ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

NO. 64 DECEMBER / DESEMBER 2000 ISSN 1012-9987

CYCAD SOCIETY OF SOUTH AFRICA

BROODBOOM VERENIGING VAN SUID-AFRIKA

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COVER / VOORBLAD : ***Lepidozamia hopei*, female cone / vroulike keël.**
In a private collection, Florida, U.S.A. / In 'n privaatversameling, Florida, V.S.A.

Photo / Foto: Piet Vorster

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FROM THE PRESIDENT

VAN DIE PRESIDENT

Something which surprises me, is that white-hot interest in cycads has never waned. I would have thought that the initial interest in this plant group started because they were unusual, unknown, and scarce.

Today they are still unusual, but we have become so familiar with almost every aspect of cycads that we no longer realise what unusual plants they really are.

To a large extent, the aspect of unfamiliarity also no longer applies; because either we ourselves or other people around

Iets wat my verbaas, is dat die wit-warm belangstelling in broodbome nog nooit afgeneem het nie. Ek sou dink dat die aanvanklike belangstelling in hierdie plantgroep begin het omdat hulle buitengewoon, grootliks onbekend, en skaars was.

Vandag is hulle nog steeds buitengewoon, maar ons het so vertroud geraak met bykans alle aspekte van broodbome dat ons amper nie meer besef watter uitsonderlike plante hulle is nie.

Die aspek van onbekendheid is ook grotendeels nie meer

us possess almost all the species, and because we know from practical experience or from the beautiful books which are available, how the plants look and how they grow in nature.

Cycads are also no longer nearly as scarce as 30 years ago; in fact, I would guess that currently there are in gardens hundredfold more cycads than there were 30 years ago in nature. The reason is that almost no cycad collector can resist the temptation to pollinate cones and to plant seeds. Some people do this because they have visions on wealth, but other do it without any clearly defined aim. The result is that many species have become so common that one gives them away for almost nothing to who-ever may want them, because no-one is willing any more to pay a price which is related to the production costs. Other species remain scarce, because both in nature and in gardens they cone rarely and it is difficult to produce viable seed. However, there are also species of which we readily and regularly got seed 30 years ago, but of which seeds are today virtually unknown. In most of these cases it doesn't mean that the plants and their seeds are now better protected against collectors, but rather that the plants' numbers have diminished to such an extent that they now seldom produce viable seed.

To maintain interest in something like cycads, a challenge is necessary. Initially this challenge was to obtain all the species, even if one had to mortgage your home and/or resort to crime. Collections tend to grow slowly with the first ten plants, but thereafter expand so rapidly that before long all available space is taken up with plants. Soon there are more plants than one can properly care for, and then plants start to die from neglect. This is the second phase in a collector's life. The third phase is when one realises that you cannot successfully grow all the species, and when one selects those species which look nicest to you and which grow well for you. The challenge then becomes to grow those plants to perfection in spite of gales, hail, cold, and diseases.

The true collector will always strive to add new species to increase the visual diversity of his collection. At this moment it is still possible, because not all of us have yet got all the tropical African species. There are also foreign species on other continents which are virtually unknown in our gardens, and which often differ markedly from what we are used to - for example, *Cycas micholitzii* with its bi-pinnate leaflets, or some of the tropical *Zamia* species with enormously large leaflets. In most cases we don't yet know how these foreign species will react to our conditions, but often they turn out to be surprisingly adaptable. Here I am thinking of species like *Encephalartos kisambo* from Kenya, or *Zamia poeppigiana* from Ecuador, which grow remarkably well in the open ground even in Stellenbosch (34°S).

Lastly there is the possibility of hybridizing and selective

waar nie, omdat ons self of ander mense om ons byna al die soorte besit; en omdat ons uit praktiese ondervinding of uit die pragtige boeke wat beskikbaar is, weet hoe die plante lyk en hoe hulle groei in die natuur.

Broodbome is ook nie meer naastenby so skaars soos 30 jaar gelede nie; trouens ek sou raai dat daar tans in tuine honderdvoudig meer broodbome is as wat daar 30 jaar gelede in die natuur was. Dit is die gevolg daarvan dat byna geen broodboomversamelaar die versoeking kan weerstaan om keëls te bestuif en die saad te plant nie. Sommige mense doen dit omdat hulle visioene van rykdom het, maar baie ander mense doen dit sonder enige goed-omskryfde doel. Die gevolg is dat baie soorte so volop geword het dat mens hulle feitlik verniet weggee aan wie ookal hulle wil hê, omdat niemand meer gewillig is om 'n prys te betaal in verhouding met die produksiekoste nie. Ander soorte bly skaars, omdat hulle in die natuur sowel as in tuine selde keël en omdat dit moeilik is om vrugbare saad te produseer. Daar is egter ook soorte waarvan ons 30 jaar gelede geredelik saad gekry het, maar waarvan saad vandag bykans onbekend is. In meeste van hierdie gevalle dui dit nie daarop dat die plante en hulle saad nou beter beskerm word teen versamelaars nie, maar eerder dat die wilde plante se getalle so afgeneem het dat hulle nou selde vrugbare saad produseer.

Om belangstelling te behou in iets soos broodbome, is 'n uitdaging noodsaaklik. Aanvanklik is hierdie uitdaging om alle soorte te bekom, selfs al moet mens jou huis verpand en/of 'n misdaad pleeg. Versamelings neig om stadig te groei met die eerste tien plante, maar daarna gaan dit so vinnig dat al die beskikbare ruimte voor lank vol plante staan. Spoedig is daar meer plante as waaraan behoorlike aandag gegee kan word, en dan begin plante doodgaan van verwaarlosing. Dit is die tweede fase in 'n versamelaar se lewe. Die derde fase is wanneer mens besef dat jy nie meer al die soorte suksesvol kan aanhou nie, en wanneer mens daardie soorte uitkies wat vir jou mooi is en wat goed groei by jou; en dan is die uitdaging om daardie plante mooi te kry ten spyte van wind, hael, koue en siektes.

Die ware versamelaar sal altyd begeer om nuwe soorte by te kry om die visuele verskeidenheid in sy versameling te verhoog. Op hierdie tydstip is dit nog moontlik, omdat ons nog nie almal al die tropies-Afrikaanse soorte het nie. Daar is ook nog uitheemse soorte op ander kontinente wat feitlik heeltemal onbekend is in ons tuine, en wat dikwels treffend verskil van wat ons aan gewoond is - dink maar aan *Cycas micholitzii* met sy dubbelveervormig-saamgestelde blare, of sommige van die tropiese *Zamia*-soorte met enorme groot pinnas. In meeste gevalle weet ons nog nie hoe hierdie vreemde soorte gaan reageer onder ons omstandighede nie, maar dikwels blyk hulle verbasend aanpasbaar te wees. Dink maar aan soorte soos *Encephalartos kisambo* uit Kenya, of *Zamia poeppigiana* uit Ecuador, wat selfs in Stellenbosch (34°S) buitengewoon goed groei in die oop grond.

breeding. Within a few years breeders of *Aloe* have managed to produce really remarkable plants, and at this moment there is an extensive breeding program to improve *Clivia*. It is probable that there are good prospects of improving cycads to produce plants with specific properties, though it will take somewhat longer than in cases of *Aloe* and *Clivia*. Some of the very interesting and showy hybrids which we have already made, include *Encephalartos natalensis* x *E. arenarius*, *E. transvenosus* x *E. horridus*, and also *Cycas revoluta* x *C. micholitzii*.

I would like to predict that the interest in cycads will remain lively, as long as there are challenges. However, it is going to depend on whether we can create challenges for ourselves. I am always sorry to hear of someone who collected cycads enthusiastically, but are now selling his plants because he has lost interest.

Piet Vorster

Laastens is daar die moontlikheid van hibridisering en selektiewe teling. Binne enkele jare het aalwyntelers werklik merkwaardige plante geteel, en op hierdie oomblik is daar 'n uitgebreide teelprogram om *Clivia* te veredel. Dit is waarskynlik dat daar groot moontlikhede is om broodbome te veredel om sodoende plante met spesifieke eienskappe te produseer, hoewel dit effens langer gaan neem as in die gevalle van *Aloe* en *Clivia*. Van die baie interessante en aanskoulike hibriede wat ons reeds gemaak het, sluit in *Encephalartos natalensis* x *E. arenarius*, *E. transvenosus* x *E. horridus*, en ook *Cycas revoluta* x *C. micholitzii*.

Ek wil voorspel dat die belangstelling in broodbome lewendig gaan bly, solank as wat daar uitdagings is. Dit gaan egter daarvan afhang of ons vir onsself uitdagings kan stel. Dit is altyd vir my jammer om te hoor van iemand wat entoesiasties versamel het, maar nou sy plante verkoop het omdat hy belangstelling verloor het.

Piet Vorster

FROM COUNCIL / VAN DIE RAAD

OUR OVERSEAS CORRESPONDENTS

Our two overseas correspondents make life a lot easier. It is a pain, and quite expensive, to send money overseas to pay subscriptions. These two people collect subscriptions from their countrymen, and then send it to us in a lump sum. They are also on the ground to solve any Society-related problems which their countrymen may have.

Paul Kennedy: He is married to Margaret, and they have 3 children. He is a resident of Engadine, a suburb in south-western Sydney, Australia, with *Macrozamia communis* growing naturally within 1 kilometre of his home. He was employed as a Customs Officer with the Australian Customs Service for over 31 years. He is now retired, but drives a taxi on a part time basis. He is interested in cycads for the past 20 years. When the children were younger, they travelled (generally unwillingly) to many different parts of New South Wales (along dirt tracks and forestry roads) as Paul searched for cycad localities to study and photograph plants and collect seed.

Paul has seen all New South Wales cycads in habitat conditions and has written articles about most of these species; these articles have been published in *Palms & Cycads*, *Encephalartos*, *The Cycad Newsletter* and *Principes Minor* (the journal of the Sydney Chapter of *Palms & Cycads*).

He had the privilege and pleasure, along with his colleague, Craig Thompson, to escort Cynthia Giddy around cycad localities in New South Wales, on two separate occasions - the first with husband Ted, and the second with Elsa and Piet Vorster, after they all attended CYCAD 90. They also escorted Loran Whitelock on a similar trip. These three trips were the highlights of Paul's association with cycads.

He has two endearing memories of Cynthia. The first concerns her absolute amazement at the abundance and

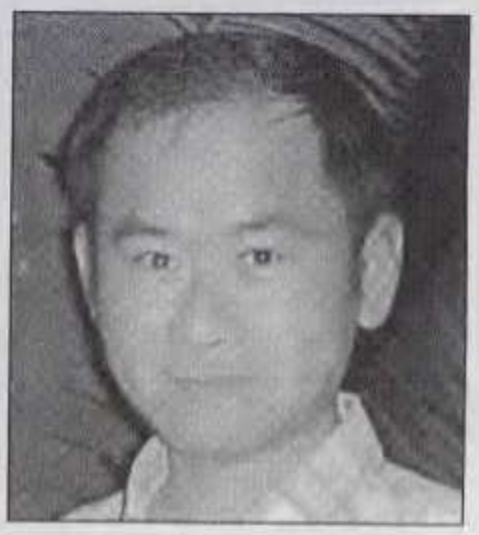
profusion of *Macrozamia communis* plants growing in dense colonies on the south coast of New South Wales. The second relates to her gift to Paul of an autographed copy of her book "Cycads of South Africa" with a caption which reads: "To Paul Kennedy, whose enthusiasm introduced me to the cycads of Australia."

