still limited to *ex situ* living plant collections.

*In vitro* tissue culture is a promising technique for conserving cycads, while attempts have been made, there has been a few reported successes; however, there has been no successful regeneration of *Encephalartos* species. As such, this study was aimed at developing an efficient and successful *in vitro* regeneration protocol for *Encephalartos* species. Embryo regeneration of *E. altensteinii* and *E. manikensis* was assessed, testing the effects of plant growth regulators (PGRs) (Kinetin and 6-BAP, alone or in combination), sucrose (0, 15 and 30 g.l<sup>-1</sup>) and environmental conditions (light and darkness). Within six weeks of culture, embryos of both species were able to regenerate, however, they each responded differently to each of the tested variables. Although embryos of both were able to regenerate shoots within six weeks of culture, this was not explained by any of the variables assessed. Rooting was highest in the treatments with Kinetin for *E. altensteinii*, after subculture rooting was favoured by the combination of Kinetin and 6-BAP. *Encephalartos manikensis* rooting was significantly higher in PGR-free treatment in the first six weeks of culture (Figure 1). After subculture, rooting was favoured by the treatment with the highest PGR concentration of Kinetin and 6-BAP. Darkness favoured rooting while the alternation between light and darkness favoured shooting for both species although this was more prevalent for the treatments that were initiated in darkness. Both species responded to sucrose; with increase in sucrose concentration, callus induction increased for *E. altensteinii* while, necrosis and contamination increased for *E. manikensis*). *In vitro*-derived *E. altensteinii* plantlets acclimatization

was unsuccessful and only 3.5% of *E. manikensis* were successfully acclimatized (Figure 2).

This study suggests that although both these species belong to the same genus, *in vitro* culture protocol should be species specific. The overall regeneration of both species was however low, thus the second study assessed the levels of phytohormones in *E. altensteinii* seed tissues (embryos and megagametophytes) of the same age as those used in the *in vitro* regeneration. Phytohormones, as well as multiple phytohormone interactions (i.e. interplay between Abscisic acid (ABA) and Gibberellins (GAs)), play a role in the germination, growth and development of a plant. The high levels of a germination inhibiting ABA compared to the low levels of cytokinins and auxins as well as the absence of GAs obtained in the assessed seed tissue suggest that no real germination was taking place. Thus these results suggest that *E. altensteinii* seeds have a very slow developmental process with the likely chance that at this age they may be immature.

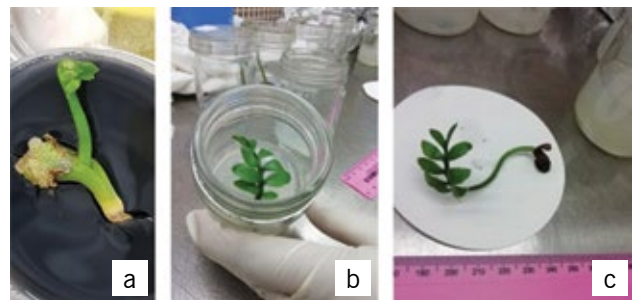


Figure 1: *Encephalartos manikensis* (a) at the end of six weeks incubation period, with callus and a newly merged shoot, (b & c) embryo-derived plantlet without a root at the end of 12 week incubation.

