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ENCEPHALARTOS

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Journal of the Cycad Society of South Africa

ENCEPHALARTOS

Tydskrif van die Broodboom Vereniging van Suid-Afrika

On the cover:

Burning cycads: you have to be cruel to be kind. These cycads (*Encephalartos humilis*) were set on fire in an experiment performed at the Lowveld National Botanical Garden, Nelspruit. This was done in an attempt to see if the cycads would be stimulated to cone following a fire event. After they were burnt, the cycads produced beautiful new foliage and the scientists are now waiting anxiously to see if this had any effect on coning. Photo: Lou-Nita le Roux (SANBI).

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VAN DIE PRESIDENT / FROM THE PRESIDENT

Hierdie jaar was geen uitsondering op vorige jare nie en het weereens verby gevlieg. So ook my en die huidige Raad se termyn van net meer as twee jaar. Die Wes-Kaap, Laeveld en Oos-Kaap Takke het reeds hul nuwe bestuurkomitees gekies vir die 2010–2011 termyn wat begin op 1 Januarie 2010. Dankie aan die huidige bestuurkomitees vir hul betrokkenheid en moeite die afgelope twee jaar. Die ander streke gaan voor die einde van die jaar of vroeg volgende jaar hul nuwe bestuurkomitees kies en ook die gepaardgaande jaarprogramme beskikbaar stel.

Alicia Grobler, ons huidige redaktrise, is die enigste van die huidige verkose Raadslede wat nie weer beskikbaar was nie. Alicia, baie dankie vir 'n puik publikasie onder jou redakteurskap en die nuwe baadjie wat jy vir *ENCEPHALARTOS* gegee het. Ek weet dit was 'n gestoei tussen die studies en die insameling van genoeg artikels, nogtans het jy jouself goed van jou taak gekwyt. Ons het slegs 'n enkele nominasie vir die pos van redakteur ontvang, naamlik: Wynand van Eeden. Hy is geen onbekende aan julle nie en benodig geen bekendstelling nie en neem die leisels oor by Alicia vanaf 1 Januarie 2010.

Die Raad het op Saterdag, 7 November 2009, 'n vergadering gehou waar verskeie aangeleenthede bespreek is. Die belangrikste hiervan was die finalisering van die grondwetwysigings. Hierdie wysigings is genoodsaak deur tekorte wat aan die lig gekom het as gevolg van gebeure in die onlangse verlede. Hierdie voorgestelde wysigings, soos deur die Raad aanvaar, sal vroeg in Desember beskikbaar gestel word vir kommentaar van die lede op ons webblad. Alternatiewelik is dit ook verkrygbaar by die onderskeie Raadslede indien u nie toegang tot internet het nie. Ek versoek ons lede wat wel insae op die grondwetwysigings wil lewer om dit asseblief voor 15 Januarie 2010 te doen. Die finale grondwet met sy wysigings sal dan in die Maart 2010 *ENCEPHALARTOS* beskikbaar wees vir stemming deur die lede. Ek wil ook van die geleentheid gebruik maak om die uittredende Wes-Kaapse Streektakverteenwoordiger, Jaap Viljoen, te bedank vir sy bydrae tot hierdie grondwet.

Daar is weer baie stories wat die rondte doen oor die Bedreigde of Beskermde Spesies Regulasies (TOPS) en dat daar belangrike wysigings voor Maart 2010 gemaak gaan word. Ek gee ons lede die versekering dat ons julle op hoogte sal hou van sodanige wysigings en jul belange verteenwoordig via die onderhandelingskomitee. Die jongste inligting is dat die Departement van Waterwese en Omgewingsake 'n konsultant/maatskappy gaan aanstel om die TOPS regulasies te hersien en wysigings voor te stel. Magdel Boshoff, van die Departement, het onderneem om ons dan van sodanige beplande wysigings in kennis te stel vir ons inligting en kommentaar voor finalisering. Ons het ook kommentaar gelewer op die 'Draft CITES Regulations' en sal julle dienooreenkomstig op hoogte hou.

Tydens die afgelope Raadsvergadering was al die streke verteenwoordig en die onderskeie Streektakke se suksesse en probleme is in diepte bespreek. Die gebrek aan vroegtydige jaarprogramme is geïdentifiseer as een van die probleme, asook die gebeure van ongeveer twee

This year was no exception to any other and passed in a flash. The current Board's term of just over two years has also come to an end. The Western Cape, Eastern Cape and Lowveld Branches have already elected their new management committees for the 2010–2011 term, starting on 1 January 2010. I would like to thank the outgoing committee members for their time and effort. Our other Regions will elect their new committees soon and will make their year programs available at that time.

Alicia Grobler, our current editor, is the only member of the current Board that is not available for another term. I would like to make use of this opportunity to thank Alicia for a job well done. We all enjoyed the new face of *ENCEPHALARTOS* and I realize that it was no easy task between your studies and the continuous search for good articles. We received a single nomination for the editor's post. Wynand van Eeden will be taking over from Alicia. He is no stranger to you and needs no introduction.

The Board had a meeting on 7 November 2009 and several issues were discussed. The most important of these was the finalization of the revised constitution. This revision and changes to the constitution was due to shortcomings that came to light in the recent past. We approved several changes and the final draft constitution will be available for your comment on our webpage in early December. Alternatively it is obtainable from any of the Board Members should you not have internet access. Please comment before 15 January 2010 since we would like to have the final constitution published in the March 2010 issue of *ENCEPHALARTOS* for voting by our members. I would like tot thank Jaap Viljoen, the outgoing Western Cape Regional Branch Representative, for his time, effort and contribution to this new constitution.

Rumour has it, that there are several changes due to the Threatened or Protective Species Regulations (TOPS) in March 2010. The Society will keep members up to date of any such changes and the negotiation team will represent our interest at all time. The latest is that the Department of Environmental Affairs is going to appoint a private consultant/company to revise the current TOPS regulations and propose extensive changes. Magdel Boshoff of the Department gave us the assurance that we will be informed of such proposed changes and we will be allowed input before publication in the Government Gazette. The Society commented on the 'Draft CITES Regulations'. We shall keep you posted regarding any new developments.

At the mentioned Board meeting all the Regional Branches were represented and we had an in-depth discussion about each Branch. Some of the problems relate to the lack of year programs and issues of the past. I believe that we need to get over the past and move on. The Eastern Cape Branch is planning a mini congress in September 2010 and they would like to combine this with a plant sale. This will become a biennial event and will rotate between the Branches. Ian Bassingthwaighte was involved in the production of an information pamphlet that will be available from Board Members for use at plant shows and auctions. We will also have a set of

en ‘n half jaar gelede. Ek dink dit is belangrik en hoogtyd dat ons die verlede begrawe en vorentoe beweeg. Die Oos-Kaap Tak beplan ‘n minikongres in September 2010 en ons wil dit ‘n twee-jaarlikse, streektak-roterende instelling maak. Die betrokke Streektak sal dit met ‘n plantverkoping kombineer. Ons het ook ‘n inligtingspamflet beskikbaar vir gebruik by kwekerye en plantverwante skoue. Dit was die werk van Ian Bassingthwaighte en beskikbaar by hom of enige van die Raadslede vir sodanige gebruik. Ons gaan ook permanente baniere en materiaal beskikbaar stel vir Streektakke om die Vereniging by sodanige aktiwiteite bekend te stel.

Die nuwe Raad, soos deur die Raad aangestel op die afgelope Raadsvergadering, vir die volgende termyn vanaf 1 Januarie 2010 tot 31 Desember 2011 is as volg:

President—Xander de Kock
Sekretaris-tesourier—Ian Bassingthwaighte
Redakteur—Wynand van Eeden
Gekoöpteerde lid met volle stemreg (webmeester)—Pieter van der Walt
Die onderskeie Streektakverteenwoordigers wat ook deel uitmaak van die Raad is as volg:
Wes-Kaap—Frikkie Conradie
Laeveld—Dirk van der Walt
Oos-Kaap—Marius Helm

Streektakverteenwoordigers van die ander streke sal bekendgemaak word sodra die onderskeie streke vergader het en lede vir kandidate gestem het. Die Raad het ook besluit om die poste van Druk- en versendingsbeampte en Beampte vir vorige uitgawes nie te vul nie. Die poste gaan in die nuwe Grondwet nie meer bestaan nie.

Ek wil namens die Raad en my gesin al ons lede ‘n Geseënde Kersfees en Voorspoedige 2010 toewens.

Groete
Xander de Kock

banners and information boards available for the Branches to use at such events.

The new Board, as approved at the recent meeting, for the term 1 January 2010 to 31 December 2011 is as follow:

President—Xander de Kock
Secretary-treasurer—Ian Bassingthwaighte
Editor—Wynand van Eeden
Co-opted member with full voting rights (webmaster)—Pieter van der Walt
The Regional Branch Representatives who also form part of the Board are as follows:
Western Cape—Frikkie Conradie
Lowveld—Dirk van der Walt
Eastern Cape—Marius Helm

Since the positions of Printing and dispatch Officer and Back copies Officer will not be included in the new constitution, the Board decided not to fill these vacancies.

On behalf of the Board and my family I would like to wish you all a Merry Christmas and Prosperous New Year.

Regards
Xander de Kock

FROM THE COUNCIL / VAN DIE RAAD

NEW MEMBERS

The Society welcomes the following new members who joined the Society between January and September 2009.

3582	GRAHAM, Mr K	1648 Beryl Str, SAN DIEGO, CA 92109-2211, USA
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3585 G	HECKER, Mr A	P O Box 2856, HOUGHTON, 2041
3586 G	LIEBENBERG, Mr H	P O Box 9517, VERWOERD PARK, 1453
3587 K	ROBINS, Mr W & Mrs A	P O Box 176, HLUHLUWE, 3960
3588 E	VAN DER MERWE, Mr P J J	21 Buxton Str, QUEENSTOWN, 5320
3589 W	BARNARD, Mnr C J	Posbus 34, JEFFREYSBAAI, 6330
3590 G	HATTINGH, Mnr H C	Privaatsak X 2026, KRUGERSDORP, 1740
3591 M	KNOBEL, Mnr D W P	Privaatsak X 91, PIET RETIEF, 2380
3592	BATZLOFF, Mr J G	674 Glenmont Dr, SOLANA BEACH, CA 92075, U S A
3593 G	CASOOJEE, Mr M F	P O Box 449, CROWN MINES, 2025
3594 G	CLARKE, Mr D R	4 Homestead Rd, EASTLEIGH, 1609
3595 L	FOURIE, Me M	Posbus 626, POTGIETERSRUS, 0600
3596	HARTLIEB, Mr K	P O Box 193, VICTORIA PARK, W A 6979, Australia
3597 G	KREDER, Mev A	Posbus 24312, INNESDALE, 0031
3598 M	MABOKA, Mr S L	P O Box 537, MHLUZI, 1053
3599 G	MIENY, Mnr P J J	Sanniestraat 625, PRETORIA TUINE, 0082
3600 L	SMIT, Mnr C	Posbus 433, POTGIETERSRUS, 0600
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3603 G	BOY, Mnr G	Jack Hindonstr 413, PRETORIA NOORD, 0116
3604 G	DAVIDGE-PITTS, Mr G & Mrs M	P O Box 3191, PARKLANDS, 2121
3605 L	EBERHARD, Mr D P	P O Box 1164, TZANEEN, 0850
3606 L	FRANGERICO (PTY) LTD	P O Box 4141, POLOKWANE, 0700
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3614 L	VAN DYK, Mnr W F	Posbus 35, MAASSTROOM, 0623
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Ian Bassingthwaighte

ENCEPHALARTOS PAUCIDENTATUS UITSTAPPIE NA BARBERTON

Figuur 1.—Teen die steiltes uit.