Paul's principle interest in cycads at the moment relates to weevils, which he has simplistically classified into two types - those, which as far as he is concerned, are responsible for cycad pollination (as opposed to wind pollination) and those trunk-boring weevils which can, and do, wreak havoc in home garden situation.

In addition to his interest in cycads, he has recently become and avid bird watcher.

[Willie Tang submitted only a very brief biological sketch and we added the last paragraph.]

Willie Tang: He is married to Li-Mei and they have no children. He is a resident of Miami, Florida, U.S.A. He obtained a Bachelors degree from the University of California Berkely, and a Masters degree from the University of Miami. He is an Entomologist for the United States Department of Agriculture Research Associate at Fairchild Tropical Garden (adjunct position). His interests in cycads are: the ecology of cycads, and conservation of cycads in the wild.



He has written articles about several aspects of cycads. These articles have been published in scientific journals as well as in journals of Cycad Societies, e.g. *The Cycad Newsletter* and *Encephalartos*.

PROBLEME MET NATUURBEWARING

Ons probeer hard om wetsgehoorsame burgers te wees, ten spyte van die groot verskeidenheid verwarrende natuurbewaringswette wat nie alleen verskil tussen provinsies nie, maar ook in baie gevalle teenproduktief lyk. Ons sukses in hierdie verband blyk daaruit dat vir jare nie een van ons lede skuldig bevind is aan 'n broodboomverwante wetsoortreding nie.

Dit het egter onder ons aandag gekom dat baie van ons lede onaangename of onbevredigende ondervindings met Suid-Afrikaanse natuurbewaringsliggame gehad het. Dit sluit in plante wat doodgegaan het nadat hulle voorsien is van mikroskyfies, briewe wat nooit beantwoord is nie, en aansoeke om vervoerpermitte wat na agt maande nog nie toegestaan is nie. Ten einde verhoudings te normaliseer, nooi ons u om u klagtes skriftelik of telefonies oor te dra aan Erik Heine, Groeneweide 10, 7600 Stellenbosch (Tel. 021 883 3638).

PROBLEMS WITH NATURE CONSERVATION

We try hard to be law-abiding citizens, in spite of the large diversity of confusing nature conservation laws, that not only differ between provinces, but in many instances appear to be counter-productive. Our success in this connection appears to be that for many years none of our members was found guilty of cycad connected crimes.

However, it came to our knowledge that many of our members had unpleasant or unsatisfying experiences with South African Nature Conservation Authorities. This involves plants that died after implantation of micro chips, letters not being answered, and permits to transport cycads not being issued even eight months after applied for. To normalize relations we invite you to forward your complaints in writing to Erik Heine, 10 Groeneweide. 7600 Stellenbosch, or to telephone him at (021) 883 3638.

"FOCUS ON .... " ARTICLE

We are pleased to announce that Roy Osborne's article on *Lepidozamia hopei* appears in this issue (at last!). It should have appeared in the March 2000 issue, but the first two sets of photographs which Roy posted by airmail never arrived. We thank Roy for sending a third set of photographs by registered post. We also thank Gary Wilson for sending a second print-out and set of colour slides for the March 2001 "Focus on ...." series by registered post. He also posted a first set, which did not arrive, by airmail.

It is uncertain where these postal articles disappeared. However, it is interesting to note that postal articles from the U.S.A. posted by airmail by Jeff Chemnick (see *Encephalartos* **63**) and Willie Tang (see this issue), which they marked on the envelopes as "Containing photographic material" arrived within two weeks after being posted.

NEW CYCAD PUBLICATIONS

CHAVEZ, V.M. & LITZ, R.E. 1999. **Organogenesis from megagametophyte and zygotic embryo explants of the gymnosperm *Dioon edule* Lindley (Zamiaceae, Cycadales).** *Plant Cell Tissue and Organ Culture* 58(3): 219–222.

[Organogenic cultures were induced from zygotic embryo and megagametophyte explants of the Central American cycad species, *Dioon edule*. Plant growth medium consisted of B5 major salts, Murashige and Skoog minor salts and organics, 400 mg l^{-1} glutamine, 100 mg l^{-1} arginine, 100 mg l^{-1} asparagine, 60 g l^{-1} sucrose, 8 g l^{-1} Difco Bacto agar was supplemented with kinetin (0–13,94 mμM) and 2,4-dichlorophenoxyacetic acid (2,4-D) (0–9.0 mμM) arranged as a 5 x 4 factorial in a randomized block design. Callus initiation occurred on a wide range of medium formulations from megagametophyte explants; however, shoot formation occurred only on medium supplemented with 2.26 mμM 2,4-D. In comparison, callus initiation from explanted zygotic embryos occurred on fewer medium formulations, and adventitious shoot induction occurred from callus on formulations with 9.29–13.94 mμM kinetin + 0.45–9.05 mμM 2,4-D. Rooted shoots derived from megagametophyte and zygotic embryo cultures, have been regenerated.]

First author's address: Tropical Research and Education Center, University of Florida, 18905 SW 280 St., Homestead, FL, 33031–3314, U.S.A.

CHUBB,H. 2000. ***Microcycas calocoma*: The Cruz de Joaquin and Moncado sites.** *The Cycad Newsletter* 23(1): 10–11.

[Unfortunately an abstract is not available.]

Author's address: The Center for Cycads, 65 Johnston Road, West Cornwall, CT 06796, U.S.A.

GREENWOOD, D.R. 2000. **Australia's cycad fossils and the antiquity of the Daintree rainforest.** *Palms & Cycads* No 66.

[Unfortunately an abstract is not available.]

Author's address: Department of Ecology and Palaeoecology, Victoria University of Technology, Melbourne, Australia.

NEGRON-ORTIZ, V. & GORCHOV, D.L. 2000. **Effects of fire season and postfire herbivory on the cycad *Zamia pumila* (Zamiaceae) in slash pine savanna, Everglades National Park, Florida.** *International Journal of Plant Sciences* 161(4): 659–669.

[The effect of prescribed wet-season fire on the demography of *Zamia pumila* L. (Zamiaceae) in slash pine savanna was investigated in the Everglades National Park, Florida. The survival, coning, leaf production, and herbivore damage were monitored on two plots burned during the wet season of 1995 and on two unburned plots. Fire killed all leaves and promoted the flushing of new leaves but caused minimal mortality of adults and seedlings. Seeds within cones were killed, but some dispersed seeds survived. Coning, particularly of females, was enhanced in the plot that burned earlier and hotter. Larvae of *Seirarctia echo* appeared on new leaves within one month postfire and were present at higher density on burned plots. Herbivore damage was significantly greater on burned plots for the first wet season following the fire, with many plants completely defoliated. This defoliation, which was more frequent in the plot burned late in the wet season, resulted in mortality of some adults but promoted greater leaf production in the remainder. *Seirarctia echo* consumed some *Zamia* cones, cancelling the positive effect of fire on reproduction. Overall, the combined direct and indirect

effects of wet-season fires on *Zamia* was positive for the early wet-season fire but negative for the late wet-season fire because of reduced coning and increased mortality following herbivory.]

First author's address: Botany Department, Miami University, Oxford, OH, 45056, U.S.A.

NORSTOG, K. 2000. **Fifty years of cycad tissue culture.** *The Cycad Newsletter* 23(1): 12–16.

[Unfortunately an abstract is not available.]

Author's address: 6656 Gladel Drive, Waterloo, IL, 62298, U.S.A.

PANT, DD. 2000. **Occurrence of unusual branching in female cones in some *Zamia* plants and their implications on the branching of cycads.** *The Cycad Newsletter* 23(1): 6–9.

[Unfortunately an abstract is not available.]

Author's address: Department of Botany, University of Allahabad, Allahabad 211001, India.

Compiled by ***Nat Grobbelaar****, P.O. Box 15357, 0039 Lynn East, South Africa.*

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

S.A. CYCAD CHAT GROUP ON THE INTERNET

We as members of the Society are very fortunate to have "*Encephalartos*" as a source of cycad related information, supplementing our reference books. Since becoming a member and aquiring all the back issues of our magazine, I have gained so much more knowledge regarding our cycads. I do, however, sometimes find myself in the predicament, where I wish I could just pick up the phone and quickly get specific information or advice from other members or enthusiasts. I'm sure many members have experienced the same headache.

This has led me to create the S.A. cycad chat group on the Internet. This group enables all its members to be in direct communication with each other and allows for the sharing of ideas and information on S.A. cycads. If one member poses a question to the group for instance, all members have the opportunity to answer and share their views. I believe this can be a wonderful vehicle to assist the members of this Society to disseminate and share information on S.A. cycads.

If anyone would like to join this group, please send an e-mail to: sacycad-subscribe@egroups.com or go to the eGroups site at http://www.egroups.com/invite/sacycad and click the "JOIN" button.

Mornè Ferreira, *sacycad Group Moderator, Mbabane, Swaziland, personal e-mail cycad@realnet.co.sz*

Received 17 August 2000

Dear Editor

WHOSE SEED IS IT ANYWAY?

I have on two occasions in the past (both times without a response) appealed to Nature Conservation for answers to questions via this publication. This time I hope again for an answer. What I want to know is this: If a female cycad in nature (let us use *Encephalartos latifrons* as an example, as we know most plants left in nature are so far removed from each other that natural pollination cannot happen) happens to cone and somebody like me goes to great lengths to pollinate the cone in order to generate viable seed, who does the seed belong to? If I understand the law correctly (and often I'm not sure that I do) I may NOT harvest seed from nature under ANY circumstances. What is to be done in such a case? Are we to let the potential seed go to waste? Are we to break the law and harvest the seed ourselves? Are we to notify Nature Conservation? Will they do anything?

André Cilliers, ARC • LNR, Private Bag 1251, 2520 Potchefstroom, R.S.A.

Received 21 August 2000

[I suggest that you should rather contact the relative Nature Conservation Authorities directly instead of asking information from them via our journal. - **Editor.**]

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Dear Editor

HUGE PINEAPPLE?

I have just received this amazing photograph (Colour Figure 12 on p. 17) of an *Encephalartos princeps* female cone, from Mike at "Cycads for Africa", near Knysna in the Western Cape, and feel it worthwhile for publication - probably the largest pineapple I have ever seen - perhaps this one is from Texas.

I am going to have a get together and slide show for the Natal Branch of the Cycad Society in the near future and perhaps we can get something going here again.

Avis Nel, P.O. Box 45, 3730 Umlaas Road, R.S.A.

Received 12 September 2000

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Geagte Redaktrise

***ENCEPHALARTOS*: TYDSKRIF VAN DIE BROOD-BOOM VERENIGING VAN S.A.**

Ek het maar onlangs aangesluit by die Vereniging en vind dit van onskatbare waarde vir nuwelinge soos ek. Die versamel van plante het natuurlik tot gevolg gehad dat boeke en publikasies oor broodbome ook nou ywerig versamel word. Ek was baie gelukkig om 'n stel *Encephalartos*-tydskrifte te bekom wat begin by die heel eerste uitgawe en boonop in uitstekende toestand is! Ongelukkig het uitgawe nommer **37** in die slag gebly in die omswerwinge van die tydskrifte. As daar enige lede is wat my kan help om 'n oorspronklike kopie van nommer 37 te bekom, om die versameling volledig te maak, sal ek dit baie waardeer.