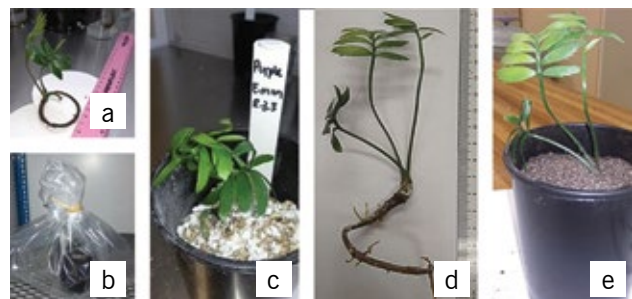
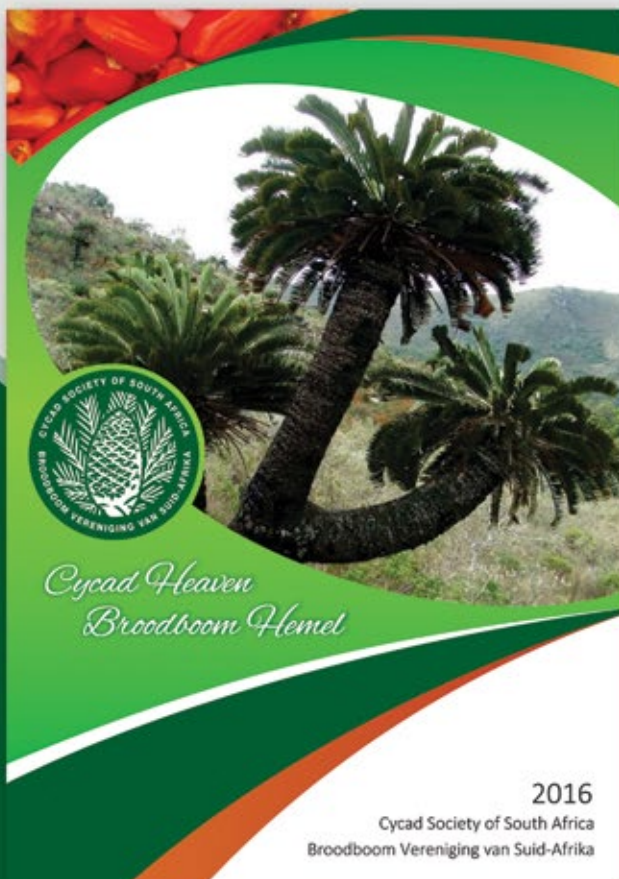
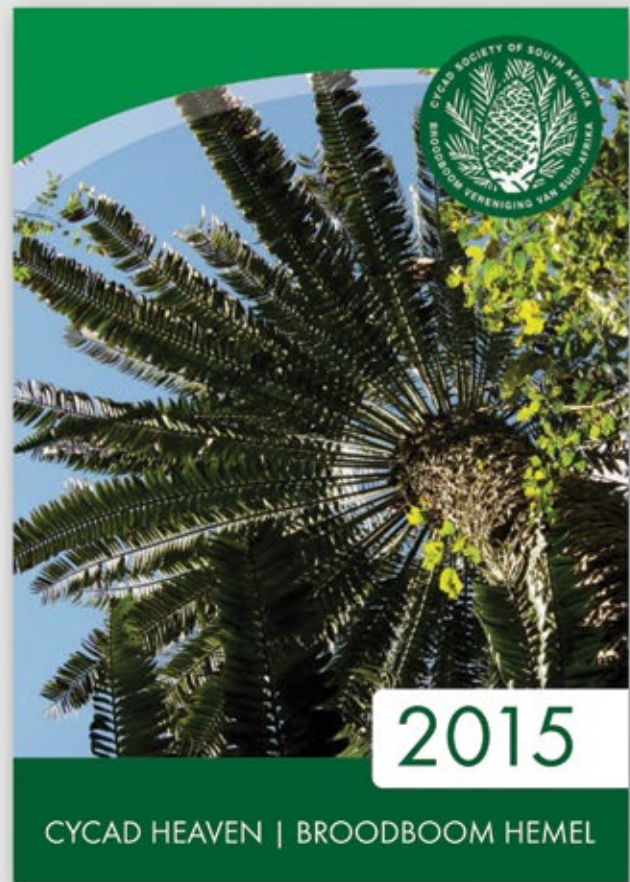


Figure 2: Hardening and acclimatization of *E. manikensis* embryo-derived plantlets. (a) Plantlet with both root and shoot 84 days after the beginning of culture. (b) Plantlet during primary hardening in perlite and vermiculite substrate, 112 days after initial culture. (c) Hardening plantlet covered with a plastic bag to maintain high relative humidity. (d) Elongated shoots (pinnate leaves) and primary root with small secondary roots, between 112-150 days after initial culture. (e) Acclimatized plantlet.

<sup>1</sup>Presented for the degree of Masters of Science in the Department of Molecular and Cell Biology, University of Cape Town.  
Supervisors: Professor Jill M. Farrant, Mr Phakamani M'Afrika Xaba (SANBI), (UCT), and Professor John Donaldson (SANBI).

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- Stoor as jpeg, maksimum lêergrootte (d.w.s. minimum kompressie).
- Stuur per e-pos na [wynand@ananzi.co.za](mailto:wynand@ananzi.co.za) en merk 'Vir Encephalartos'.

Die tabelle en figure/foto's van 'n manuskrip moet genommer wees en elke tabel moet 'n opskrif hê. Alle figure en foto's moet 'n onderskrif hê. Agter op elke figuur/foto moet die naam van die outeur en die nommer van die figuur/foto geskryf word en die bopunt van die figuur of foto moet aangedui word.

Alhoewel die formele beskrywing van nuwe broodboom taksons en nuwe naamkombinasies in ENCEPHALARTOS opgeneem kan word, word daar aanbeveel dat sodanige artikels eerder in die tydskrif *Novon*, wat spesiaal vir sodanige artikels in die lewe geroep is, gepubliseer word. Artikels oor potensiële nuwe broodboomtaksons kan ook opgeneem word in ENCEPHALARTOS sonder dat die artikels die nuwe takson formeel beskryf. Om latere moontlike naamsverwarring van sodanige taksons tot die minimum te beperk, moet die potensiële nuwe takson in die artikel deur terme soos byvoorbeeld Spesie A of Spesie 99 aangedui word.

### Bydraes moet die redakteur voor of op die volgende datums bereik:

Maart-uitgawe	: Eerste week van Januarie
Junie-uitgawe	: Eerste week van April
September-uitgawe	: Eerste week van Julie
Desember-uitgawe	: Eerste week van September

Een eksemplaar van die ENCEPHALARTOS uitgawe waarin 'n bydrae verskyn, sal gratis aan alle nie-lid outeurs voorsien word.

**Nota:** Waar van toepassing, sal alle finaal gedrukte figure en foto's verklein of vergroot word om oor óf een, twee óf drie kolomme te pas.

### Tariewe om in ENCEPHALARTOS te adverteer:

Bladsy grootte	Swart en wit	Kleur
Kwart blad	R175	R250
Half blad	R350	R500
Vol blad	R700	R1000

Lede: tot 'n maksimum van 'n kwartblad gratis—slegs swart en wit.

Om in ENCEPHALARTOS te adverteer, kontak die Sekretaris-tesourier en/of Redakteur.