Die Laeveld Tak tesame met lede van die Limpopo Werkgroep en Sentrale (Transvaal) Tak het om 7:00 voor die Polisiestasie in Barberton bymekaargekom. Die motors is daar gelos en 'n konvooi van bakkies het vertrek na 'n kolonie *Encephalartos paucidentatus* plante op 'n Sappi bosbouplantasie wat grens aan die Songimvelo Nasionale Park. Die pad was moeilik en die vordering was redelik stadig, maar teen 9:30 het almal veilig gearriveer.

Met ons aankoms was ons welkom geheet deur twee Sappi werknemers, vrywaringsdokumente was aan ons oorhandig en almal het dadelik aan die werk gespring

Figuur 2.—Die enigste groot regopgroeiende plant.

Figuur 3.—Een van die ses groot plante met stamme tussen 4 en 7 meter lank.

Figuur 4.—Die wind het hierdie plant waarskynlik omgewaai.

Figuur 5.—'n Plant wat relatief onlangs omgewaai het.

Figuur 6.—Van die plante het, met tyd, weer opwaarts begin groei.

Figuur 7.—Nog 'n plant wat opwaarts begin groei.

met die voltooiing daarvan. Ons wil graag vir Martin van Rensburg bedank vir al die reëlings en toestemming om die uitstappie moontlik te maak.

Uiteindelik het die oomblik waarvoor almal gewag het aangebreek! Ons het hoog in 'n kloof op begin stap na waar die plante groei. Die gras was lank en die helling steil (Figuur 1), maar na ongeveer 45 minute se klim het ons die plante bereik. Daar is ses groot plante met stamme wat wissel van tussen 4 en 7 meter lank waarvan nog net een regop staan (Figuur 2 & 3). Die ander is waarskynlik oor tyd deur die wind omgewaai (Figuur 4 & 5). Twee van die plante se wortelstelsels was erg ontbloot wat daarvan getuig dat dit onlangs moes gebeur het, terwyl die ander alreeds weer opwaarts begin groei het (Figuur 6 & 7). Wat verblydend was is dat almal gesond voorgekom het en 'n paar saailinge is ook waargeneem (Figuur 8) wat beteken dat daar manlike sowel as vroulike plante in die kolonie is en natuurlike voortbestaan is dus moontlik. Daar is egter tekens dat daar plante in die verlede deur stropers verwyder is. Wat verblydend was is dat die plante opgepas word deur Natuurbewaring. Tydens ons besoek het twee veldwagters hul opwagting gemaak en was baie verontwaardig omdat hulle nie geweet het van die besoek nie. Die Sappi werknemmers het hulle egter gerus gestel met die nodige dokumentasie waarmee Sappi vooraf toestemming gekry het vir die besoek.

Die afkom was net so moeilik soos die opgaan vra maar vir Wiley Wilken (Figuur 9), maar almal het veilig by die braai area aangekom. Daar is toe vleis gebraai en heerlik geëet waarna daar weer in 'n konvooi teruggery is Barberton toe.

Dirk van der Walt

Figuur 8.—'n Gesonde populasie met saailinge aanwesig.

Figuur 9.—Opgaan en afkom was ewe moeilik teen die steil helling, vra maar vir Wiley Wilken!

NEWS FROM THE WESTERN CAPE

A new committee has been chosen for the next term at the last meeting of the Western Cape Branch of the Cycad Society of South Africa.

The committee chosen is as follows:

Regional branch representative: Frikkie Conradie
Secretary: Johan Kotze
Treasurer: Talita van Schoor
Media Liaison: Wynand van Eeden

A preliminary programme for next year has been suggested but any recommendations or suggestions from members would also be welcomed. The official program is as follows:

23 January—Garden visit
15–16 May—Robertson/Swellendam/Gouritzrivier/Caledon weekend outing
July—Identification course over two days (if a suitable presenter can be found)
18 September—Garden visit
November—Year-end function planned for the first weekend

It was also decided to have more, albeit smaller and informal meetings to make it possible for members to meet up and visit, get to know each other and just talk about cycads and related matters. This, we hope, will involve more people more often to stimulate interest in and knowledge of cycads.

Johan Kotze

MEMBERSHIP FEES

Members should have received invoices in respect of the 2010 fees by now. In case yours has gone astray or been mislaid, the amounts payable are mentioned below. This year I have extended the final date of payment to 28 February 2010, as I will be out of the country from the beginning of December to the middle of February. Members are reminded that fees cover the period from January to December annually.

South African members	R185.00

Southern African members	Air mail	Surface mail
	R300.00	R260.00

Rest of the world	Air mail	Surface mail
ZAR	315.00	275.00
Au$	65.00	55.00
US$	50.00	45.00
GBP	32.00	28.00
Euro	35.00	33.00

South African members who pay by internet transfer need no longer provide proof of payment, as the system is working well, provided that your name and membership number (the one appearing on the address label after your name) appears on the 'beneficiary bank statement' or whatever other term your bank uses. Members who pay in cash over the bank counter are requested to continue providing proof of payment as I have had a few instances where payments have not reached the account and it is only with the proof of payment in hand that I could launch an enquiry into the missing funds.

Some local members send me registered envelopes containing their payments and while I have no objection in receiving payment in this manner, they might investigate making payment at a local branch of the Standard Bank should there be one in your area, as this could be a cheaper option for you.

Foreign members residing in Australia and the USA are reminded that they may send their payments directly to Paul Kennedy or Willie Tang respectively. Their contact details appear on the inside of the front cover of this issue of *ENCEPHALARTOS*. Members residing elsewhere should choose the method which is most suitable to them to remit funds. MoneyGram is represented in South Africa and I have received funds via this channel in the past. Funds have not yet been received via PayPal.

Payments by VISA or MasterCard: I have received a number of requests over the years from members wishing to make payments by credit card and have investigated the cost structures. Unfortunately these companies' charges are so high that the Society would have to raise its fees substantially, in order to make payment by this method viable. This matter is, however, being looked into from time to time.

Ian Bassingthwaighte

2010 PROGRAMME FOR THE EASTERN CAPE BRANCH/2010 PROGRAM VIR DIE OOS-KAAP TAK

Herewith the year programme of the Eastern Cape Branch of the Cycad Society.

Hiermee die jaarprogram van die Ooskaap tak van die Broodboom Vereniging.

13–14 Maart 2010: Cycad weekend (Addo National Park Area) and annual general meeting/Broodboomnaweek (Addo Nasionale Park Area) en jaarvergadering.

24–25 September 2010: Cycad expo (Port Elizabeth) and meeting/Broodboom ekspo (Port Elizabeth) en vergadering.

Contact Marius Helm, whose details appear on the inside of the front cover, if you are interested in the above-mentioned activities.

Kontak Marius Helm, wie se besonderhede aan die binnekant van die voorblad verskyn, indien jy belangstel om deel te neem aan bogenoemde aktiwiteite.

Marius Helm

GROW CLIVIAS

Following on the popularity of the booklet 'Grow Cycads', the Society has decided to stock another title in the 'Kirstenbosch Gardening Series' namely 'Grow Clivias'. For further details of this publication, please consult the advertisements in this issue.

Ian Bassingthwaighte

NUWE BESTUURSRAAD VIR DIE LAEVELD TAK

Die Laeveld Tak van die Broodboom Vereniging het op 30 Augustus 2009 'n algemene jaarvergadering gehou. Tydens die vergadering is die bestuurslede gekies vir die volgende twee jaar vanaf 1 Januarie 2010.

Die twee jaar termyn van die huidige bestuur verstryk einde Desember 2009. Daar het 19 persone die vergadering bygewoon waarvan 10 opbetaalde lede by die Vereniging is.

Streektakverteenwoordiger: Dirk van der Walt
Sekretaris-tesourier: Retha van der Walt
Addisionele lede: Jan Joubert en Chris Brummer
Saadbankbeampte: Robert Kunitz

Dirk van der Walt

COMPUTER PROGRAMS

The Society currently uses a mix of Microsoft Word, Xcel, Corel Word Perfect and a paperbased register to administer the membership database. While the system worked well in the past, it is now becoming somewhat cumbersome due to the increasing number of members and has necessitated the investigation into a more efficient means of running the Society. A program named Microsoft Access has been mentioned on a number of occasions and it appears to suit the Society's needs. We therefore enquire whether any member has experience in the use of this program and would be willing to assist with the conversion of our records into that format. It would obviously be more convenient (but not a prerequisite) if the volunteer is located in the Pretoria area, where the records are held. Should anybody see their way clear to be of assistance, or have knowledge of a similar program, kindly contact the secretary on 012 548 1152 or cycad@cycadsociety.org.

Ian Bassingthwaighte

Below follows a list of recently published literature on cycads and cycad-related topics. Where available, abstracts have been included so as to give readers a clearer indication of the themes addressed in the books or papers listed, since a wide variety of topics are included. One other news item is reported on and some useful websites are mentioned.

BARCELOUX, D.G. 2009. **Cycad Seeds and Chronic Neurologic Disease (*Cycas* Species).** In BARCELOUX, D.G. (ed.). *Foodborne and Microbial Toxins, Part II: Staples and Spices* 55(6): 313–412.

CHIANG, Y-C., HUNG, K-H., MOORE, S-J., GE, X-J., HUANG, S., HSU, T-W., SCHAAL, B.A. & CHIANG, T.Y. 2009. **Paraphyly of organelle DNAs in *Cycas* Sect. *Asiorientales* due to ancient ancestral polymorphisms.** *BMC Evolutionary Biology* 9: 161–180.

Background: This study addresses the apportionment of genetic diversity between *Cycas revoluta* and *C. taitungensis*, species that constitute the section *Asiorientales* and represent a unique, basal lineage of the Laurasian genus *Cycas*. Fossil evidence indicates divergence of the section from the rest of *Cycas* at least 30 million years ago. Geographically, *C. taitungensis* is limited to Taiwan whereas *C. revoluta* is found in the Ryukyu Archipelago and on mainland China.

Results: The phylogenies of ribosomal ITS region of mtDNA and the intergenic spacer between *atp*B and *rbc*L genes of cpDNA were reconstructed. Phylogenetic analyses revealed paraphyly of both loci in the two species and also in the section *Asiorientales*. The lack of reciprocal monophyly between these long isolated sections is likely due to persistent shared ancestral polymorphisms. Molecular dating estimated that mt- and cpDNA lineages coalesced to the most recent common ancestors (TMRCA) about 327 (mt) and 204 MYA (cp), corresponding with the divergence of cycad sections in the Mesozoic.

Conclusion: Fates of newly derived mutations of cycads follow Klopfstein *et al.*'s surfing model where the majority of new mutations do not spread geographically and remain at low frequencies or are eventually lost by genetic drift. Only successful 'surfing mutations' reach very high frequencies and occupy a large portion of a species range. These mutations exist as dominant cytotypes across populations and species. Geographical subdivision is lacking in both species, even though recurrent gene flow by both pollen and seed is severely limited. In total, the contrasting levels between historical and ongoing gene flow, large population sizes, a long lifespan, and slow mutation rates in both organelle DNAs have all likely contributed to the unusually long duration of paraphyly in cycads.

DOWNIE, D.A. & WILLIAMS, J.G. 2009. **Population Structure of *Porthetes hispidus* (Coleoptera: Curculionidae), a Pollinator of the African Cycad *Encephalartos friderici-guilielmi*.** *Annals of the Entomological Society of America* 102(6): 1126–1134.

Porthetes hispidus (Boheman) (Coleoptera: Curculionidae: Amorphocerini) is thought to be the primary pollinator of and is completely host specific to *Encephalartos friderici-guilielmi* Lehmann, which is considered threatened. It is distributed across the Eastern Cape of South Africa. Here, genetic diversity and structure of a cycad-associated weevil, *P. hispidus*, was investigated using the cytochrome oxidase I (COI) and elongation factor 1a genes (EF-1α). Samples were taken from nine populations on isolated colonies of the host plant from across its known range. Nucleotide and haplotype diversity were moderate to high. Little to no phylogeographic structure was found, and very low values of F_{ST} and high values of Nm (COI: F_{ST} = 0.0759, Nm = 3.04; EF-1α: F_{ST} = -0.0175, Nm = ∞) indicated high levels of gene flow despite current geographical disjunctions. These data suggest that isolated colonies of *E. friderici-guilielmi* maintain a viable population of pollinators. However, more rapidly evolving markers may reveal current genetic differentiation that did not exist in the past.