Ek is ook op soek na 'n kopie van "The Living Cycads" geskryf deur C.J. Chamberlain (1919). As iemand 'n kopie beskikbaar het, sal ek dit graag wil bekom vir my boekversameling.

Persone wat kan help kan met my in aanraking kom by Tel. (021) 710 2703 bedags en (021) 913 5187 saans of E-pos stuur aan wynand@ananzi.co.za

***Wynand van Eeden,** Posbus 3489, 7536 Tygerpark, R.S.A.*

Ontvang 22 September 2000

Summary

Wynand van Eeden recently joined our Society. He was fortunate to obtain a complete original set of our *Encephalartos* journal with the exception of No. **37**. He would be grateful to obtain an original copy of No. 37 as well as a copy of C.J. Chamberlain's book "The living cycads" (1919). Any person who can help him to obtain any of thse publications can contact him at: Tel. (021) 710 2703 during the day, or (021) 913 5187 after hours, or E-mail: wynand@ananzi.co.za

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Geagte Redaktrise

WATTER SAAILING GROEI DIE VINNIGSTE?

Kan iemand met sekerheid sê watter saailing groei die vinnigste: een wat in 'n klein houer geplant word en dan herhaalde kere oorgeplant word in groter houers, en dan mettertyd in 'n permanente posisie uitgeplant word teenoor 'n identiese grootte saailing wat baie gouer in 'n permanente posisie uitgeplant word?

***Leon van Rooy,** Posbus 1019, 1240 Witrivier, R.S.A.*

Ontvang 30 September 2000

Summary

Leon van Rooy asks the question: which of two identical seedlings grows faster, one that was planted successively into larger containers before being planted in a permanent position, or one that was planted much sooner in a permanent position?

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Dear Editor

"THE DEVIL TREE OF MADAGASCAR" (*ENCEPHALARTOS CANIBULES*)

Much interest is being displayed in botanical circles in the light of new interpretaion of certain information regarding the "Devil Tree", which was overlooked or ignored at the beginning of the nineteenth century.

The original botanists/explorers who braved the dense forests of northern Madagascar, did not realize how deeply grounded the superstitious fear of the tree was rooted in the local populace. When pressed to point out the rumoured carnivorous plant, they were shown the innocuous *Cycas thouarsii*, known to them as "Betsilea". The actual plant in question is known to the Howa people as "Batisimisaraka" which translates as "Tree with blood sucking tentacles" (Schuster 1932, also *Encephalartos* No 6, 1986).

The only known record of an actual viewing of the plant was printed in *Encyclopedia Brittanica* around 1900, and the following abridged account was included in Lawrence G. Green's book "Secret Africa". I am including the

excerpt, which may interest our members.

"I have never encountered the tree," said the trader. "Nevertheless,, I have found a deep belief in the existence of such a tree among the Sakalavas, the Hovas and other tribes of Madagascar. Some tribes worship the tree. That provides a reason why they have never been willing to lead white men to it. No doubt sacrifices are offered, and accepted by the tree — a religious ceremony which, if proved, would lead to punishment in the French courts.

"It may be a myth, but other 'devil trees' are known to botanists. There is a plant in India that traps, consumes and digests mice. Can we say that no greater and more ghastly plant exists in the world. When I am in civilisation I become doubtful about the man-eating tree. But when I am alone in the tropical forests at night, in the midst of a hundred dangers and among poisonous growths the botanists have never seen — then I am ready to believe in the man-eating tree.

"When all the exaggeration has been stripped from a queer tale, there often remains something truly weird. Madagascar itself supports the legend of the man-eating tree. Botanists have described it as possessing the richest flora in all the tropics, a world in minature where many thousands of plants remain unclassified. The country that has revealed the Traveller's Tree may still hide the man-eating tree in its jungles."

Carl Liche, an early traveller in Madagascar, was the first European to describe the man-eating tree. His account, to which I have referred, was printed in the *Antananarivo Annual*, No. 5, of Christmas, 1881, and was widely reprinted. The London Missionary Society, publishers of the Annual, "gave the story for what it was worth," as we say in newspaper offices when something comes in which is outside our experience but not impossible. Here are the relevant portions of Liche's narrative:

"The Mkodos, of Madagascar, are a very primitive race, going entirely naked, having no religion beyond that of the awful reverence which they pay to the sacred tree."

Liche then describes how he and his companion Hendrik were led into the recesses of a black forest composed of jungle below and palms above. "Suddenly all the natives began the cry 'Tepe! Tepe!' and Hendrik, stopping short, said 'Look!' In a bare spot was the most singular of trees. If you can imagine a pineapple eight feet high and thick in proportion resting upon its base and denuded of leaves, you will have a good idea of the trunk of the tree, which, however, was a dark, dingy brown, and apparently as hard as iron. From the apex of this truncated cone (at least two feet in diameter) eight leaves hung sheer to the ground, like doors swung back on their hinges.

"These leaves, which were joined at the top of the tree at regular intervals, were about eleven or twelve feet long, tapering to a sharp point and set with strong thorny hooks. They hung limp and lifeless, dead green in colour. The apex of the cone was a round white concave figure like a smaller plate set within a larger one. This was not a flower but a receptacle, and there exuded into it a clear, treacly liquid, honey sweet, and possessed of violent intoxicating and soporific properties.

"From underneath the rim (so to speak) of the undermost plate a series of long hairy green tendrils stretched out in every direction towards the horizon. Above these six white almost transparent *palpi* reared themselves towards the sky with such a sinuous throbbing against the air that they made me shudder with their suggestion of serpents flayed, yet dancing upon their tails.

"With wild shrieks and chants the natives now surrounded one of the women and urged her with the points of their javelins until slowly, and with despairing face, she climbed up the stalk of the tree and stood on the summit of the cone, the *palpi* swirling all about her. 'Tsik! Tsik!' (Drink! Drink!) cried the men. Stooping, she drank of the viscid fluid.

"The slender *palpi*, with the fury of starved serpents, quivered a moment over her head, the fastened upon her in sudden coils. The tendrils wrapped her about in fold after fold; and now the great leaves rose and closed about the victim with the ruthless purpose of a thumbscrew. May I never see such a sight again.

"The retracted leaves of the great tree kept their upright position during ten days. Then when I came one morning they were prone again, the tendrils stretched, the *palpi* floating, and nothing but a white skull at the foot of the tree to remind me of the sacrifice."

Such is the weird story of Carl Liche. Yet is it more strange than the unexplained facts that face the scientist in Madagascar? The very people of the island, the olive-skinned races of the interior who bear no resemblance to the natives of Africa, cannot be explained.

I find it hard to accept Carl Liche's story of the man-eating tree. But like my friend the trader, I know that if I spent a night in the primeval forest of the great island I should step warily, and dread the honey-sweet odour that lures creatures larger than mice to death.

There is a possibility that an expedition will be mounted early next year to ascertain if there is any factual basis for this centuries old story or myth as it my be.

One of our members is prepared to subsidize a considerable portion of the costs on the strange condition that he is allowed to take his video camera and Mother-in-law with him!

Cycad Greetings.

***Jack van der Merwe**, P.O. Box 39, 0835 Duiwelskloof, R.S.A.*

Received 3 October 2000

Geagte Redaktrise

"GRONDMENGSEL EN MOONTLIKE SIEKTE" EN "VRAE WAT KWEL"

E-pos korrespondensie tussen **Andre Kirsten** (vrae) en **Piet Vorster** (antwoorde), 13 tot 21 Augustus 2000.

Andre: Ek is nog onervare met broodbome en het so twee jaar gelede 'n paar saailinge van *Encephalartos lebomboensis* aangeskaf. Die plante se blare kry egter ligte bruin (of grys) kolle wat nader aan die punt van elke blaartjie is. Nie al die blare kry dit nie maar 'n paar ontwikkel die kolle en dit word groter met tyd. Dit lyk letterlik of die blaar sy "vel" verloor en op die kol self droog raak terwyl die res van die blaar niks makeer nie.

Sommige van die blaartjies sal dan ook omkrul. Die blaar self met uitsondering van die kol voel egter nie droog nie. Die plante word egter nie in direkte sonlig aangehou nie en water word ook nie te veel van gegee nie.

In sommige van die blaartjies ontwikkel gaatjies wat baie klein is, maar die blaar self is nog donkergroen.

Ek was onder die indruk dat dit dalk 'n stikstof tekort kan wees en het 'n aanvulling aan die plante gedoen.

'n Ander vraag wat ek het is: wat is die beste moontlike grondmengsel vir die plante om die beste groei resultate te kry? Al my broodbome is nog klein en word in potte gehou.

Ek nader u vir hulp aangesien geen kwekery my kan help nie en ek nie weet vir wie anders om te vra nie.

Piet: Ons plaas jou brief en my antwoord in *"Encephalartos"*.

Sulke kolle op die blare, wat soos 'n 1 cm-deursnee blasie lyk, het ek ook al gekry, selfs op blare van volwasse plante. Ek weet nie wat dit is nie, maar my indruk was dat dit verskyn as daar vir 'n lang tyd 'n druppel water op die blaar lê, hetsy op 'n baie warm dag of tydens 'n koue nag.

Dit klink nie vir my na 'n stikstofgebrek nie - laasgenoemde veroorsaak gewoonlik 'n egalige siek-geel kleur oor die hele blaar. Pasop vir te veel stikstof: onder sekere omstandighede kan dit lei na 'n kaliumgebrek wat baie moeilik is om weer reg te stel. Persoonlik gee ek vir my plante 2:3:4, en hulle het 'n baie mooi kleur.

Wanneer dit egter kom by saailinge wat vir jare in dieselfde pot staan, is dit raadsaam om van die begin af ook spoorelemente toe te dien. Daarvoor kan jy enige hidroponiese megsel gebruik, soos Chemicult of Multigro (wat ek gebruik). Dit is egter te duur om te gebruik vir groot plante wat in die oop grond staan.

Ek weet nie wat die ideale grondmengsel is nie. Wat wel belangrik is, is dat dit baie goed dreineer moet wees. 'n Komposinhoud het 'n heilsame uitwerking, maar in potte werk dit nie goed nie omdat die kompos spoedig oksideer en dan sit die plantjie onder in die pot op 'n bietjie sand. Dit is nie 'n goeie plan om dan die plant te verplant nie, omdat hulle nie daarvan hou dat hulle wortels versteur word nie. 'n Growwe riviersand is altyd veilig, maar dan moet mens omtrent weekliks voed. Daar is baie stories oor grondsuurtegraad, maar vir beste resultate moet die grond neutraal wees (pH7), eerder as suur. Vir plante in die oop grond gee ek altyd 'n dik deklaag van plantreste of selfs ou kraalmis: dit hou die grond klam, die grondtemperatuur egalig, en die erdwurms wat dit aanlok verseker dat die grond om die plante goed deurlug bly.

Andre: Aangaande *Encephalartos lebomboensis*. Ek het ongeveer drie weke gelede 'n grondmengsel aangemaak wat bestaan uit helfte riviersand en die ander helfte uit kommersiële potplant grond. Daarby het ek ongeveer 'n handvol "Wonder" superfosfaat, wat bestaan uit 105 g P/kg, ingemeng, asook ongeveer 20g kalk. Toe plant ek 'n ander *E. lebomboensis* in die grondmengsel in 'n 5 liter grootte pot. Ek het die plant toe goed water gegee. Na drie weke het ek die plant weer ongeveer 250 ml water gegee.

'n Paar maande gelede het die plantjie 'n nuwe blaar gevorm. Nadat ek die plant in die nuwe grondmengsel geplant het, het die punte van die nuwe blaar se blaartjies begin swart word vir ongeveer 5 mm vanaf die punte. **Vraag**: Wat veroorsaak die verskynsel? Die wortelstelsel is bykans geensins versteur nie. **Antwoord**: Ek weet nie wat makeer nie. Dit mag wees dat daar te veel kunsmis is, wat die plant gebrand het. Ek is gladnie ten gunste van die byvoeging van kalk nie, maar ek glo nie dat die kalk verantwoordelik is vir die swart vlekke nie. Ek het ook bedenkings oor die geskiktheid van kommersiële potplantgrond vir broodbome. **Vraag**: Wat is die tekens op so 'n plantjie van oorwatering en die tekens van te min water? **Antwoord**: Te min water: die plantjie is gelerig. Te veel water: die blare gaan heeltemal dood.

Vraag: Hoe gereeld moet mens plantvoedsel toedien en sal 'n weeklikse aanvulling van Chemicult moontlik skade doen? **Antwoord**: Chemicult weekliks sal nie skadelik wees nie, maar elke maand of so moet die opgehoopte soute en draer behoorlik uitgeloog word. Probeer eerder iets soos Multigro, wat heeltemal oplosbaar is.

Andre: 'n Ander *E. lebomboensis* was soortgelyk as bo oorgeplant. Die plant het mooi gegroei vir amper 'n jaar. Die plant se blare het toe 'n snaakse bruin kleur gekry (soortgelyk aan die effek van swart ryp) en doodgegaan. Ek kon nie verstaan dat die blare na 'n jaar net vanself so bruin word nie. **Vraag**: Wat veroorsaak die verskynsel? **Antwoord**: Ek weet nie.

Vraag: Wanneer kan 'n mens die pH van pasaangemaakte grond toets en 'n "ware" en korrekte pH lesing kry? **Antwoord**: Wanneer organiese materiaal nie ter sprake is nie, sou mens dit seker dadelik kon toets. Organiese materiaal wat afbreek behoort egter die grond effens te versuur.

Andre: Ek kan net noem al die plante word binnenshuis aangehou waar hulle heeldag aan nie-direkte sonlig blootgestel word. Ryp en koue is dus nie 'n faktor nie. Daar is van die plante wat soortgelyk oorgeplant is wat baie goed lyk en groei. Dit is waarom dit vir my so onverklaarbaar is

André Kirsten, *andre_kirsten@yahoo.com* ***Piet Vorster,*** *pjvor@akad.sun.ac.za*

Summary

"SOIL MIXTURE AND PROBABLE DISEASE" AND "HARASSING QUESTIONS"

André Kirsten, who recently joined our Society, has problems with some of his *Encephalartos lebomboensis* seedlings, which he obtained about two years ago. The plants are still small, planted in containers, not kept in direct sunlight, and are not given too much water.

Some leaflets developed light-brown spots near their apices. The spots enlarged with time, and became parched. Some of the leaflets curl up. With exception of the spots the leaves do not feel dry to touch. Small holes developed in some of the dark green leaflets.

As he thought that the problem was nitrogen-deficiency he applied fertilizer. He asks which soil mixture to use for cycads to get optimum growth results.

Piet Vorster replies that he has observed spots looking like 1 cm-diameter vesicles even on leaves of mature plants. He got the impression that they appeared after waterdrops remained on leaves for a long period, either on a very hot day or during a cold night. In his opinion it is not a nitrogen-deficiency which usually causes an even sickly-yellow colour right across the leaf. Under certain conditions too much nitrogen can lead to a potassium-deficiency which is very difficult to rectify. He applies 2:3:4 fertilizer to his plants. When seedlings are kept in the same containers for many years it is advisable to apply trace-elements (such as Chemicult or Multigro) from the start. He does not know which soil mixture is the ideal one, however, good drainage is essential. A compost content is beneficial but in a container the compost soon oxidizes and then the plant sits at the bottom of the container. At that stage it is not advisable to transplant the cycad because of possible damage to the root system. It is safe to use coarse river sand, but then you'll have to feed the plant on a weekly basis. For best results a neutral (pH7) soil mixture should be used. Piet applies a thick mulch, or even old kraal manure, to his plants in the open: it keeps the soil moist, the soil temperature even, and attracts earthworms which keep the soil around the plant well ventilated.

Andrè prepared a soil mixture consisting of 1:1 river sand and a commercial potting soil, adding about 20 g calcium and a handful of "Wonder" superphosphate consisting of 105 g P/kg. Using this mixture he planted a two year old *E. lebomboensis* seedling in a 5 litre container, with very little disturbance to its root system and watered it well. After three weeks he watered it again using about 250 ml water. Some months ago the plant produced a new leaf. After the plant was transplanted in the new soil mixture the leaflets turned black for about 5 mm at their apices. **Question 1**: What caused this phenomenon? **Answer**: I do not know what the matter is. Perhaps the soil mixture contained too much fertilizer which caused the damage. I am not in favour of adding calcium but I don't think that calcium caused the black spots. I also have misgivings about the suitability of commercial potting soil for cycads. **Question 2**: What is the symptoms on a cycad of too much and too little water? **Answer**: Too little water: the plant becomes yellowish. Too much water: the leaves will die off. **Question 3**: How often should fertlizer be applied, and will a weekly supplement of Chemicult harm the plant? **Answer**: Adding Chemicult on a weekly basis won't be harmful, but each month the accumulated salts and their carrier should be leached out. Rather use Multigro which is completely soluble.

Andrè transplanted another *E. lebomboensis*, similar to the one discussed above. It grew quite nicely for about a year, then the leaves became brownish (similar to the effect of black frost) and died off. He does not understand why after a year the leaves just turned brown. **Question 4**: What caused this? **Answer**: I do not know.

Question 5: When can the pH of freshly mixed soil be tested to get a "true" and correct pH reading? **Answer**: If no organic material is involved, the pH can be tested immediately. Decomposing organic material will somewhat acidify the soil.

Andrè's plants are all kept indoors where they are exposed to indirect sunlight throughout the day. Frost and cold are thus of no concern. Some of the plants that were transplanted in the same manner look good and are growing nicely. That it is why he finds the problems inexplicable.

FOCUS ON ... FOKUS OP ...

In each edition of *ENCEPHALARTOS*, we focus on one cycad species, in the form of an in-depth article in layman's language. In this edition the spotlight falls on:

In elke uitgawe van *ENCEPHALARTOS* fokus ons op een broodboomsoort, in die vorm van 'n in-diepte-artikel in leketaal. In hierdie uitgawe val die kollig op:

LEPIDOZAMIA HOPEI (W. Hill) Regel

Roy Osborne
Cycad Connections, P.O. Box 244, Burpengary, Queensland 4505, Australia

INTRODUCTION

North-eastern Queensland is the only site in the world where one finds adjacent World Heritage listed zones, *viz.* The Wet Tropical Rainforests and the Great Barrier Reef, which meet just north of Cairns. For naturalists, a visit to these areas is an experience of a lifetime. For cycad enthusiasts, add *Lepidozamia hopei, Bowenia spectabilis* and several species of *Cycas* and one might claim it as the experience of the millenium. Only in parts of Queensland is it possible to see three cycad genera in close proximity in the wild.

Is Australia's *Lepidozamia hopei* the biggest of all cycads? Evidence suggests so: as reported in "*Encephalartos*" No. **48** (December 1996), Paul Forster of the Queensland Herbarium has devoted a fair amount of effort tracking down the tallest specimens and getting accurate measurements of their height. The height record at present goes to a specimen at Pine Creek, in the Malbon Thompson Range near Yarrabah, which measured 17.5 m in 1995. The runners-up prize goes to a 17.3 m tall plant at El Arish. Apart from the impressive heights of these specimens, the basal trunks are reminiscent of fairly hefty trees too: the diameter one metre up from soil level has been recorded as 1.64 m (that's 5.15 m in circumference) on a plant near Babinda Creek.

DISCOVERY

An earlier "Focus on ... " article in "*Encephalartos*" No. **58** (September 1999) dealt with *Lepidozamia peroffskyana* and gave brief details of the derivation of the genus name. But just as with that species, there is some uncertainty about the first botanical collection of *Lepidozamia hopei*.

The feature plant of the present article was first described in 1865, under the name *Catakidozamia hopei* by Walter Hill, Curator of the Brisbane Botanic Garden. The epithet honours Louis Hope (1817–1894), grazier and pioneer of the sugar industry in north Queensland. Citing material growing in the European garden of Haage and Schmidt, Eduard von Regel (1876a and 1876b), aware of the relationship between this species and *L. peroffskyana*, renamed the new taxon as *Lepidozamia hopei*. How the plant material got to Europe is uncertain: Hill, von Mueller, Charles Moore or north-Queensland collectors like John Dallachy are possible candidates.

In common with many cycads described in early years, the species subsequently appeared under a number of other names: both Charles Moore and Frederick Manson Bailey referred to it as *Macrozamia hopei* while Schuster constructed *Macrozamia denisonii* var. *hopei*. Invalid names *Katakidozamia hopei* and *Catakidozamia hilli* also arose. The situation continued in relative confusion until 1959, when Lawrie Johnson ruled that *Lepidozamia hopei* was correct.

DISTRIBUTION AND ECOLOGY

Lepidozamia hopei is confined to the "wet tropics" of north-eastern Queensland, where it comprises numerous fairly small populations scattered along a 320 km coastal zone (Figure 1). Interestingly, this cycad is often found in association with *Bowenia spectabilis* (Figure 2). The southern end of the distribution zone is at Rockingham Bay, near Cardwell, while the northern end reaches to the Bloomfield River near Cooktown. [For readers not familiar with Australian geography, one could say that plants occur in a coastal band north and south of the city of Cairns.]

Plants are found on level sites near streams and also on steep drier slopes, from 0–1000 m in altitude. The climate is distinctly tropical and annual rainfall ranges from 1750–2500 mm (and sometimes a lot more) falling mainly in summer. Fires do not generally occur in areas where *Lepidozamia hopei* grows.