HILL, K.D. & STANBERG, L.C. 2009. **Notes on Cycas truncata de Laub. and related matters.** *Telopea* 12(3): 447–450.

KRÜGER, T., MÖNCH, B., OPPENHÄUSER, S. & LUCKAS, B. 2009. **LC–MS/MS determination of the isomeric neurotoxins BMAA (β-N-methylamino-L-alanine) and DAB (2,4-diaminobutyric acid) in cyanobacteria and seeds of *Cycas revoluta* and *Lathyrus latifolius*.** *Toxicon* (In press).

Since diverse taxa of cyanobacteria has been linked to biosynthesis of BMAA, a controversy has arisen about the detection of neurotoxic amino acids in cyanobacteria. In this context, a novel LC–MS/MS method was developed for the unambiguous determination of β-N-methylamino-L-alanine (BMAA) and 2,4-diaminobutyric acid (DAB) in cyanobacteria and selected plant seeds. Both neurotoxic and non-proteinogenic amino acids were analyzed without derivatization considering the total concentration of the free and protein-bound form. The investigation of overall 62 cyanobacterial samples of worldwide origin by application of this method revealed the absence of BMAA, whereas seeds of *Cycas revoluta* contained 6.96 $\mu g\ g^{-1}$ of free BMAA. In contrast, the isomer DAB was confirmed in 16 cyanobacterial samples in concentrations of 0.07–0.83 $\mu g\ g^{-1}$, whereof one sample is distributed as nutritional supplement. In addition, seeds of *Lathyrus latifolius* contained 4.21 $\mu g\ g^{-1}$ of free DAB. Limits of detection were for BMAA < 1.0 $\mu g\ g^{-1}$ in the cyanobacterial matrix and < 0.14 $\mu g\ g^{-1}$ in angiosperm seeds. DAB exhibits higher sensitivities of <0.06 $\mu g\ g^{-1}$ in cyanobacteria and <0.008 $\mu g\ g^{-1}$ in angiosperm seeds. The highly specific analysis method with increased detection sensitivity eliminates the disadvantages of derivatization-based methods to be discussed.

LI, L., WANG, Z-F., JIAN, S-G., ZHU, P. ZHANG, M. YE, W-H. & REN, H. 2009. **Isolation and characterization of microsatellite loci in endangered *Cycas changjiangensis* (Cycadaceae).** *Conservation Genetics* 10:793–795.

Eight microsatellite loci were isolated from repetitive DNA enriched libraries for *Cycas changjiangensis*, an endangered endemic species in Hainan Island, China.

The number of allele ranged from three to seven. The observed (HO) and expected (HE) heterozygosities ranged from 0.0000 to 0.8750 and from 0.2359 to 0.7582, respectively. These microsatellite loci will enrich our scientific understanding for *C. changjiangensis* conservation.

LIDDLE, D.T. 2009. **Management Program for Cycads in the Northern Territory of Australia 2009–2014**. Northern Territory Department of Natural Resources, Environment, the Arts and Sport, Darwin.

The aim of this management program is to maintain viable wild populations of all cycad taxa and cycad habitats across their range in the Northern Territory. Objectives to achieve this aim are:

1. To promote the conservation of cycad populations through sustainable land management practices.

2. To develop and apply strategies for the ecologically sustainable use of cycads.

3. To provide for the wise use of cycads that will otherwise be destroyed through land use permitted under relevant legislation.

4. To facilitate essential research.

5. To promote public awareness and education.

The invasion of exotic pasture grasses into cycad habitat is increasing fuel load, giving rise to substantial increases in fire intensity. In the absence of sympathetic land management, high intensity fires are expected to have a major deleterious impact on cycad populations in the savanna woodlands of the Northern Territory. Adult cycad stems capable of producing seeds are particularly at risk from high intensity fire events. In addition, loss of habitat due to land clearing is having a negative impact on wild populations in some areas. Sustainable harvest of cycads provides an opportunity for landholders to maintain wild populations while providing a financial incentive to maintain cycad habitats. Concern for the conservation of Northern Territory cycads, in combination with the requirement for a management program to allow export of wild harvested cycad products other than seed, has led to this program. All Northern Territory cycads are listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. In recognition of this listing, the export of cycad products such as whole plants or leaves requires an export permit issued by the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999*. In the Northern Territory, commercial harvest of cycads requires a permit issued under the *Territory Parks and Wildlife Conservation Act.* This program specifies limits and conditions for the harvest of cycads. The program also provides for monitoring and assessment of harvest impacts. Provision exists for the salvage of cycads from areas where they will be destroyed in the pursuit of other legitimate purposes such as construction of roads or under a clearing permit. Research that supports the aim of this program will be encouraged. Extension activities will include the dissemination of research findings and providing guidelines on harvesting cycads. The biology, ecological significance and value of cycads will be promoted in a variety of media and landholder extension activities. The program encourages the conservation of cycads through sustainable land management practices. The management measures and performance indicators are aligned to the overall program objectives and the performance indicators summarised in a milestone matrix.

LINDSTROM, A.J., HILL, K.D. & STANBERG, L.C. 2009. **The genus *Cycas* (Cycadaceae) in Indonesia.** *Telopea* 12 (3): 385–418.

The genus *Cycas* is reviewed for Indonesia. Ten species are enumerated, two of them new (*C. sundaica*, *C. montana*). Lectotypes are designated for *Cycas* Subsection *Endemicae*, *C. glauca*, *C. circinalis* subsp. *riuminiana* var. *curranii* forma *maritima* J.Schust. The species are placed in an infrageneric classification previously outlined. Distribution of all taxa is mapped, and a key to species provided. Extensions into Malaysia (*C. edentata*) and Papua New Guinea (*C. apoa*, *C. pappuana*, *C. scratchleyana*) are discussed under the species. Previous recordings of *C. circinalis* from Indonesia are discussed.

MADULID, D.A. & AGOO, E.M.G. 2009. **Taxonomy and conservation of Philippine Cycads.** *Blumea* 54(1–3): 99–102(4).

Six species of cycads are recorded in the Philippines, three of which are endemic. The different species of cycads can be recognized by the characters of the microsporophylls, megasporophylls, and seeds. The current conservation status of the different species of *Cycas* is assessed and categorized using the IUCN criteria on basis of currently available information.

MARLER, T.E. & SHAW, C.A. 2009. **Free and glycosylated sterol bioaccumulation in developing *Cycas micronesica* seeds**. *Food Chemistry* 115(2): 615-619.

The bioaccumulation of free and glycosylated forms of stigmasterol and β-sitosterol were determined from *Cycas micronesica* K.D.Hill seeds throughout seed ontogeny. Per-seed pool of the four compounds increased linearly from 2 to 24 months, indicating no developmental period elicited a major shift in the rate of bioaccumulation. The slopes were not homogeneous, signifying a change in relative sterol profile concomitant with seed maturation. This shift was in favour of the glucosides, as their rate of accumulation exceeded that of the free sterols. Stigmasterol content exceeded that of β-sitosterol, but ontogeny did not influence the ratio of these dominant sterols. The quantity and quality of sterol exposure during consumption of foods prepared from gametophytes by humans is strongly influenced by age of harvested seeds. Results are critical for a further understanding of the link between human neurodegenerative diseases and historical consumption of foods derived from the seed gametophyte tissue.

OCTAVIO-AGUILAR, P., GONZÁLEZ-ASTORGA, J. & VOVIDES, A.P. 2009. **Genetic diversity through life history of *Dioon edule* Lindley (Zamiaceae, Cycadales).** *Plant Biology* 11: 525–536.

The distribution of genetic diversity and structure for three populations of *Dioon edule* Lindley (Zamiaceae) at Monte Oscuro (MO), El Farallón (EF) and Rancho del Niño (RN) in Veracruz, Mexico was studied using 20 allozyme loci, considering four life history classes: seeds, seedlings, juveniles and adults. The MO population is genetically less diverse than the EF and RN populations. Total

and local inbreeding differ significantly between life history classes. An increment of inbreeding among all classes was observed, and genetic differentiation among populations was higher in seeds and seedlings than in juveniles and adults. In terms of percentage of polymorphic loci, the MO seeds showed least (80%), followed by RN (95%) and EF had the highest values (100%), probably because of a reduction in effective population size and habitat fragmentation processes. In this context, the mean effective population size was 23.2 ± 11.3 for all populations. We conclude that seed cohorts in EF and RN represent a reservoir of genetic diversity within these two populations. Also, preservation of adult plants is an essential aspect to consider in management and conservation efforts for populations of *Dioon edule* in natural conditions.

PINARES, A., GONZÁLEZ-ASTORGA, J., VOVIDES, A.P., LAZCANO, J. & VENDRAME, W.A. 2009. **Genetic diversity of the endangered endemic *Microcycas calocoma* (Miq.) A. DC (Zamiaceae, Cycadales): Implications for conservation.** *Biochemical Systematics and Ecology* 37(4): 385–394.

The diversity and genetic structure of seven populations of *Microcycas calocoma* (Miq.) A. DC, were analyzed by gel electrophoresis using 19 allozymes. The mean number of alleles per locus (A) was 1.49 and the percentage of polymorphic loci was relatively high ($P = 48.09$). The mean observed (H_o) and expected heterozygosity (H_e) were 0.20 and 0.17, respectively. The *F*-statistics revealed a high population structure ($F_{st} = 0.34$). Mean gene flow between population pairs was Nm = 0.96. Results were compared with those of other cycad species, and indicate that *M. calocoma* populations have become fragmented due to increasing pressures of habitat conversion and disturbance. Also, geographical isolation among populations has generated allele loss in relation to altitude. The establishment and maintenance of protected areas for in situ conservation is critical to preserve the high genetic diversity of *M. calocoma*. Conservation strategy guidelines have been specified.

PROCHES, S. & JOHNSON, S.D. 2009. **Beetle pollination of the fruit-scented cones of the South African cycad *Stangeria eriopus*.** *American Journal of Botany* 96: 1722–1730.

There has been considerable uncertainty about the importance of wind vs. insects in cycad pollination, but recent studies in several cycad genera have indicated that these are pollinated primarily, if not exclusively, by insects. *Stangeria* represents an isolated southern African cycad lineage previously thought to be wind-pollinated. Unlike in most other cycads, there is no evidence of cone thermogenesis in *Stangeria*. We found that the scent of both male and female *Stangeria* cones mimics that of fermented fruit, the main volatiles being esters of acetic acid, ketones, and aldehydes. We found a large variety of insect visitors on the cones, the most common ones being sap and rove beetles (Coleoptera: Nitidulidae, Staphylinidae) and fruit flies (Diptera: Drosophilidae). Of these, only sap beetles (Nitidulidae) were able to effect pollination under experimental conditions. Because sap beetles are also pollinators of *Cycas* and members of several ancient angiosperm families, their role in the pollination of *Stangeria* adds interesting details to the role this group of insects has played in the history of plant–pollinator interactions.

SCHWENDEMANN, A.B., TAYLOR, T.N. & TAYLOR, E.L. 2009. **Pollen of the Triassic cycad *Delemaya spinulosa* and implications on cycad evolution.** ***Review of Palaeobotany and Palynology*** 156(1–2): 98–103.