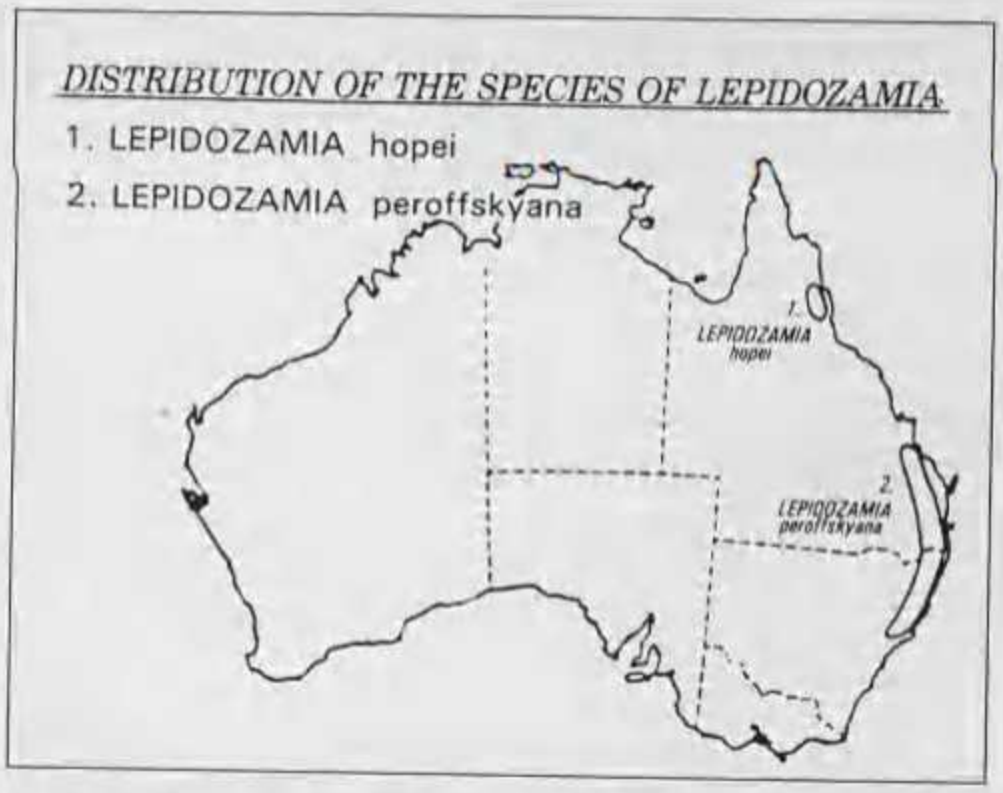


Figure 1 Map - distribution of the genus *Lepidozamia*. *L. hopei* is a tropical species from north-eastern Queensland while *L. peroffskyana* is more subtropical, occurring in south-eastern Queensland and north-eastern New South Wales. From "Introduction to the Zamiaceae", PACSOA 31, April-June 1991.

In a study of *L. hopei* biology reported in "*Encephalartos*" No. 52 (December 1997), Gary Wilson and Peter Rowles found three insect species in the dehiscing male cones: the weevil *Tranes insignipes*, a native bee of the genus *Trigona*, and the green tree ant, *Oecophylla smaragdina*. Of these, only the weevil is thought actively to transport pollen to the female cones.

The large and colourful seeds of *L. hopei* are dispersed by several animals, notably the white-tailed rat, *Uromys caudimaculatus*. [The feral pig, *Sus scrofa*, nowdays also disperses the seed but a large proportion is damaged in the process.] Confirming the somewhat surprising observations of other workers, Wilson and Rowles found no evidence of the southern cassowary, *Casuarius casuarius*, either eating or being involved in dispersal of *Lepidozamia* or *Bowenia* seed. [By contrast, cassowaries in New Guinea and Aru are said to swallow whole *Cycas* seeds, digesting off the sarcotesta and eventually passing the "cleaned" seed.]

Testimony to the seeds of this cycad being an important part of aboriginal culture, is the diversity of names by which the species is known: ngarumba (arumba), binggira, bingir, wunu and julbin being mentioned (Forster 1996). Climbing tall trees to harvest seeds was facilitated by cutting out hand and footholds up the trunk, some of these cuts still being evident on older specimens at the present time (Bosworth 1993). Seeds were treated by roasting, crushing and leaching to remove the toxins, after which the flour was cooked to provide a crude bread (Roberts *et al.* 1995). [There are plant specimens and details of its aboriginal use on the very interesting "food plants walk", a permanent display at the well-known Flecker Botanic Gardens in Cairns.]

The species is well-represented in botanical gardens in Australia (Brisbane, Cairns, Canberra, Darwin, Rockhampton, Sydney) and also overseas in Europe (Kew, Naples, Lyon), the USA (Fairchild, Huntington, Lotusland), South Africa (Durban) and Asia (Bogor). It is also widely distributed amongst private collectors, especially those in tropical or subtropical regions.

Figure 2 Pedestrian bridge over the Mossman River, within the Daintree National Park complex in north Queensland. *Lepidozamia hopei* is just on the right hand side of the bridge while *Bowenia spectabilis* is slightly to the left. Photo: Roy Osborne.

DESCRIPTION

1. STEM

Lepidozamia hopei is an arborescent cycad usually with a single trunk (Colour Figure 1 on p. 15), sometimes reaching up to 17.5 m tall with extensive basal girth (Colour Figure

2 on p. 15). The outer part of the trunk comprises the remains of scale-like leaf bases for which the genus is named.

Bosworth (1993) and Wilson and Rowles (1997) note that there are various sites with a number of mature branched specimens of similar age, and speculate that this branching may be the result of cyclone damage. [From the measurement of the height of the trunks above the branching points, and with the records of the years of major cyclones, growth rates and plant's ages can be estimated. Brien Bosworth calculated that some of the larger plants are as much as 700 years in age. Gary Wilson and Peter Rowles derived a growth rate of 6.0–8,5 cm per year.]

2. LEAVES AND LEAFLETS

Mature *Lepidozamia hopei* plants can bear up to 100 leaves in the crown; these are typically 2–3 m long, straight, with 300–600 mm of smooth petiole, rounded from above but slightly angular from below, enlarged and slightly hairy at the base (Colour Figure 3 on p. 15). Each leaf has 160–200 dark green leaflets, widely and evenly-spaced along the rachis, typically 200–400 mm long by 15–30 mm wide. Leaflets (Colour Figures 4, 5 on p. 15, 16) are glossy on the upper surface, slightly falcate with a blunt apex, have 15–30 parallel veins and bear stomata only on the lower surface. Emergent leaves are attractive in colour due to the presence of short soft reddish-brown hairs. Leaf flushes alternate with the production of short, sharp, persistent cataphylls.

3. REPRODUCTIVE STRUCTURES

Male plants of *Lepidozamia hopei* bear single, shortly-stalked, cylindrical cones, 250–400 mm long by 80–140 mm in diameter. The flattish, pale grey, wedge-shaped microsporophylls are 30 mm long by 25 mm wide and have distinctly recurved spines.

Female plants of *Lepidozamia hopei* bear single, shortly-stalked, ovoid cones, 400–600 mm long by 200–300 mm in diameter (Front Cover). The wedge-shaped, grey-green megasporophylls are typically 50–80 mm long, 35–65 mm wide and 14–40 mm high. Each megasporophyll bears two large, oblong seeds on its lower surface, these about 40–70 mm long by 30–45 mm, with a bright red sarcotesta.

AFFINITIES

Lepidozamia hopei is clearly closely related to *L. peroffskyana*, but readily distinguished by its bigger leaves, wider leaflets and general overall size. The current *Flora of Australia* (Hill 1998) uses leaflet characters to key out the two species in the genus, as follows:

Broadest pinnae 15–30 mm wide, with 15–30 parallel veins
. . . . . *L. hopei*

Broadest pinnae 5–13 mm wide, with 7–13 parallel veins
. . . . . *L. peroffskyana*

At the present time, the closest wild populations of these two species are separated by more than 1500 km and no natural hybrids have been documented. Although known only from their leaf fragments, two fossil cycads are also related to their living counterparts. These are *Lepidozamia hopeites* from a Tertiary coal deposit in Victoria and *L. foveolata* from Eocine strata in New South Wales.

CONSERVATION AND CULTIVATION

The species is not considered at risk. Its distribution range is extensive, recruitment in populations is effective, the total number of plants is relatively high and many of the populations are in protected areas. It is categorised as "LR,1c" on the IUCN Red List.

Lepidozamia hopei is "easy" in cultivation. Being relatively fast-growing, it needs either a succession of sizeable containers or the appropriate amount of space in a large garden. The species requires ample water and responds well to fertiliser during the spring and summer growth phases. It will "do" in full sun in the coastal tropics and subtropics, but prefers some shade. It is not known as a cold-hardy species, but would probably survive a short frost. Propagation is by seed.

ACKNOWLEDGEMENTS

I thank Gary Wilson and Lou Randall for their kind help in the preparation of this text.

REFERENCES

BOSWORTH, H.R. 1993. Notes on *Lepidozamia hopei*. *Palms & Cycads* 38: 9–12.

FORSTER, P.I. 1996. *Lepidozamia hopei* (Zamiaceae), the world's tallest cycad. *Encephalartos* 48: 12–15.

HILL, K.D. 1995. Taxonomic changes in the Australian cycads. Proceedings of the Third International Conference on Cycad Biology: 193–223. The Cycad Society of South Africa, Stellenbosch.

HILL, K.D. 1998. Cycadophyta. In: *Flora of Australia* 48: 597–661.

HILL, K.D. & OSBORNE, R. In preparation. Cycads of Australia.

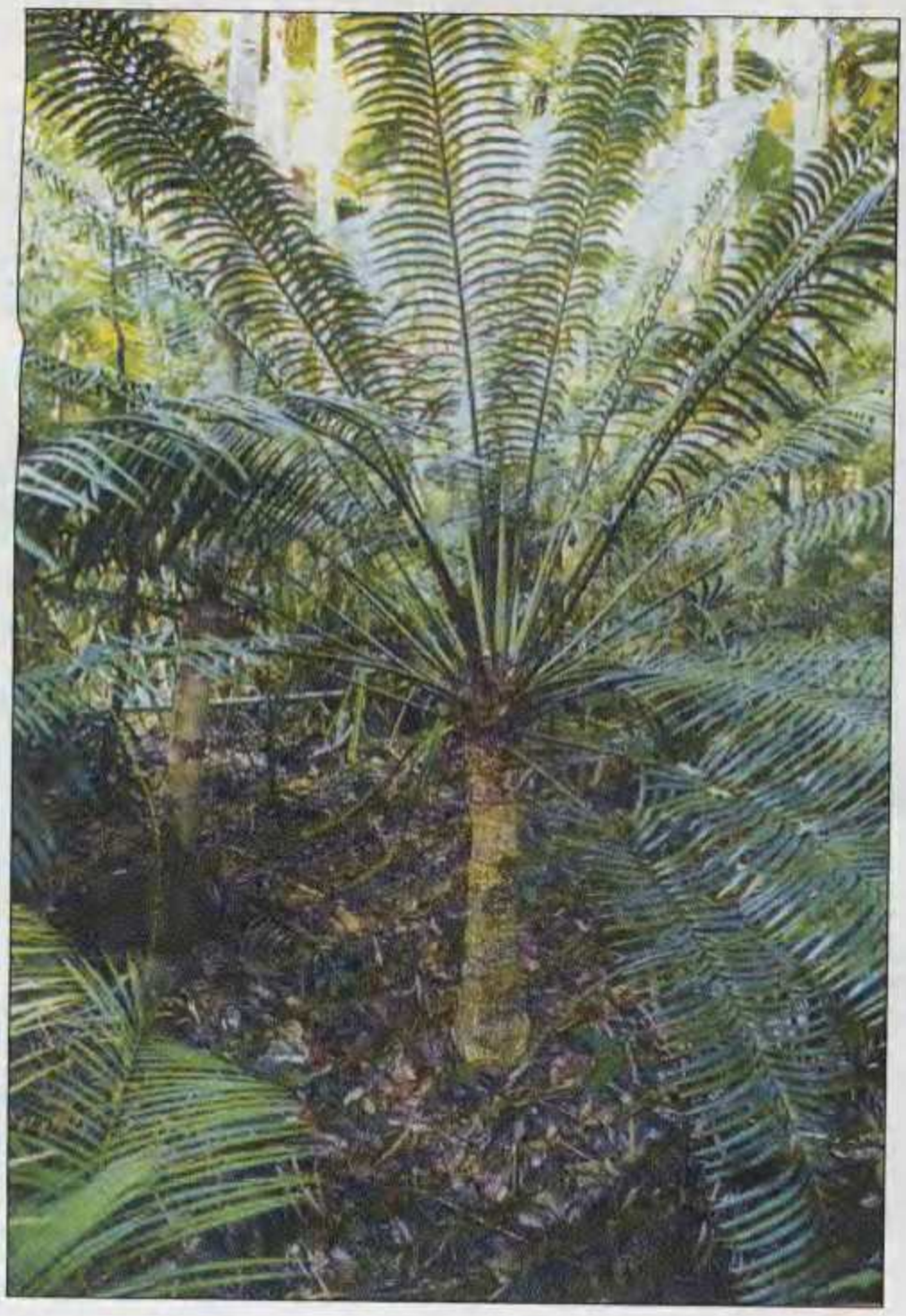
HILL, T.W. 1865. *Catakidozamia*. *Gardeners' Chronicle* 47: 1107.

JOHNSON, L.A.S. 1959. The families of cycads and the Zamiaceae of Australia. *Proceedings of the Linnean Society of New South Wales* 84: 64–117.

JONES, D.L. 1993. Cycads of the World. Reed, Australia.

OSBORNE, R. 1999. Focus on .... *Lepidozamia peroffskyana*. *Encephalartos* 58: 4–11.

ROBERTS, J., FISHER, C. & GIBSON, R. 1995. A guide

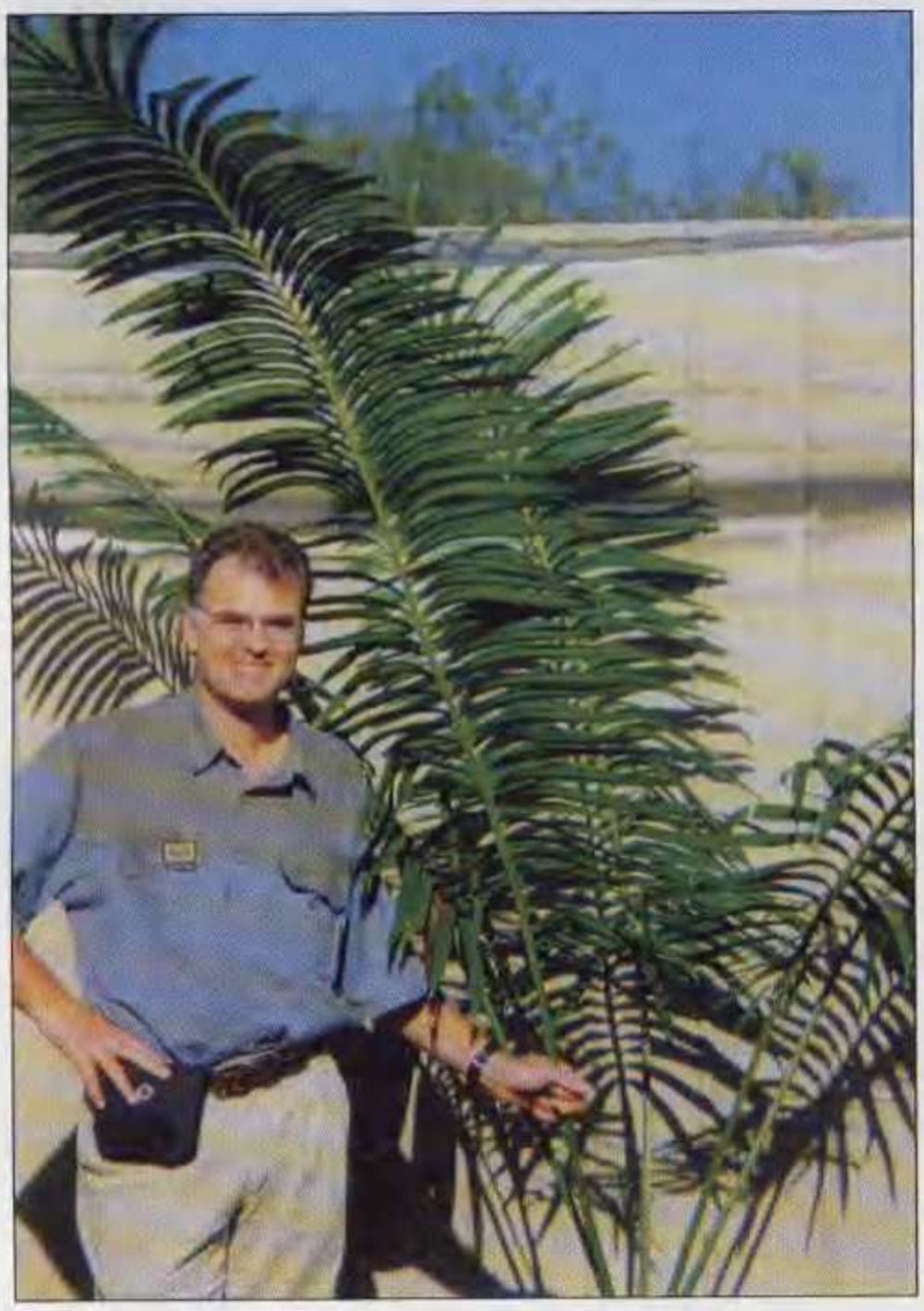


Colour Figure 1 *Lepidozamia hopei.* **Young plant at the Tam O'Shanter National Park, north Queensland, where this cycad occurs together with large numbers of very impressive *Licuala ramsayi* palms. Photo: Roy Osborne.**

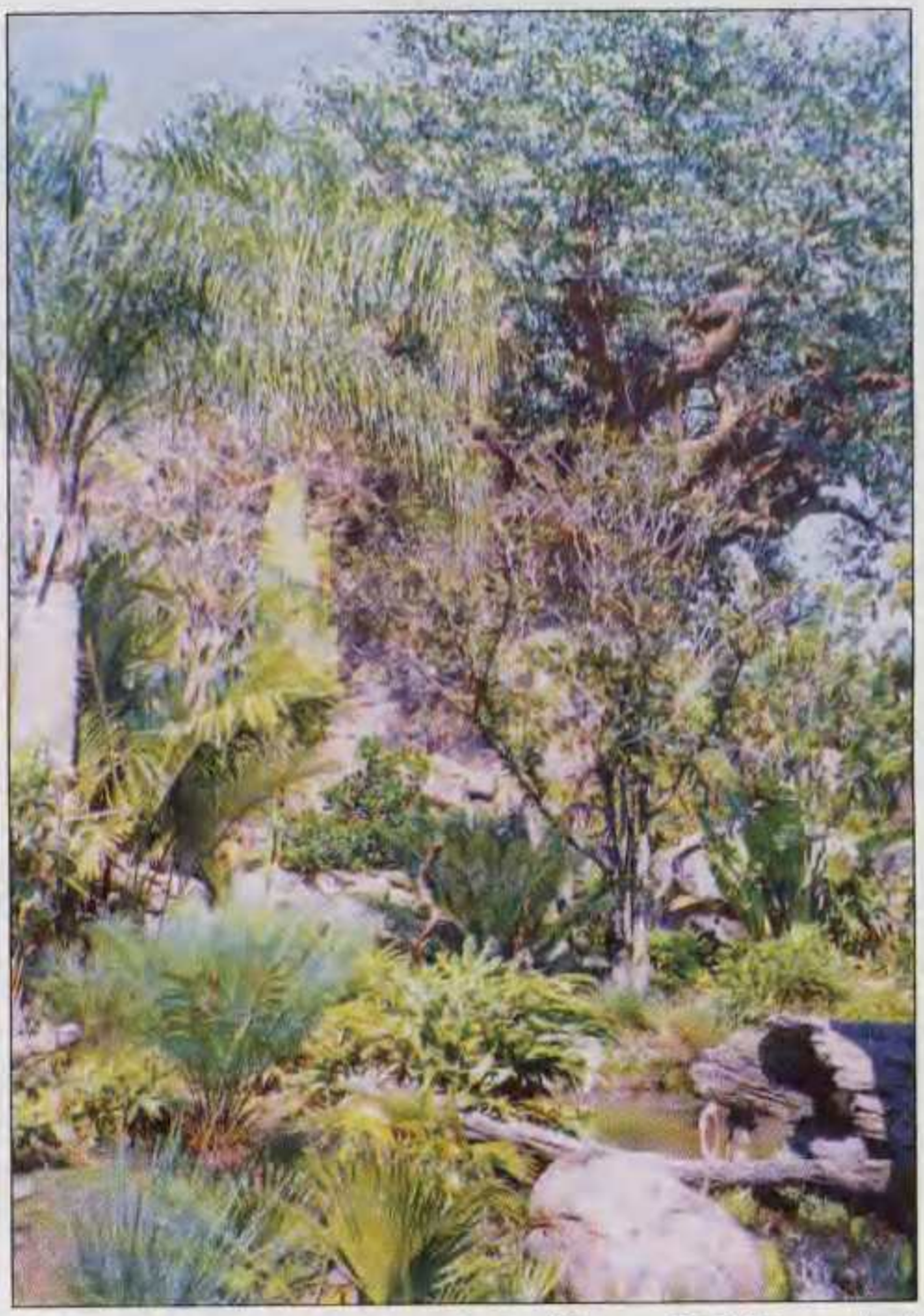
Colour Figure 2 *Lepidozamia hopei.* **Base of a large old specimen in north Queensland. From "Introduction to the Zamiaceae", PACSOA 31, April-June 1991. Photo: Brien Bosworth.**

Colour Figure 3 *Lepidozamia hopei.* **Sharp, stiff and persistent cataphylls are interspersed amongst the swollen leaf bases. Photo: Roy Osborne.**

Colour Figure 4 *Lepidozamia hopei.* **The leaflets of plants in habitat are often covered with a microflora of mosses, lichens and other small plants. Photo: Roy Osborne.**