The Cycadales are an order of gymnosperms that represent one of the oldest lineages of seed plants. Cycads are thought to have originated in the Carboniferous, and subsequently diversified and geographically expanded throughout the Mesozoic. Despite the geologic diversity of the group, the evolutionary history of cycads remains unresolved. To a large degree this is because the leaves of cycads and various other fossil groups (e.g., pteridosperms and Bennettitales) are morphologically similar. To date there are relatively few fossil cycad reproductive structures. Several are known from the Permian of China, but these compression specimens provide little detailed information useful in tracing the evolution of cycad cone morphology and anatomy. A permineralized cycad pollen cone from the Triassic of Antarctica, *Delemaya spinulosa*, contains in situ pollen. The objective of the current study is to further elaborate the structure of the pollen grains in this species, with particular emphasis directed at the structure and organization of the pollen wall. The elliptical shape, monosulcate aperture, and small size of the pollen grains are like those of extant Cycadales. The exine, although originally described as homogenous, appears to possess an alveolar organization. Pollen and cone features are compared to those in extant Cycadales.

SOLOMON RAJU, A.J. 2009. **Nesting behaviour of the Baya Weaver bird, *Ploceus philippinus* (Ploceidae) and the life-cycle of the Plains Cupid butterfly, *Chilades pandava* (Lycaenidae) with the red-listed *Cycas sphaerica* and *C. beddomei* (Cycadaceae).** *Journal of Threatened Taxa* 1(8): 429–433.

The Baya Weaver bird, *Ploceus philippinus* utilizes the well developed leaves of *Cycas sphaerica* for nest construction and offspring production. It constructs nest on the leaf tips of this species; the nest material used is exclusively *Dendrocalamus strictus*. This bird species does not utilize *Cycas beddomei* for nest construction and offspring production. The Plains Cupid butterfly, *Chilades pandava* utilizes the newly emerging leaves of both *C. sphaerica* and *C. beddomei* for raising its offspring. In both the *Cycas* species, the new leaves emerge as a crown at the top of the plant; the larvae of *C. pandava* feed on these leaves and make the plant as leafless until the next leaf flushing season. New leaf production occurs after coning event in *Cycas* species; coning is not annual event. In consequence, the plants utilized by *C. pandava* for the production of its offspring remain leafless until the next coning season and their survival during this period depends on the nutrient status within the shoot system and in the soil system. The study suggests that there is no direct or indirect interaction between *C. pandava* and *P. philippinus*. *C. sphaerica* serves as a host plant for these two animal species at different times; but the interaction of these animal species is dependent on the leaves only; *C. pandava* on newly emerging leaves while *P. philippinus* on well developed leaves.

TERRY, I., ROE, M., TANG, W. & MARLER, T.E. 2009. **Cone insects and putative pollen vectors of the endangered cycad, *Cycas micronesica*.** *Micronesica* 41(1): 83–99.

Several sampling methods were used to survey for potential pollinators of the critically endangered *Cycas micronesica* in different forest communities on the islands of Guam and Rota. The most common insects found depended on the method. From direct observations, *Anatrachyntis* sp. (Lepidoptera: Cosmopterygidae) larvae and adults were observed only on male cones. Adult *Carpophilus* sp. beetles (Coleoptera: Nitidulidae) were common on male cones and were occasionally observed on female cones. In bag traps over cones, adult *Anatrachyntis* were consistently trapped and were very abundant on both sexes, and other insects were rarely observed. Sticky collars around cones captured the highest diversity of taxa, mostly Diptera, Hymenoptera and Coleoptera comprising several families within each order, as well as *Anatrachyntis* adults. Two species within the family Phoridae were the most common Diptera and ants were the most common Hymenoptera. The most common Coleoptera were Staphylinidae and Nitidulidae. Similar taxa were trapped on both sexes and from four different habitats on Guam. On female cone sticky traps, ~30% of the pollen grains were associated with *Anatrachyntis* moths or moth scales and less than 5% with other insects; however, over 60% of the pollen was not associated with any insect, suggesting some pollen is wind dispersed. On Rota, 60 km northwest of Guam, *Anatrachyntis* moths and *Carpophilus* beetles were found on cones. In sum, the results suggest both wind and insects as pollen vectors, with *Anatrachyntis* moths the most likely insect vector and, secondarily, nitidulid beetles. To date, no other Lepidoptera has been implicated as a pollinator of any cycad species.

ZHANG, M., WANG, Z-F, JIAN, S-G., YE, W-H., CAO, H-L., ZHU, P. & LI, L. 2009. **Isolation and characterization of microsatellite markers for *Cycas hainanensis* C. J. Chen (Cycadaceae).** *Conservation Genetics* 10(4): 1175–1176.

Cycas hainanensis is an endangered cycad species endemic to Hainan Island, China. To enrich our scientific conservation for this species, we developed eight microsatellite markers using repetitive DNA enriched libraries. The number of alleles per microsatellite locus varied from 8 to 17. The expected (HE) and observed (HO) heterozygosities varied from 0.4754 to 0.8846 and from 0.3636 to 0.9600, respectively. These markers will be employed to determine whether the ex situ *C. hainanensis* individuals in South China Botanical Garden capture a representative portion of genetic diversity of the wild populations.

OTHER NEWS ITEMS

T-STAR Grant Funds Genetic Studies and Endangered Cycad Rescue
Posted on www.wptrc.org

The University of Guam's Western Pacific Tropical Research Center (WPTRC) was awarded $510,165 in T-STAR grant funds from USDA. T-STAR (Tropical and Subtropical Agriculture Research) is a special grant program explicitly for research that enhances the development of sound tropical and subtropical agricultural practices including value-added product development and the control of diseases, insects, weeds, and invasive species.

The projects funded will serve aquaculture and papaya farmers as well as work toward the preservation of an endemic cycad species endangered due to attacks by several species of invasive insects.

Hui Gong, an aquaculture researcher with WPTRC, was awarded $186,960 for a genetic variability study of specific pathogen free (SPF) Pacific white shrimp, *Penaeus vannamei,* through developing a panel of species-specific microsatellite genetic markers. Says Dr. Gong, 'The long term research objective is to establish a medium-scale, effective genetic selection program of *P. vannamei* on Guam to support the development and expansion of shrimp aquaculture in the Western Pacific region.'

George Wall, plant pathologist, received $162,856 in collaboration with Dr. D. Nandwani from the Northern Marianas College to improve papaya cultivars from the Mariana Islands in their tolerance to papaya ringspot virus (PRV) and other important diseases. Dr. Wall's studies have found that a local variety is tolerant to PRV but needs genetic improvement to reduce the incidence of male character and deformed fruit. "We intend to take our selections to an F4 generation with this grant project and ultimately to an F7 or beyond," says Wall.

WPTRC research scientist Thomas Marler is known internationally as an expert on cycad plants. Marler, in collaboration with pollination biologist Irene Terry, was awarded $120,318 to study the pollination process of *Cycas micronesica*, a plant endemic to the Mariana Islands. This cycad is currently listed as endangered on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of endangered species. 'This project addresses a pressing horticultural problem, an acute invasive species crisis, fundamental questions concerning pollinator-plant interactions in an ancient lineage of plant, and critical gaps in knowledge needed to steer urgent conservation decisions,' says Marler.

'WPTRC scientists in partnership with USDA continue to keep the needs of farmers and the ecosystems of Guam and the region on their research agendas. UOG researchers have a stellar track record with T-STAR administrators,' says Greg Wiecko, associate director of WPTRC.

Useful websites for cycad-lovers

The Cycad Society of South Africa:
http://www.cycadsociety.org

IUCN/SSC Cycad Specialist Group:
http://www.cycadsg.org

Cycad information on Wikipedia:
http://en.wikipedia.org/wiki/Cycad

Palm and Cycad Societies of Australia:
http://www.pacsoa.org.au

The Cycad Pages:
http://plantnet.rbgsyd.nsw.gov.au/PlantNet/cycad/index.html

Compiled by Alicia Grobler

FOCUS ON

ZAMIA POLYMORPHA D.W.STEV., A.MORETTI & VÁZQ.TORRES

Roy Osborne[1] & William Tang[2]

Introduction

How many pairs of cycads have the same or very similar species epithet? More than most of us would guess! Consider the pairs *Ceratozamia miqueliana/Macrozamia miquelii* (but not *Cycas miquelii* that is now regarded as a synonym for *C. revoluta*), *Ceratozamia whitelockiana/Encephalartos whitelockii*, *Cycas furfuracea/Zamia furfuracea*, *Cycas inermis/Zamia inermis*, *Encephalartos concinnus/Macrozamia concinna, Macrozamia dyerii/Encephalartos dyerianus* (although referring to different Drs Dyer), *Macrozamia montana/Zamia montana*, and *Macrozamia polymorpha/Zamia polymorpha*. It is the last of these which we 'Focus on …' in this issue.

Figure 1.—Approximate distribution of *Zamia polymorpha*.

Discovery

The first collections of this taxon were under the name *Zamia loddigesii* in the early 1900s. During fieldwork in late 1988 and early 1989 in Belize and a contiguous area of Mexico's Yucatán Peninsula, Dennis Stevenson, Aldo Moretti and Luciano Gaudio surveyed and collected specimens from eleven populations of *Zamia*. Although it was first thought that these were populations of *Z. loddigesii* disjunct from its distribution in Veracruz and other states, a more detailed inspection of this and other material from the Peninsula, collected by Salvatore Cozzolino and Gioacchino Vallariello, and examination of additional herbarium vouchers from Belize, led to the conclusion that this was a new but highly variable species.

Figure 2.—Entrance to the Jardín Botánico Barrera Marín, within the forest habitat of *Zamia polymorpha*, near Puerto Morelos, Quintana Roo, Mexico. Photo: William Tang.

The taxon was described by Stevenson, Moretti and Gaudio in 1998, their choice of epithet referring to the unusual degree of variation in leaf and leaflet morphology, with a corresponding range in chromosome number and karyology. The type specimen is a 4-sheet herbarium voucher, *D. Stevenson et al. 1119*, collected in Cayo Province, southern Belize, in January 1989, and filed at the herbarium of the New York Botanical Garden.

After examining historical records, herbarium specimens and wild cycad populations in Belize, Michael Calonje and Jan Meerman (2009) have put forward a proposal to synonymise *Z. polymorpha* with their concept of *Z. prasina*, a taxon listed with a brief description in William Bull's horticultural catalogue of 1881. However, their view has not yet received the support of all taxonomists working on the genus and may be contested. The central consideration is whether the type specimen for *Z. prasina* at the Kew herbarium is consistent with wild *Z. polymorpha* plants or not.

Figure 3.—Forest habitat of *Zamia polymorpha* near Puerto Morelos, Mexico. Photo: William Tang.

1.—19 Calhoun Street, Macdowall, Queensland 4052, Australia
2.—65 Corydon Drive, Miami Springs, Florida 33166, USA

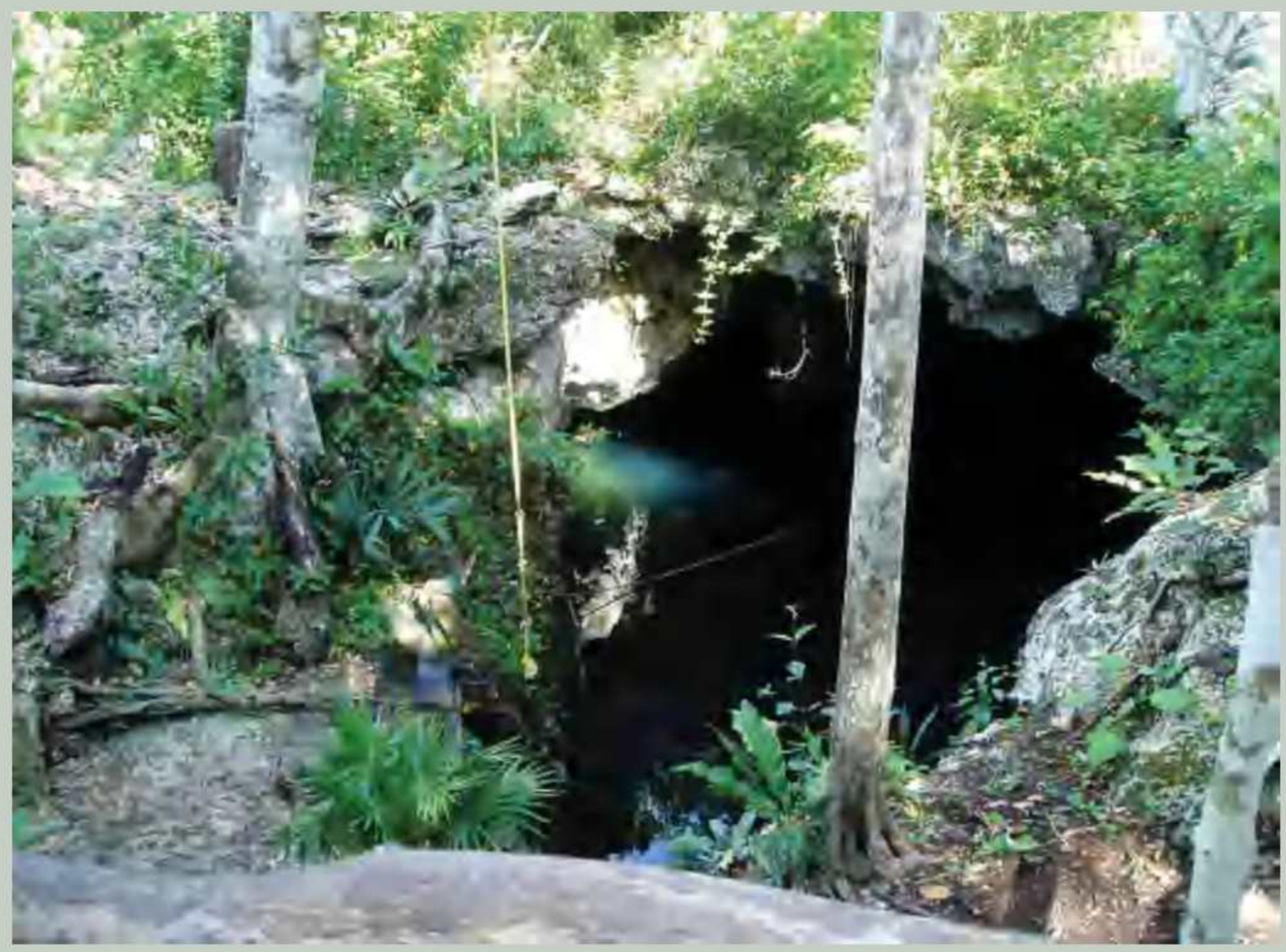

Figure 4.—*Zamia polymorpha* often occurs in higher densities around *cenotes*, where the tree canopy is open and light is more abundant. *Cenotes*, such as this moderate-sized one, are sinkholes with exposed rocky edges containing groundwater. Photo: William Tang

Distribution, habitat and ecology

Zamia polymorpha is widespread in its distribution in the three states of the Yucatán Peninsula (Campeche, Quintana Roo and Yucatán), westward into Tabasco and Chiapas, and along the coast of Belize, where populations extend along the slopes of the Maya Mountains, and with a further range extension into the Petén Province of Guatemala (Figure 1). Because of the presence of occasional leaf spotting, some of the Guatemalan plants may represent intergradation with *Z. variegata* (Schutzman 2004, Dale Holton pers. comm.).

Plants grow in flat or slightly hilly areas, at altitudes from sea level to 500 m, in exposed and shady sites. The vegetation throughout the plant's range varies from sub-tropical moist forest (*bosque tropical perennifolio*) to deciduous tropical forest (*bosque tropical subcaducifolio*), thorn forest (*bosque espinoso*), and their secondary succession stages (Figure 2 & 3). The soil is a sparse loam cover over a vast, relatively flat, limestone tableland (Figure 4).

The climate throughout the range is humid and tropical with an average annual temperature of 25°C. The annual rainfall ranges from 800 mm in the northwest increasing to 1300 mm along the eastern coast, increasing further into Belize. Plants are found at higher densities in the wetter southern portions of the distribution (S. Torres Pech pers. comm.). A dry season extends from December to May.

Trees such as *Bursera simaruba* and *Swietenia macrophylla* are common throughout the range. A terrestrial bromeliad, *Aechmea* sp., is also present as an understorey plant associated with this zamia.

Insect pollinators for this cycad have not been recorded but *Rhopalotria* (Coleoptera: Curculionoidea: Belidae) weevils and *Pharaxonotha* (Coleoptera: Erotylidae) beetles are the putative zamia pollinators in general. Similarly, seed dispersal agents for *Z. polymorpha* are not documented but mockingbirds and fruit-eating bats are candidates.

Description, vegetative structures

Zamia polymorpha has subglobose, subterranean stems, up to 32 cm long and 15 cm in diameter, these branching dichotomously in older specimens (Figure 5). Each stem bears 1–5 (usually 2–3) leaves that are erect to spreading in a sparse crown, brown initially maturing to a bright or dark green, 30–105 cm long, 29–45 cm wide, flat in cross-section (pinna-to-pinna angle: 180°), straight or arching in longitudinal profile. The petiole is 10–95 cm long, subterete, greenish in young leaves, and subtending a rachis bearing 3–12 pairs of leaflets in an opposite to subopposite arrangement, both the petiole and proximal portion of the rachis sparsely to very densely armed with prickles up to 4 mm long. Leaflets are papyraceous (in shade) to coriaceous (in sun), lanceolate to oblanceolate, acute apically, attenuate basally, with margins subrevolute and serrate in

Figure 5.—A large specimen of *Zamia polymorpha* in forest habitat near Puerto Morelos, Mexico, with Silvia Torres Pech, Director of the Jardín Botánico Barrera Marín. Photo: William Tang.

the distal 33%. Median leaflets are 15–35 cm long by 2–8 cm wide, the leaflet width increasing for plants in the shade (Figure 6–10). Cataphylls are persistent, chartaceous, triangular at the base, aristate at the apex, 3–7 cm long by 1–3 cm wide at the base and brown tomentose.

Description, reproductive structures

Pollen cones (Figure 11 & 12) of *Zamia polymorpha* are 1–2 per stem, 6–8 cm long excluding the peduncle, 1–2 cm in diameter, erect, conical with an acute apex, light to dark brown tomentose, and with a light brown tomentose peduncle 6–7 cm long and 12 mm in diameter. Microsporophylls are cuneiform, 4 mm long, with the apex hexagonal, truncate, with well-defined facets, and with sporangia distributed abaxially.

Ovulate cones (Figure 13) of *Z. polymorpha* are usually solitary per stem, 8–16 cm long excluding the peduncle, 5–8 cm in diameter, erect, cylindrical to ovoid, dark brown tomentose, with an acute apex, and with a brown tomentose peduncle 4–8 cm long and 11 mm in diameter. Megasporophylls are peltate, 4 mm long, with the apex hexagonal, truncate, 18–21 mm wide by 8 mm high, with well-defined facets. Seeds are ovoid, 14–21 mm long, 5–9 mm in diameter, the sarcotesta pink initially and red when ripe, the sclerotesta smooth and pale brown.

Like the situation in a few other zamias with extensive distributions (e.g. *Z. herrerae*, *Z. paucijuga*), the chromosome number for *Z. polymorpha* is variable, with

Figure 6.—A narrow leaflet form of *Zamia polymorpha* near Puerto Morelos, Mexico, with the typical subterranean stem. Photo: William Tang.

Figure 7.—A wide leaflet form of *Zamia polymorpha* near Puerto Morelos, Mexico. Photo: William Tang.

Figure 8.—*Zamia polymorpha* in a gravel area west of Belmopan, Belize. Photo: Dale Holton.

Figure 9.—Leaflet detail of *Zamia polymorpha* showing lichens and other microflora that grow on the leaflets in habitat. Photo: William Tang.

Figure 10.—An emerging leaf of *Zamia polymorpha*, on a plant near Puerto Morelos, Mexico. Photo: William Tang.

2n numbers of 17, 22, 23, 24, 25, 26, 27 and 28 being recorded, and with karyotypes varying accordingly (Stevenson *et al*. 1998, Napolitano *et al*. 2004). Vovides & Olivares (1996, then referring this taxon to *Z. loddigesii*) rationalise the changes in karyotype in terms of processes called centromeric fission, pericentric inversion and unequal translocation, and identify a correlation between high chromosome number and increasing dryness of the habitats. All this suggests that the species is of more recent origin than other members of the genus.

A different point of view is that of Bart Schutzman (pers. comm.) who believes that '*Zamia polymorpha*' is a hybrid swarm of multiple species origin that may in fact be developing into a semispecies, but will probably not make it due to man's pressure on the populations.

Distinguishing features

Zamia polymorpha is most closely related to *Z. loddigesii*, being separated from the latter species only in 1998. Geographically, the ranges for these taxa do not overlap. Morphologically, the main differences lie in the shape and colour of the pollen and ovulate cones. Pollen cones of *Z. polymorpha* are dark reddish brown or maroon tomentose, and have sporophylls with a small terminal process surrounded by six prominent lateral facets. Pollen cones of *Z. loddigesii*, in contrast, are brown at the time of dehiscence and have sporophylls with a large terminal facet obscuring the laterals. Ovulate cones of *Z. polymorpha* are ovoid maroon tomentose, and have a gradually acute apex, while the ovulate cones of *Z. loddigesii* are cylindrical, grey to light tan, with a prominent apical extension. Some plants on the periphery of the *Z. polymorpha* range show intergradation and probable hybridization with *Z. loddigesii* and/or other poorly understood forms of *Zamia*.

Ethnobotany

Despite its wide distribution, we have no record of any ethnic name or usage for *Z. polymorpha.* It is almost certain that the Mayan people of the Peninsula would have a name for this plant, but such information could not be sourced.

Conservation status

This species is one of the best protected of all Neotropical cycads in terms of demarcated reserves, at least in Mexico. A population in Campeche falls within the Los Petenes Biosphere Reserve, a population along the Campeche-Yucatán border lies in the Río Celestún Biosphere Reserve, a population in Quintana Roo is in the Arrecifes de Sian Ka'an Biosphere Reserve, and other populations in Yucatán Province are protected within the Arrecife Alacranes National Park and the Río Lagartos Biosphere Reserve.

The total number of mature *Z. polymorpha* plants probably exceeds the conservatively estimated figure of 10 000 cited by Stevenson *et al*. (2003). Habitat reduction is assessed as moderate and the populations are stable. The land where the plants grow is of poor quality and generally not suitable for agriculture. As mentioned above, several populations fall within protection of reserves and the species is also protected, as are all na-

Figure 11.—A coning male *Zamia polymorpha* near Puerto Morelos, Mexico. Photo: William Tang.

tive cycads, under the Mexican law NOM-059-ECOL. The species is currently regarded by the World Conservation Union as near threatened (IUCN Red List of Threatened Species 2008).

For persons wanting to see this species in its forest habitat, there are two Mexican botanic gardens well worth visiting. Firstly, the Jardín Botánico Dr. Alfredo Barrera Marin (Avenida Centenario km 5.5, Chetumal, Quintana Roo) has local *Z. polymorpha* specimens planted in intact forest—and also has an interesting Mayan *chiclero* (gum-processing worker) camp and archeological ruins; an extensive forest preserve with wild *Z. polymorpha* is also located nearby. Secondly, the Jardín Botánico 'Xíitbal Neek', Centro de Investigación Científica de Yucatán (ex-Hacienda Xcumpich at km 7 on the old road to Progreso, before Dzibilchaltún, Mérida, Yucatán) is situated in tropical thorn forest typical of the drier parts of the Peninsula and has a good representation of native *Z. polymorpha*.

Cultivation

Zamia polymorpha is relatively easy to maintain in tropical and subtropical garden plantings and in glasshouse cultivation in more temperate zones (Figure 14). Its requirements are much as for the closely related *Z. loddigesii*, with good drainage being essential. Cultivated plants cone annually and human-assisted pollination can ensure a good seed set from which plants are easily raised.