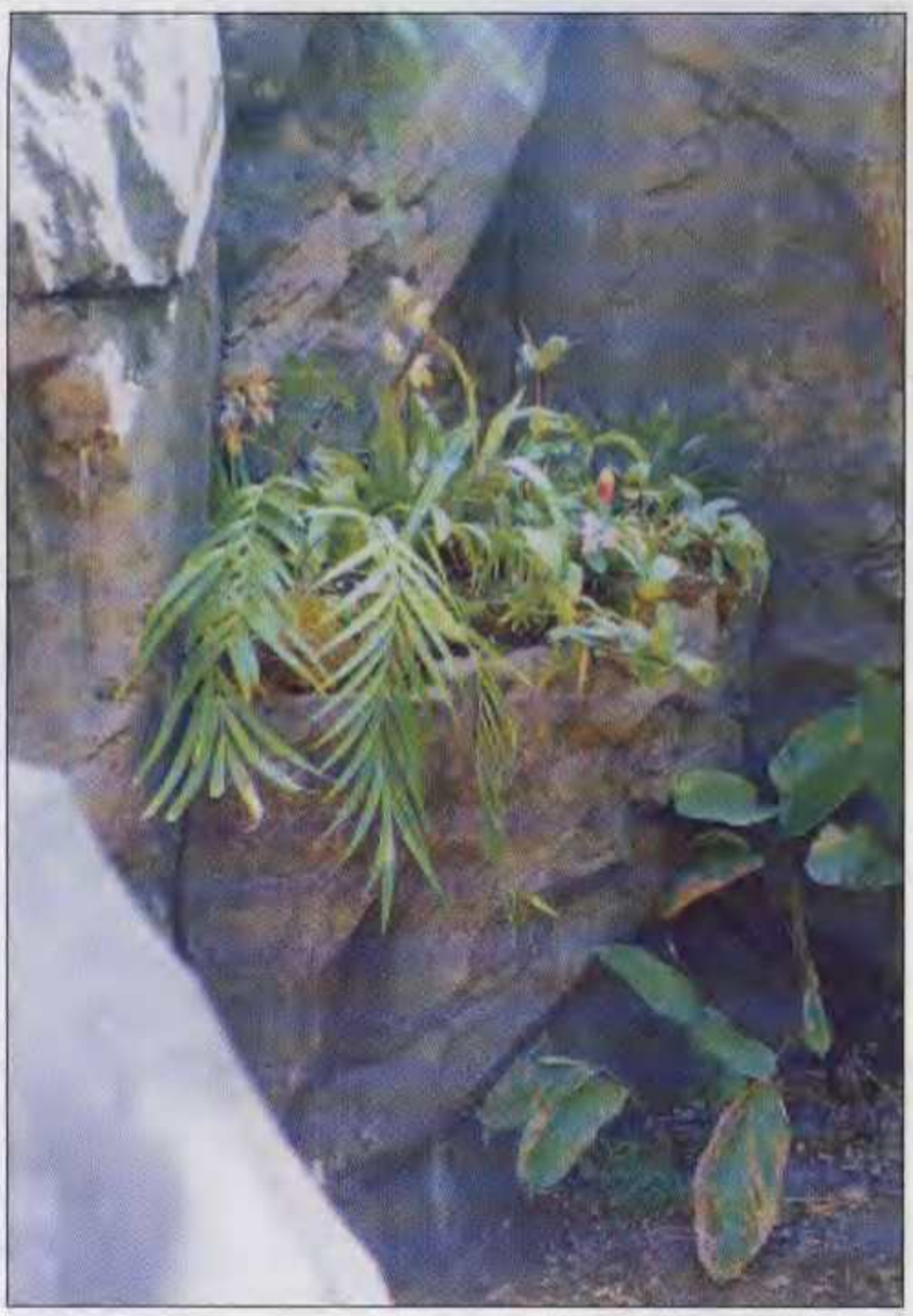
Colour Figure 5 *Lepidozamia hopei*. **Nursery-grown 5-year old seedling, with Dr John Donaldson of Kirstenbosch National Botanic Gardens during a recent visit to Australia. Photo: Lou Randall.**



Colour Figure 6 A view of the "Tree of Life", a giant artificial tree at the center of the Animal Kingdom (Disney World). Two *Cycas* sp. *rumphii* complex are located in the foreground. Photo: Willie Tang.

Colour Figure 7 Part of the Cretaceous Trail (Disney World). *Cycas* and *Encephalartos* can be seen on the right. In the background are *Araucaria* trees. Photo: Willie Tang.

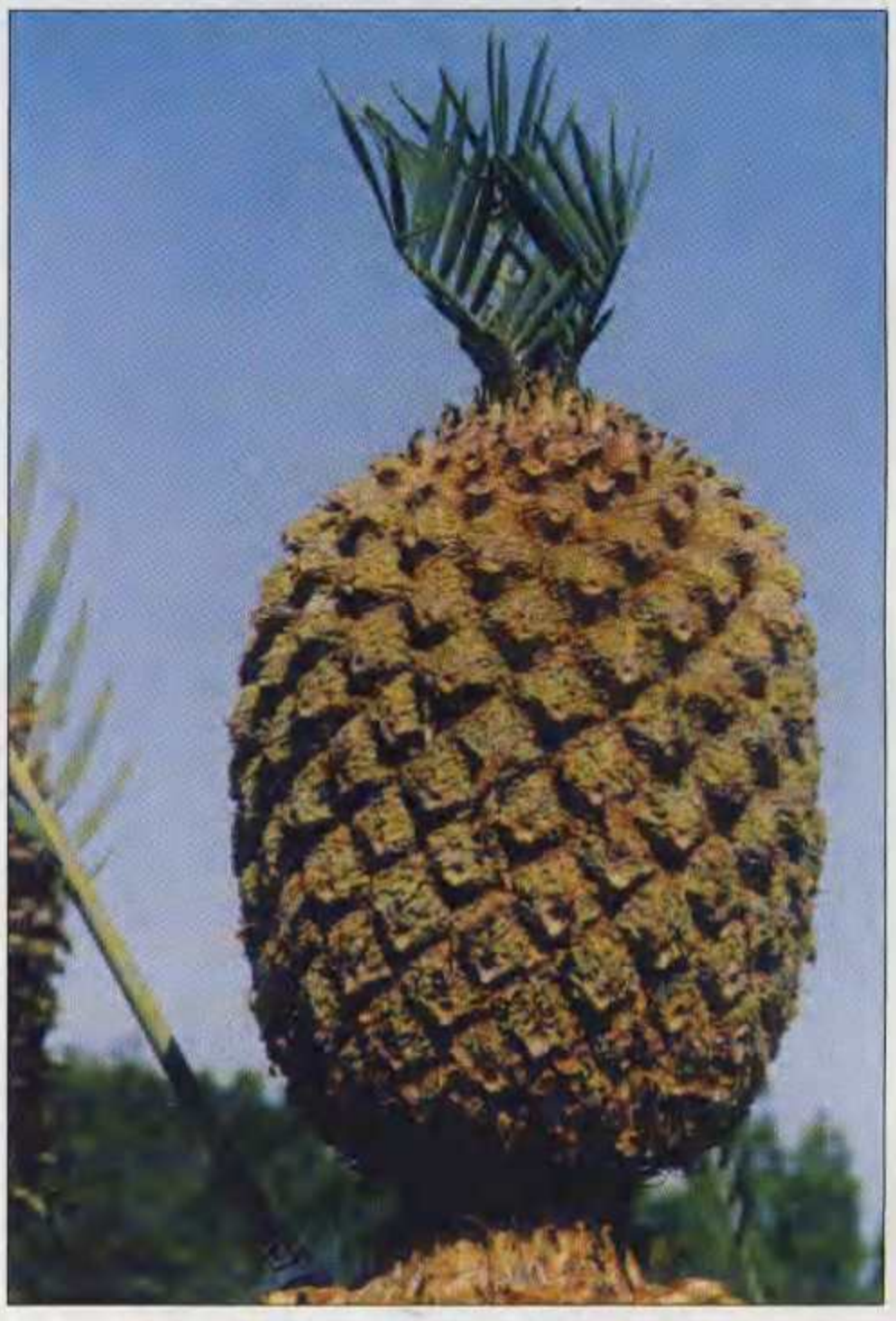
Colour Figure 8 Cycads on the Cretaceous Trail (Disney World) are often closely spaced, creating a thicket in places. Each individual plant may not be displayed to the best advantage, however, the overall affect is interesting - it is more like a wild area rather than a garden. Photo: Willie Tang.



Colour Figure 9 *Zamia pseudoparasitica* **planted on a wall in one of the animal exhibits in the "Oasis" section of Animal Kingdom (Disney World). Photo: Willie Tang.**

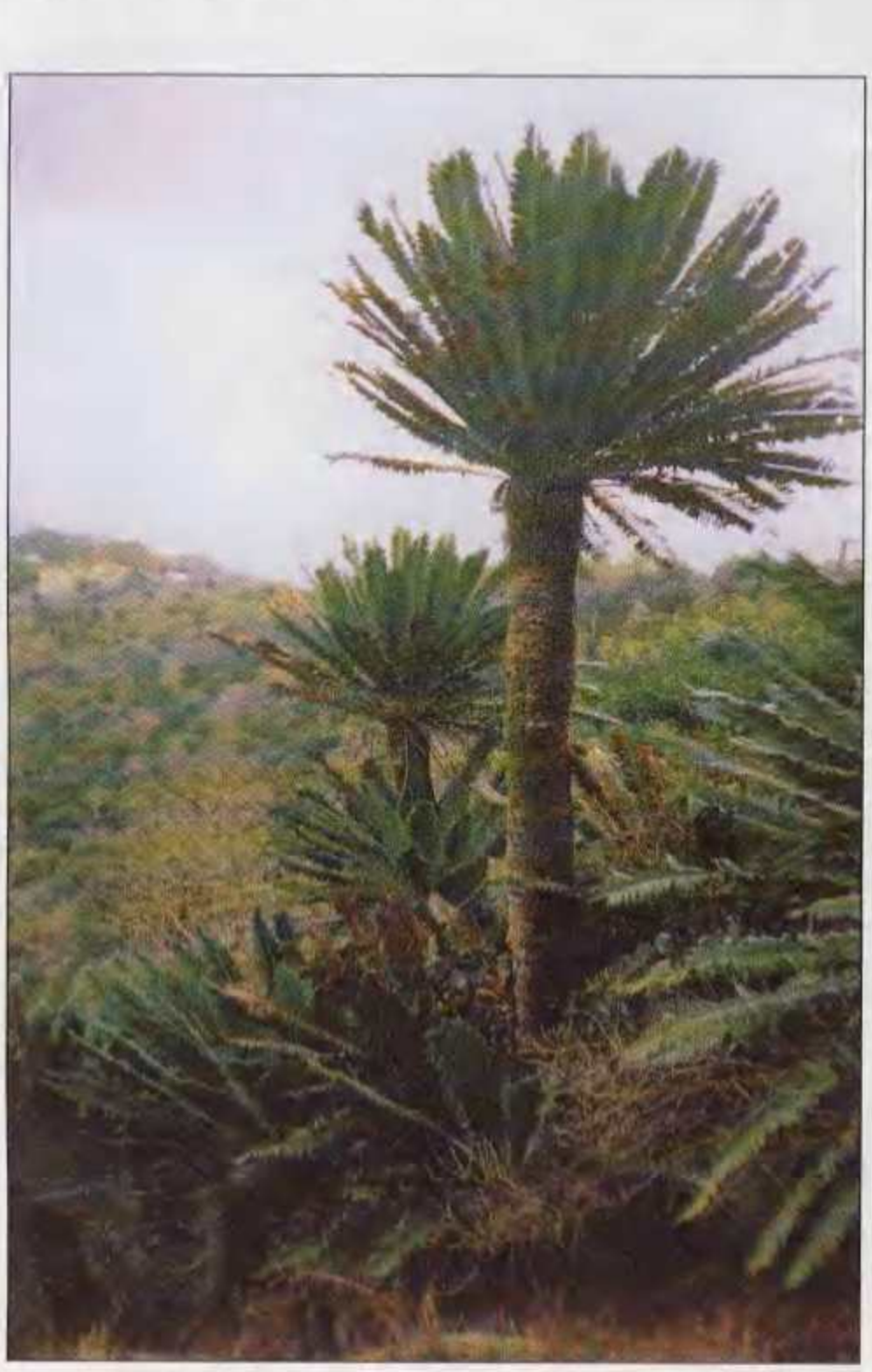
Colour Figure 11 *Cycas platyphylla* **growing in the cemetry at Irvinebank in north-east Queensland, Australia. Photo: Paul Forster.**

Colour Figure 10 This life-size ceratopsian dinosaur is surrounded by *Dioon edule* **and** *Cycas revoluta* **(Disney World). Photo: Willie Tang.**



Colour Figure 12 *Encephalartos princeps* **female cone. Note the leaves at the top of the cone. Photo: Mike Pautz.**

Colour Figure 13 Multi-stemmed *Encephalartos transvenosus* in the picnic area at the Modjadji Forest, Northern Province. Photo: Alice de Beer.