Figure 12.—A coning male *Zamia polymorpha* in cultivation at the Jardín Botánico Barrera Marín. Photo: William Tang.

Figure 13.—A female cone of *Zamia polymorpha*. Photo: Andrew Vovides.

Figure 14.—A healthy crop of *Zamia polymorpha* plantlets grown from seed collected near Belmopan in Belize. Photo: Dale Holton.

Acknowledgments

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Literature cited

ANON. 1994. NOM-059-ECOL-1994, que determina las especies y subespecies de flora y fauna silvestre terrestres y acuáticas en peligro de extinción, amenazaas, raras y las sujetas a protección especial, y que establece especificaciones para su protección. *Diario Oficial de la Federación*. México, D.F.

CALONJE, M. & MEERMAN, J. 2009. What is *Zamia prasina* (Zamiaceae, Cycadales)? *Journal of the Botanical Research Institute of Texas* (3)1: 43–49.

IUCN. 2008. Red List of Threatened Species: http://www.iucnredlist.org

NAPOLITANO, A., CAPUTO, P. & MORETTI, A. 2004. Karyology, phytogeography, and the origin of intra-specific karyotypic variation in *Zamia paucijuga* and *Z. polymorpha* (Zamiaceae). *Delpinoa* n.s. 46: 71–83.

SCHUTZMAN, B. 2004. Systematics of meso-American *Zamia* (Zamiaceae). Pp. 159–172 in WALTERS, T. & OSBORNE, R. (eds), *Cycad classification—concepts and recommendations*. CAB International, Wallingford, England.

STEVENSON, D.W., MORETTI, A. & GAUDIO, L. 1998. A new species of *Zamia* (Zamiaceae) from Belize and the Yucatán Peninsula of Mexico. *Delpinoa* n.s. 37–38: 3–8 [1995–1996].

STEVENSON, D.W., VOVIDES, A.P. & CHEMNICK, J. 2003. Regional overview: New World. Pp. 31–38 in DONALDSON, J.S. (ed.), *Cycads. Status survey and conservation action plan*. IUCN/SSC Cycad Specialist Group, Gland, Switzerland & Cambridge, U.K.

VOVIDES, A.P. & OLIVARES, M. 1996. Karyotype polymorphism in the cycad *Zamia loddigesii** (Zamiaceae) of the Yucatan peninsula, Mexico. *Botanical Journal of the Linnean Society* 120(1): 77–83 [*Data refer to *Z. polymorpha*].

The Umbeluzi River cycad, *Encephalartos umbeluziensis*

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Introduction

The Umbeluzi River cycad, *Encephalartos umbeluziensis*, was described in 1951 although it has probably been known and cultivated since the early 1920s. Some controversy exists about the identity of *E. striatus*, an imperfectly known cycad that was described before *E. umbeluziensis*. This species has a scattered distribution in Mozambique with a restricted distribution in Swaziland. A slightly different leaf form was observed in Mozambique and the cones and cultivation requirements are discussed.

In 1945 Mr. Brandsby A. Key, a cycad enthusiast from Johannesburg, observed cycads in gardens in Lourenço Marques (today known as Maputo) in Mozambique. After inquiring about the origin of the cycads he then found them in their natural habitat on the banks of a watercourse near the Umbeluzi River about 15 miles from Lourenço Marques. Key subsequently provided material and information of the Umbeluzi cycads to the Botanical Research Institute in Pretoria and six years later R.A. Dyer described *Encephalartos umbeluziensis* in 1951.

In 2003 H.F. Glen and P.J.H. Hurter indicated that they intended to publish a manuscript wherein it would prove that *E. umbeluziensis* is a synonym of *E. striatus*, as described by Stapf and Burtt Davy in 1926. This disputed paper was apparently never published.

Figure 1.—The type herbarium sheet of *Encephalartos striatus* showing the adaxial leaf surface with two female sporophylls.

Figure 2.—*Encephalartos umbeluziensis* in its natural habitat.

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Figure 3.—*Encephalartos umbeluziensis* in the old road.

Figure 4.—Clear petioles with leaflets decreasing in size.

The description of *E. striatus* was based on a garden plant in Pretoria of a certain Miss Reid and the type herbarium sheet consists of a median leaf blade segment and two female sporophylls (Figure 1). In 1965, R.A. Dyer excluded *E. striatus* on the grounds of inadequate information to identify it with certainty and in 2004 N. Grobbelaar, in a short communication, concurred with Dyer and disagreed about the synonymy of *E. striatus* with *E. umbeluziensis*.

On a note which R.A. Dyer wrote in 1974 and added on to the herbarium sheet, he stated that, 'Although I would not be prepared to defend the right of this name I feel there is a stronger affinity with *E. umbeluziensis* than *E. villosus*'.

Figure 5.—Median leaf detail of *Encephalartos umbeluziensis*.

The answer to the identity of *E. striatus* can probably be found by inspecting the female sporophylls on the herbarium sheet.

Distribution and habitat

Encephalartos umbeluziensis occurs in the Maputo Province of southern Mozambique and in eastern Swaziland where it can be found in forests (Figure 2), bushveld and occasionally in exposed sites on forest margins. Although the distribution is associated with the Umbeluzi River, it extends further north and slightly south on the eastern side of the Lebombo Mountains. The altitude on the coastal plains from near the Tembe and the Umbeluzi Rivers varies from about 50 m to 250 m on the Lebombo Mountains with summer rainfall and a subtropical climate.

This subterranean species has a widespread distribution but many plants were removed from its habitat possibly even since the 1920s and became popular in cultivation. In Swaziland it is protected in nature reserves and in Mozambique it suffered severe depletion due to human settlement, agriculture and the destruction of indigenous forests. After the Umbeluzi River was impounded by the Pequenos Libombos Dam, which flooded in 1989, the species suffered further loss in numbers.

Other cycad species that occur in the same general area as *E. umbeluziensis* include *E. aplanatus*, *E. lebomboensis* and *E. senticosus*.

Recolonization of a road

On a visit to Mozambique a colony of *E. umbeluziensis* was observed. The Lebombo-ironwood tree *An-*

Figure 6.—Leaf detail of an *Encephalartos umbeluziensis* seedling.

drostachys johnsonii occurs on the Lebombo Mountains usually in rocky areas where it can form thickets or forests. The wood of this tree is extremely hard and the straight trunks make them popular as poles, especially in roof construction. It was unexpected to see *E. umbeluziensis* in this habitat and the colony consists of about 50 plants of various age groups. The forest in which the cycads grow show much evidence of deforestation and on an overgrown road which was probably constructed by the Portuguese many years ago, down the mountain side, some *E. umbeluziensis* plants have recolonized the road. Amazingly some of the cycads could be more than 30 years old (Figure 3). The leaves of some of these cycads are about 1.8 m long with distinct clear petioles although the basal leaflets decrease in size to one or two spines (Figure 4). The rachis is almost straight and the leaflets are succubously orientated along the length of the leaf. The bases of the pinnae on the rachis appear to be slightly different to some *E. umbeluziensis* specimens from other localities and can be described as decurrent (Figure 5). Only limited seedling regeneration was observed in this colony (Figure 6).

Cones

The glabrous cones of *E. umbeluziensis* are initially green (Figure 7 & 8) but changes to yellow as the cones mature (Figure 9). The male cones usually develop much longer peduncles than the female cones and peduncles tend to be reclining (Figure 8).

Figure 7.—*Encephalartos umbeluziensis* female cone, receptive for pollination.

Figure 8.—Male cones with long peduncles (Photo: Exclusive Cycads).

Figure 9.—*Encephalartos umbeluziensis* female cone in cultivation at Exclusive Cycads.

The sarcotesta (fleshy outer layer) of the seed is initially greenish or yellowish green (Figure 7) and eventually turn a dark red at maturity (Figure 9).

The seed kernels of *E. umbeluziensis* can be distinguished by the tiny, irregularly shaped protuberances on the surface (Figure 10).

Figure 10.—Seed kernels of *Encephalartos umbeluziensis* displaying the irregular shaped protuberances on the surface.

Cultivation and concluding remarks

E. umbeluziensis can be grown in filtered to full sun. Although it is not very fast growing, seedlings quickly adapt to colder areas and become frost hardy. This species doen not often produce suckers and is mostly propagated from seed. The small size of *E. umbeluziensis* with straight leathery dark green leaves make it a useful and pleasing garden or container plant.

The name *Encephalartos umbeluziensis* should be retained unless it can be proven that *Encephalartos striatus* must take precedence.

Variation within *Encephalartos* species is not uncommon and narrow endemics are probably the result of different climatic or soil conditions or could be due to the isolation of single plants or populations of a species which then adapt to very specific ambient environmental conditions.

Encephalartos umbeluziensis must be considered endangered especially in Mozambique where the numbers have shown drastic decline in recent years.

The cycads at Pamplemousses in Mauritius

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'You gather the idea that Mauritius was made first, and then heaven; and that heaven was copied after Mauritius'.

—Mark Twain, *Following the Equator*, 1897

This is even truer when you visit Mauritius during winter and you come from the South African Highveld with its lifeless brown grasslands covered in black patches caused by veld fires. To learn more about the 'Green Island' plants, a visit to the botanical Gardens at Pamplemousses, is a must for most visitors to the northern part of Mauritius. It should be part of every itinerary and is worth an afternoon away from the beach. The town itself was named for the grapefruit-like citrus tree that the Dutch introduced to Mauritius from Java. The Gardens have been officially known as Sir Seewoosagur Ramgoolam (SSR) Botanical Gardens since 18 September 1988, but most people still call the Botanical Gardens Pamplemousses. These Gardens feature a stunning variety of endemic and foreign plant species.

The SSR Botanical Gardens are 24 ha in size and 11 km from Port Louis, the capital of Mauritius. At one stage it was rated third among all the Gardens that could be admired all over the world. Today, these Gardens are still one of the best places in the world to be introduced to a huge variety of plants, trees, flowers and especially palms. It's also one of the most popular tourist attractions in Mauritius and easily reached from almost anywhere on the island. Previously, entry to the Garden was free, but one hundred Rupees (Rs100) or around R30 per person is now charged. The Gardens are named in honour of Sir Seewoosagur Ramgoolam, the first prime minister of independent Mauritius. The Gardens also house the funerary platform where he was cremated. His ashes were scattered on the Ganges River in India.

The Gardens were started by Bertrand Mahé de Labourdonnais, the famous French Governor, in 1735 as a supply garden for the ships calling at the harbour and as a vegetable plot for his Mon Plaisir Château. The Gardens came into their own in 1768 under the auspices of the French horticulturalist Pierre Poivre. Initially, when Mauritius was part of the British Empire, the Gardens were neglected between 1810 and 1849, until James Duncan transformed them into an arboretum for palms and other tropical trees.

All along the Gardens the paths are called after famous people who had either played an important role in the natural history of Mauritius or visited the island. With path names, a guide book and a guide, all of which cost about Rs50 per person, one can explore the famous Gardens with its 500 species of plants. Palms still constitute the most important part of the horticultural display, and they come in an astonishing variety of shapes and sizes (Figure 1–2). Pamplemousses boast about 80 varieties of palm, of which 45 are indigenous to the Mascarene Islands (Mauritius, Réunion and Rodrigues). Some of the more prominent ones are the endemic bottle palms of Round Island, the tall royal palms and talipot palms, which flower once after 40–60 years and then die. Other varieties include the raffia, sugar, toddy, fever and fan palms. Other interesting trees are the ebony, mahogany, marmalade box tree, fish poison tree and the 220 year old 'Buddha tree'. There are many African tree species like the baobab and a sausage tree.

Figure 1.—Palms constitute the most important part of the horticultural display at the SSR Botanical Gardens.

Figure 2.—Some of the approximately 80 varieties of palm from Pamplemousses, of which 45 are indigenous to the Mascarene Islands.

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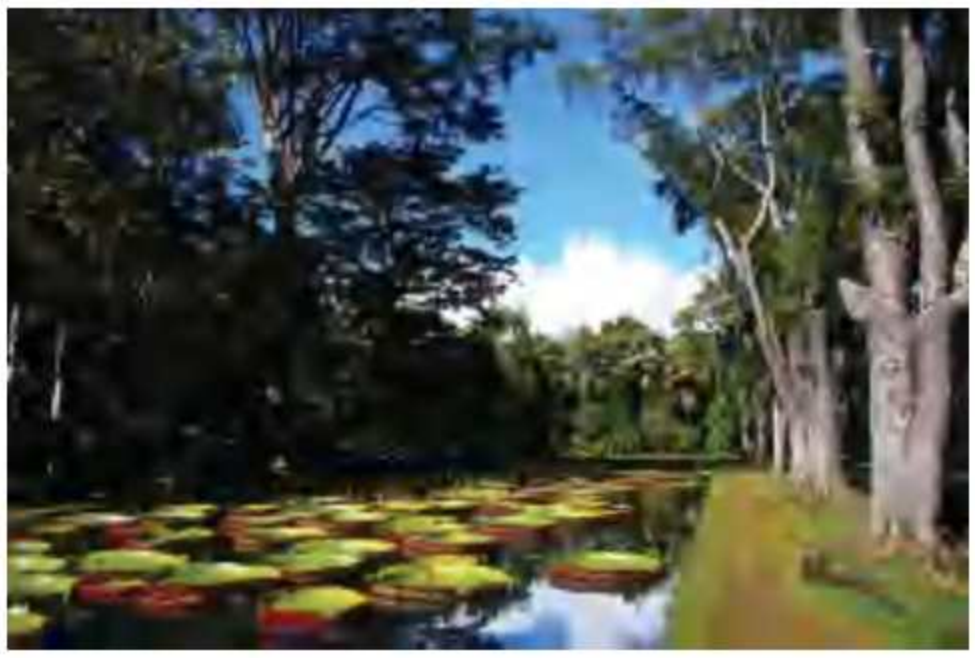

Figure 3.—The centrepiece of the SSR Botanical Gardens consist of a pond filled with *Victoria amazonica* lilies.

Figure 4.—*Victoria amazonica* water lilies are native to the Amazon region.

The centrepiece of the Gardens is a pond filled with giant *Victoria amazonica* water lilies, native to the Amazon region (Figure 3–5). These plants are famous for their classic tea-tray shaped leaves up to 2 m across and can reputedly withstand a weight of up to 45 kg. The flowers in the centre of the huge leaves open white one day and close red the next. A further attraction to the Gardens is the trees that various international dignitaries have planted in the Gardens, including Nelson Mandela, Indira Gandhi and a host of British royals.

Unfortunately the cycad collection of the SSR Botanical Gardens is not that impressive, but there are still some fine specimens (Figure 6–8). Mauritius has no in-

Figure 5.—*Victoria amazonica* plants are famous for their classic tea-tray shaped leaves that can be up to 2 m across and can reputedly withstand a weight of up to 45 kg.

Figure 6.—Single cycads grow in various places in the Gardens.

Figure 7.—Most of the cycads growing on the island are *Cycas thouarsii* (Madagascar cycad) due to Mauritius' close proximity to Madagascar.

Figure 8.—An avenue in the SSR Botanical Gardens lined with *Cycas* plants.

digenous cycads of its own, but being close to Madagascar, understandably most of the cycads on the island are *Cycas thouarsii* (Madagascar cycad). Where Octave Wiéhé Avenue reaches the fence of the Gardens, near the Port Louis Central Flacq main road, the avenue is lined with *Cycas* plants. Near Adrien D'epinay Avenue a large, many-branched Madagascan cycad of over 6 m in girth can be seen. This individual may be one of the biggest cycads in Mauritius. Single cycads grow in various places in the Gardens. Unfortunately few plants are labelled and although the guidebook (Owadally 2003), which is sold all over the island and at the gates, mentions that a *Dioon* sp. and *Encephalartos villosus* occur in the Gardens, I could not locate them—not even with a guide.

The Gardens have two entrances, both on the western side. The splendid and beautifully modelled wrought-iron main entrance gate was donated to the Gardens by Francois Liénard de la Mivoie, after he won a prize at the International Exhibition at the Crystal palace, London, in 1862.

Labourdonnais' old mansion, Mon Plaisir, no longer exists, but the recently refurbished house of the same name was constructed in 1823 and contains a free exhibition of photographs. There is also a reconstruction of an early sugar mill, a small park with Java deer and giant Aldabra tortoises from the Seychelles, which are kept in an open pen.

You have to appreciate the fact that the SSR Botanical Gardens are one of the oldest botanical Gardens in the world, especially if you consider the different colonial powers that administrated Mauritius before its independence and the extensive rehabilitation work, which have had to be carried out in the Gardens over almost three centuries of devastating cyclones, which hit the island regularly.

Reference

Owadally, A.W. 2003. *Sir Seewoosagur Ramgoolam Botanic Garden; Pamplemousses, Mauritius*. Ooz's Print, Port Louis.

Ex situ conservation of cycads at the Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram, Kerala, India.

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Abstract

The cycads is a group of primitive plants which date back to 250 million years ago and is now represented by 300 species in 11 genera and 3 families the world over. Since most of the plants are under threat, Botanic Gardens could play a key role in the conservation of this valuable group of plants. Here we describe the efforts of the Tropical Botanic Garden and Research Institute in the conservation of the cycads.

Introduction

Cycads are often referred to as 'living fossils' because they descend from, and closely resemble, plants that date back to the early Mesozoic period in the fossil record (Bold 1967). The species probably originated 250 million years ago and dominated plant life on earth between 150 and 200 million years ago when Dinosaurs were existent. Thus the era has been termed both the 'Age of cycads' and the 'Age of reptiles'. The term 'cycad' is the common name for members of the order Cycadales. In fact, the word cycad is derived from the Greek word 'cyckos' meaning 'palm-like'.

Earlier workers who studied cycads classified them into one family, the Cycadaceae. In 1959, L.A.S. Johnson divided the order Cycadales into three distinct families namely Cycadaceae, Stangeriaceae and Zamiaceae based on differences in the leaflet structure and female organs (Gilbert 1984). The world's present cycad flora is represented by about 300 species in 11 genera, in 3 families. Approximately half of the cycad species known are classified under the endangered, vulnerable or rare category with regards to their threat status. The main threat to them is the loss of natural habitat due to land usage demand and extensive, usually illegal removal of mature plants from the wild by traders.

Cycads occur in tropical and temperate regions of both hemispheres, in Central America, Africa, Asia and Australia. They generally live in the equatorial regions in the zone between the tropics of Capricorn and Cancer. But cycad endemism is mainly seen in the three countries namely Australia, Mexico and South Africa. In the latter two countries, the cycad populations have been severely affected by illegal traders (Osborne 1990). Cycads have become important plants in the landscaping industry. It is a multimillion dollar industry in Florida and it is also catching on in the East.

In India, cycads are represented only by the genus *Cycas*. There are eight species (Lindstrom & Hill 2007) namely *Cycas annaikalensis* Rita Singh & P.Radha, *C. beddomei* Dyer, *C. circinalis* L., *Cycas indica* A.Lindstrom & K.D.Hill, *C. nathorstii* J.Schust., *C. pectinata* Buch.-Ham., *C. zeylanica* (J. Schust) A.Lindstr. & K.D.Hill and *C. spherica* Roxb. so far reported from India. Of these, five species, namely *Cycas annaikaliensis*, *C. beddomei*, *C. circinnalis*, *C. indica* and *C. spherica*, are endemic to India. *Cycas beddomei* and *C. circinalis* are listed under the endangered category. *Cycas beddomei* occur in Cudapah Hills in Andhra Pradesh and *C. circinalis* occurs in the deciduous and semi-evergreen forests of the Western Ghats of Tamil Nadu, Karnataka and Kerala. *Cycas circinalis* is also abundantly seen in the cultivated lands of some districts of Kerala. *Cycas pectinata* is reported from Assam and *C. spherica* occurs in Orissa. *Cycas annaikalensis* and *C. indica* are recently described species

Table 1.—List of cycads conserved at TBGRI.

Species	Family	Nativity
Bowenia serrulata (W. Bull) Cham.	Zamiaceae	Australia
Cycas beddomei Dyer	Cycadaceae	India
Cycas circinalis L.	Cycadaceae	India
Cycas revoluta Thunb.	Cycadaceae	Japan
Cycas zeylanica (J. Schust) A.Lindstr. & K.D.Hill	Cycadaceae	India (Andaman Islands) & Sri Lanka
Ceratozamia kuesteriana Regel	Zamiaceae	Mexico
Dioon edule Lindley	Zamiaceae	Mexico
Dioon spinulosum Dyer	Zamiaceae	Mexico
Encephalartos barteri Carruth ex Miq.	Zamiaceae	South Africa
Encephalartos gratus Prain	Zamiaceae	Malawi & Mozambique
Encephalartos hildebrandtii A.Br. & Boucher	Zamiaceae	Kenya & Tanzania
Macrozamia morei F.Muell.	Zamiaceae	Australia
Zamia fischeri Miq.	Zamiaceae	Mexico
Zamia furfuracea L.f.	Zamiaceae	Mexico
Zamia pumila L.	Zamiaceae	Dominican Republic, Puerto Rico & Cuba
Zamia standleyi Schutzman	Zamiaceae	Honduras

Figure 1.—A, *Cycas circinalis*. B & C, *Cycas zeylanica*. D, *Ceratozamia kuesteriana*. E, *Zamia standleyi*. F, *Encephalartos barteri*. G, *Zamia fischeri*. H, *Zamia furfuracea*. I, *Zamia pumila*.

reported from Palakkadu district of Kerala State and Hassan district of Karnataka State respectively. They were earlier believed to be *C. circinalis.* The above two species have a very narrow distribution with scattered populations. *Cycas nathorstii* has only a very few scattered individuals in Tamil Nadu because several populations have gone extinct due to over-exploitation for medicinal purposes (Lindstorm & Hill 2007).

Figure 2.—A, Cycad Garden. B, C & D, Cycads used for landscaping in TBGRI. E, *Cycas beddomei*. F, *Cycas zeylanica*. G, *Bowenia serrulata*.

Ex-situ conservation

TBGRI, situated at the foothills of Western Ghats between 8° 45' and 8° 47' N latitude and 77° 1' and 77° 4' E longitude, was established for the conservation of plant genetic resources of the country, especially of Peninsular India. The climate is tropical with temperature between 19–34°C and an average annual precipitation of 3000 mm. Altitude ranges between 100–125 m. The 121 ha area is actually a part of the natural forest system of Western Ghats, with predominant moist deciduous vegetation and a narrow strip of riverine evergreen vegetation along the perennial Chittar River flowing aside.

Right from the inception of the Institute, development of an *ex-situ* conservatory for cycads was initiated. *Cy-*

cas *circinalis* L., the endemic cycad of Western Ghats grows naturally within the TBGRI campus. The cycad collection of TBGRI presently comprise of 16 species in 7 genera (Table 1). It is one of the largest collections in India. Three out of eight species of *Cycas* in India are represented in this collection. During 1985–1995, the Royal Botanic Gardens Kew identified TBGRI as an alternative *ex situ* centre for conserving and multiplying cycads and they provided10 species to the Institute.

At our conservatory, cycads are maintained both in the field and under pot-bounded conditions. In the field an area is demarcated for growing cycads and all the available species are grown. It is found that the cycads planted on the raised rock beds are establishing well. This can also prevent the attack of wild boars which cause severe damage to cycads in the field. Besides the Cycad Garden, *Cycas* plants are widely used for landscaping in TBGRI. The age of cycads in our collection range between15–23 years. *Ceratozamia kuesteriana*, *Cycas circinalis*, *C. zeylanica*, *Encephalartos barteri*, *Zamia fischeri*, *Z. furfuracea Z. pumila* and *Z. standleyi* have coned during the above period.

The Cycad Garden is visited by students and is open to the public. We use this collection for educating students and other interested persons about the importance of these plants and the need for conservation of these vanishing plants. The landscaping with cycads also influences the visitors for developing a landscape culture and growing cycad species in their home garden and other public gardens. An educational brochure about cycads is also supplied to the visitors.

Cycad propagation

Generally cycads are propagated through seeds and suckers. Both male and female plants must cone at the same time and grow in close proximity to produce viable seeds. However, many of the species in our collection are either male or female. So propagation is mainly carried out by suckers. Suckers are often produced in species such as *Cycas beddomei*, *C. circinalis*, *C. revoluta*, *C. rumphii*, *Dioon spinulosum*, *Encephalartos gratus* and *Zamia furfuracea*. Among the species of *Cycas*, *Cycas revoluta* and *C. zeylanica* produce more suckers than *C. circinalis* and *C. beddomei*. Suckers are collected every year for planting. After removing the leaves and protecting the cut wounds by a common fungicide, the suckers are kept for one week under shade and planted in river sand medium which has been found to be the most appropriate for its rooting. Normally, suckers take more than sixty days for rooting. Rooted sucker are planted in garden pots which contains potting medium that allow maximum aeration. Water logging may cause the decay of roots so the medium should be porous. Since *Cycas zeylanica* produced sufficient number of fertilized seeds, seed propagation was successful. The best result for germination was observed in seeds where sarcotesta were removed. River sand is the best medium for sowing seeds in. More than ninety days are required for the germination of seeds.

Pests and diseases

The attack of pest and disease are also reported in our conservatory. The larvae of *Chilade pandava* (butterfly) are causing major destruction on *Cycas* species. When the young leaves emerge, the butterfly lays eggs on the leaves and larvae feed on the young leaves and cause severe damage to the foliage. Fungal infections also cause damage to foliage. Spraying of insecticide when the young leaves emerge was found effective against the attack of larvae of *Chilade pandava*. Application of fungicide Diathene M.45 is found effective against fungal diseases in cycads. Cycad scales *Ceroplastes* and *Lepidosaphes* are also found on some of the species of cycads. A decoction made from tobacco leaves was found moderately effective against the attack of the scales.

Conclusion

In South India, five species namely *Cycas annaikalensis*, *C. beddomei* and *C. circinalis, C. indica* and *Cycas nathorstii* are known to occur. No effective measures have been taken with regards to conservation of these species in their natural habitats. Both *ex situ* and *in situ* conservation measures must be initiated for saving these species from the verge of extinction. Only around 500 plants of *Cycas beddomei* are reported to survive now in its natural habitat (Osborne 1995). The population of this precious species is declining at an alarming rate due to over exploitation for horticultural and medicinal uses. The male cones are reported to have medicinal properties and are mostly collected by local people, which badly affect the fertilization process. This results in the decline of populations in their natural habitats. Effective measures should be taken for the conservation of this species through appropriate policy and decision support systems. The populations of *Cycas circinalis* is also declining due to over exploitation for extraction of sago (a kind of starch product) from the stems. The extraction of young leaves for decorative purposes also causes severe damage to the plants. In addition, as this species occur more abundantly in the cultivated ecosystem than in wild, a good number of plants are destroyed for the cultivation of crop plants every year. The only way to overcome this situation is to conduct awareness programmes among the public and educate them about the importance of this precious species. In the cases of recently described species *Cycas annaikalensis* and *C. indica* further studies are needed to determine their status. Surely these species should be classified under the rare category since only a few localized populations have so far been located.

Botanic gardens like TBGRI could play a key role in framing programmes for the conservation of cycads. We have already initiated the *ex situ* conservation of cycad species right from the inception of the Institute. We are also promoting plant distribution/exchange programmes. Thousands of saplings of *Cycas circinalis*, *C. revoluta* and *C. zeylanica* produced through seeds and suckers were sold to the public at a nominal rate for promoting the conservation of these precious plants.

Acknowledgements

The authors are thankful to the authorities at Kew Gardens, England for providing valuable cycad species to TBGRI. We are also thankful to the Director, TBGRI, for constant encouragement. Thanks are also due to Mr. Harilal Kumar, Gardener, for his assistance in maintaining the field.

Reference

BOLD, H. C. 1967. *Morphology of plants*. Harper & Row, New York.

HILL, K. D. 1995. The genus *Cycas* (Cycadaceae) in the Indian region, with notes on the application and typification of the name *Cycas ciricinalis*. *Taxon* 44: 23.

JOHNSON, L.A.S. 1959. The families of Cycads and the Zamiaceae of Australia. *Proc. Linnean Soc. New South Wales* 84(1): 64–117.

LINDSTROM, A. J. & HILL, K.D. 2007. The genus *Cycas* (Cycadaceae) in India. *Telopea* 11(4): 463–488.

OSBORNE, R. 1995. The world cycad census and a proposal proposed revision of the threatened species status for cycad taxa. *Biological Conservation* 71: 1–12.

GILBERT, S. 1984. Cycads: Status, Trade, Exploitation and Protection 1977–1982. World Wide Fund—U. S.

SINGH, R & RADHA, P. 2006. A new species of *Cycas* from the Malabar coast, Western Ghats, India. *Brittonia* 58(2): 119–123.

Note on the name derivation of *Encephalartos transvenosus*

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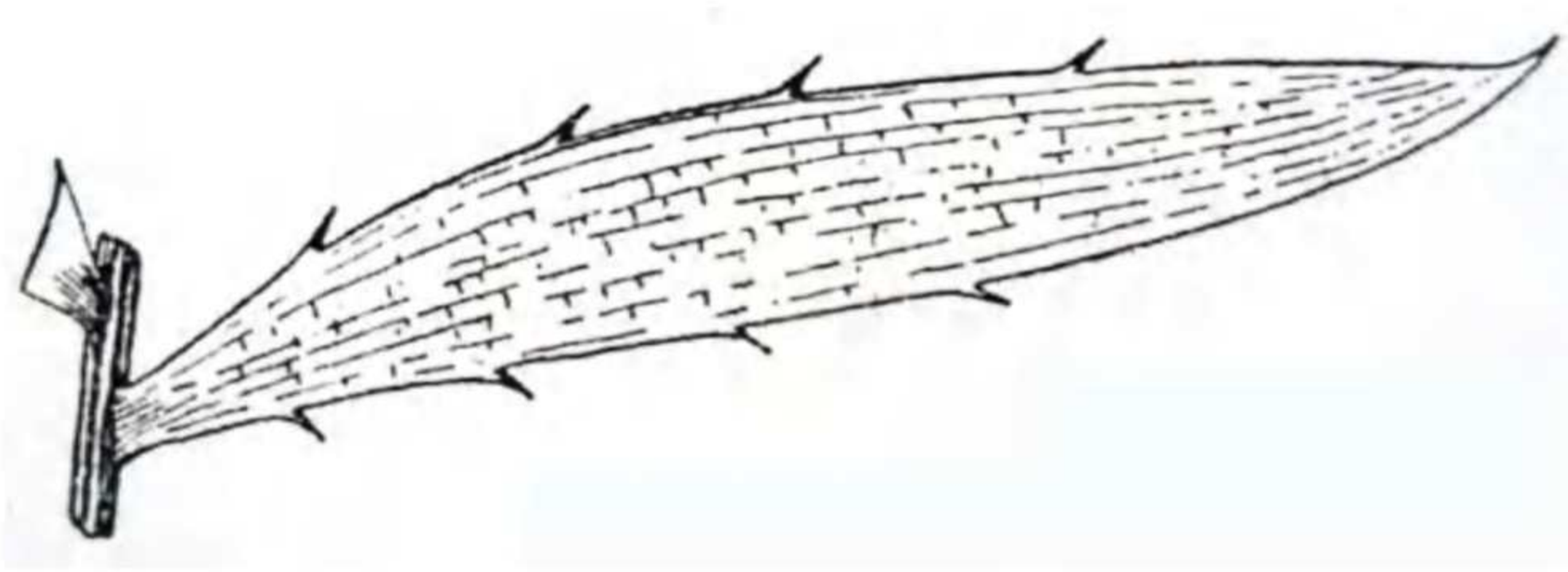

Figure 1.—Illustration of *Encephalartos transvenosus* from the description by Stapf and Burtt Davy.

Encephalartos transvenosus was described in 1926 by Otto Stapf and Joseph Burtt Davy in the celebrated work *A Manual of the Flowering Plants and Ferns of the Transvaal with Swaziland, South Africa*. The description of the leaflets from which the name is derived is as follows, 'nerves above frequently connected by transverse veinlets which are raised on the upper surface'. The accompanying illustration of the pinnae of *E. transvenosus* (Figure 1) show what seems to be the so-called 'transverse veinlets'. These are pictured as lying across or in a crosswise direction.

This is somewhat of a misnomer, since *E. transvenosus* does not display crosswise venation. However, on some specimens small raised bumps or knobs, known as nodules, are visible (Figure 2).

Figure 2.—Nodules on the upper surface of *Encephalartos transvenosus* leaflets.

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

I have just moved to Westville and have quite a number of different cycads growing in my garden.

I don't know what species they are, but there are a few different ones. I am keen to find out what species they are, and also how to grow them from seed.

Two of them have large cones which (I believe) are being tampered with by monkeys. They have 'opened' them up and the seeds are all over the ground. There are also plenty of babies growing around the base of the 'parent'.

How can I find out what type they are, more info on growing them, and is it legal for me to grow them and then sell them?

Tim de Bruyn
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Figure 1.—Detail of the yellowing leaves of the 'sick' plant.

Figure 2.—The 'sick' plant with its leaves turning yellow some months ago.

Figure 3.—One of the healthy neighbouring plants which receive the same amount of fertilizer and water as the plant with yellowing leaves

I write to request some advice regarding my cycads. In recent months one of my cycads started to dry out and lose its leaves. At first one ring of leaves turned yellow and was lowered to the ground. I subsequently removed the leaves. Now the same is happening with the next ring. The winter was rather severe this year (I stay in Benoni, near Johannesburg), but the neighbouring cycads show no signs of this problem. The supply of water and fertilizer has been the same for all the plants. I attach photographs of the 'sick' and healthy plants and hope that somebody will be able to give me some advice on how to save this plant.

Wojtek Gruszka
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Figure 4.—Recent photograph of the sick plant—it seems all but dead.

Several photographs were sent in as a matter of interest for possible inclusion in *ENCEPHALARTOS*. Fellow cycad lovers are encouraged to send in images of their own cycads with some notes on the specimen in question. Send your pictures to the editor at: wynand@ananzi.co.za.

Figure 1.—Leaf detail of *Encephalartos kisambo* with prominent teeth on the distal margin that overlaps on the rachis. Photo: Mike Hurter.

Figure 3.—*Stangeria eriopus* in cultivation with two female cones on a single plant. Photo: Exclusive Cycads.

Figure 2.—Badly mutilated stem of *Encephalartos altensteinii* in habitat in the Eastern Cape Province. This is the result of removal of stem tissue by traditional healers. Photo: Mike Hurter.

Figure 4.—A male cone of the grassland form of *Stangeria eriopus*. Photo: Mike Hurter.

Figure 5.—Female *Encephalartos umbeluziensis* near the 'Pequenos Libombos' in Mozambique shedding its seeds while a new cone emerges. Photo: Mike Hurter.

Figure 6.—*Encephalartos friderici-guilielmi* in its mountainous habitat. Photo: Mike Hurter.

Figure 7.—A very robust specimen of *Encephalartos ferox* with three stems. Photo: Mike Hurter.

Figure 8.—An impressive cone on a cycad in the Durban Botanical Gardens. Photo: Elizabeth Retief.