Colour Figure 14 *Encephalartos transvenosus* in the Modjadji Forest. Photo: Alice de Beer.

Colour Figure 15 Alice & Charles de Beer surrounded by *E. transvenosus*. Photo: Blackie Swart.

Colour Figure 16 Group photo of some of the members of the Lowveld Regional Branch of the Cycad Society of South Africa in front of a magnificant stand of *E. transvenosus*. Photo: Alice de Beer.

Kleurfiguur 17 Die broodboom uitstalling van die Transvaalse Streektak van die Broodboom Vereniging van Suid-Afrika by die Orgideeskou in Pretoria. Foto: Derik Minnaar.

Colour Figure 17 The Transvaal Regional Branch's cycad exhibition at the Orchid show in Pretoria. Photo: Derik Minnaar.

to traditional aboriginal rainforest plant use. Bamanga Bubu Ngadimunku Inc., Mossman.
SCHUSTER, J. 1932. Cycadaceae. In: *Das Pflanzenreich* 4(1): 1–168.
VON REGEL, E.A. 1876a. *Gartenflora* 25: 3–6, 140.
VON REGEL, E. A. 1876b. Cycadearum, generum specierumque revisio. *Trudy Imp. S. Petersburgsk Bot. Sada* 4(2–4): 275–320. [*Acta Hort. Petrop.* 4(4)?]
WILSON, G.W. & ROWLES, P.C. 1997. Notes on the biology of *Lepidozamia hopei* Regel (Zamiaceae). *Encephalartos* 52: 12–17.

SHORT COMMUNICATIONS / KORT MEDEDELINGS

CYCADS AT DISNEY'S ANIMAL KINGDOM

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Recently I visited Disney's Animal Kingdom in Florida, U.S.A. The Animal Kingdom is one of several Disney theme parks located together in Disney World near the city of Orlando, in north Florida. Within Disney World, the Animal Kingdom is only a few minutes drive from the Magic Kingdom and EPCOT Center. Reported to cost several billion dollars to build and landscape and many years in the making, the Animal Kingdom first opened in 1998.

Figure 1 Entrance to the Cretaceous Trail.

I have visited many zoos around the world - Animal Kingdom, however, is something quite different. First, as in all Disney Parks, great importance has been placed on landscaping - in the design as well as the maintenance. A great variety of trees, shrubs, and ground covers have been carefully placed along curving and sloping paths and everything is meticulously maintained. This is quite unlike most zoos where landscaping is usually an afterthought. Second, in the Animal Kingdom museum displays are integrated with the animal exhibits. For me, the integration of outstanding museum exhibits with live animals enhanced both. Third, Animal Kingdom is an amusement park, with rides that place you within the habitats of animals both living and extinct. The river raft, safari, and dinosaur rides literally propel visitors into worlds they rarely experience.

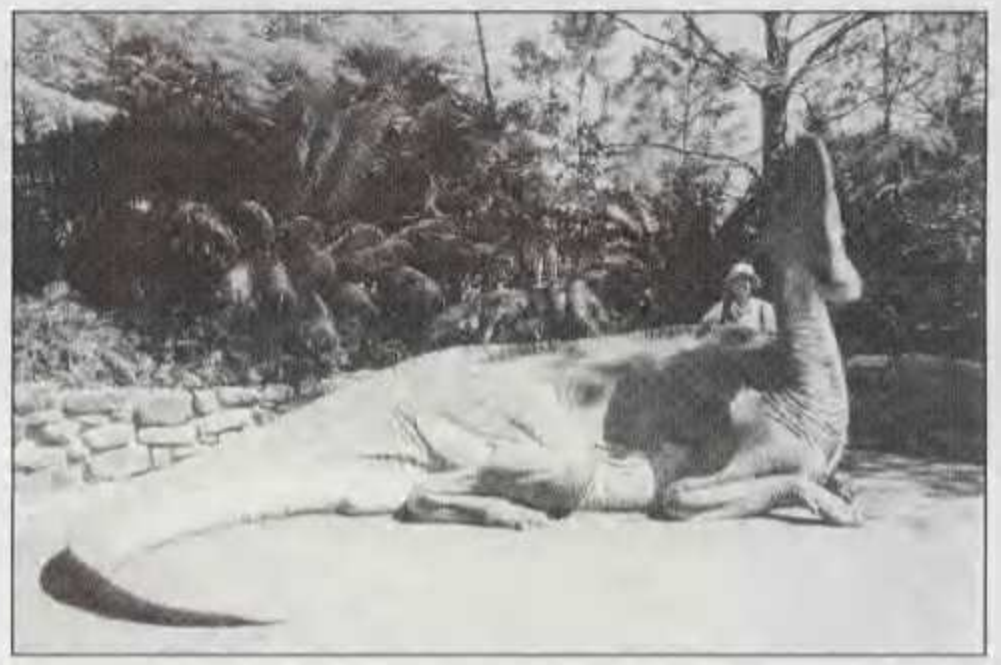

Figure 2 ***Cycas*** **sp.** ***rumphii*** **complex,** ***C. taitungensis*****, and** ***Dioon mejiae*** **can be seen behind this life-size duck-bill dinosaur model on the Cretaceous Trail.**

Since it is located in a subtropical climate, cycads are widely used throughout the landscape of the Animal Kingdom (Colour Figures 6, 9 on p. 16, 17). In most cases they are *Cycas revoluta, C.* sp. *rumphii* complex, and *Zamia furfuracea*, all basic landscape material in Florida. A surprise awaits the cycad enthusiast in "Dinoland U.S.A.", the prehistoric section of the Animal Kingdom. In this section is the Cretaceous Trail, a looping path through a recreation of the vegetation that existed in

Figure 3 Inside the Dinosaur Jubilee fossil exhibit.

the time of the dinosaurs. Cycads are a dominant part of this landscape along with ferns and conifers (Figures 1, 2; and Colour Figures 7, 8, 10 on p.16, 17). At every turn of the Trail another rare cycad greets the visitor. *Encephalartos, Lepidozamia, Macrozamia, Dioon, Zamia, Ceratozamia*, and more are to be found. Many species of each genus are planted. It is my understanding that most of the Cheek cycad collection as well as many plants from other commercial cycad nurseries were purchased by Disney to create this exhibit. Unlike any other cycad garden I've visited, realistic life-size dinosaur models are placed among the cycads (Figure 3, and Colour Figure 10 on p. 17). The dinosaurs complete the recreation of the ancient cycad landscape, where these plants are reunited with their former Mesozoic companions. At one end of the Cretaceous Trail is the dinosaur ride, a rapid visit through a dark world of lifelike moving dinosaur robots. At the other end of the Trail is a treat to those of you who are paleontologically inclined. In a large tent-like building called "Dinosaur Jubilee" are excellent displays of fossil reptiles, fish and other animals (Figure 3). These are among the most educational and effective displays of fossils I've ever seen. There is even a display of a working paleontology lab, where real scientists can be seen extracting dinosaur fossils still encased in rock. In the Disney genius for entertainment and education, the cycad plantings, rides, and museum displays have been integrated into a whole that is much more than a sum of its parts. The visitor comes away with a deeper understanding of the ancient world where cycads were once dominant and a deeper appreciation of those cycads still alive today. This is an unique experience for cycad enthusiasts of all ages.

CYCADS INVADE THE REALM OF THE DEAD

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Received 8 August 2000

Figure 1 ***Cycas platyphylla*** **and one of the ornate gravestones in the cemetry.**

Different species of cycad are routinely used as landscaping features in a variety of settings, including cemetries and funeral parlours. In these instances the cycads are not indigenous to the localities and are planted by humans. Recently I came across and instance where cycads were naturally present in a cemetry and to some extent were regenerating and invading graves.

The small village of Irvinebank is located west of Atherton Tableland in north-east Queensland. Irvinebank was established in the late 1800's as a tin and gold mining town and has subsequently languished since the heady days of mining exploration in the 1880's to early 1900's. As with many old mining towns, the cemetry contains a number of historical and often ornate gravestones, many commemorating miners and prospectors who met early deaths. Perhaps more of interest to cycad enthusiasts are the great many *Cycas platyphylla* K.D. Hill that are also growing in the confines of the small graveyard (Figure 1, Colour Figure 11 on p. 17).

Irvinebank is plumb in the middle of a population of thousands of *C. platyphylla*, so it is not surprising that the cemetry has some as well. What is uncertain is whether the cycads were there to start with and have merely resprouted around and amongst the tombstones, or whether they have

recruited into the graveyard from the adjacent population in the last 120 or more years. The Irvinebank cemetry is well maintained and the cycads seem to be tolerated, rather than actively removed. The last apparent burial in the cemetry was 1980, so perhaps the cycads will continue to invade the realm of the dead.

NEWS FROM THE LOWVELD REGIONAL BRANCH OF THE SOCIETY

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Received 28 September 2000

Report on recent activities

MODJADJI EXCURSION

Figure 1 Two magnificent *Encephalartos transvenosus* specimens in the Modjadji Forest. Photo: Blackie Swart.

On Friday 18th August eighteen members from the Lowveld Regional Branch, departed from White River, Nelspruit, Malelane and Schagen, to travel to Duiwelskloof. After a three and a half-hour scenic journey via Graskop, God's Window and the Potholes, we saw the welcoming lights of Tzaneen. Friday nigt was spent relaxing at Della Duberly's Guesthouse, discussing the weekend's events.

A misty Saturday morning saw all the Lowveld cycad enthusiasts meet at Jack van der Merwe's house and nursery. Jack kindly organised a most interesting itinerary for us. We were privileged to visit a couple of beautifully landscaped gardens.

The visit to the Modjadji forest was the highlight of the trip. It is an awsome sight. There are thousands of *Encephalartos transvenosus* growing on the mountainside (Figure 1, Colour Figures 13–16 on p. 18). As you walk deeper into the forest, you have to stand still and look around, to absorb the magnificence of the smallest seedlings to the tallest mature cycads surrounding you. There are hundreds of *E. transvenosus* that are the height of mature palm trees. From a distance it looks like a palm grove.

If you have not visited the Modjadji forests, don't delay. It is a sight not to be missed by young or old.

After much excitement and chatter, we returned to Della's Guesthouse and enjoyed a true South African braai. The awesome sight of the Modjadji forest, and the winning of the Boks (rugby) proved to be a winning recipe for a truly successful day.

Departing on Sunday, we visited Wulveskop Estate Cycad Nursery and the Malaria & Tropical Disease Research Institute. There we saw more beautiful specimens of *E. transvenosus* and other cycad species in the gardens.

Two words to sum-up the weekend's excursion: "Absolutely fantastic".

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

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Ontvang 7 Oktober 2000

Die Orgidee Vereniging van Noord-Transvaal (ONT) se organisasie ten opsigte van die Nasionale orgideeskou (names die Suid-Afrikaanse Orgidee Vereniging [SAOC]) was 'n groot sukses. Die skou en simposium het gedurende 6 tot 10 September 2000 by die Rembrandtsaal by die sportkompleks van die Universiteit van Pretoria plaasgevind. Verskeie van die lede van die 24 orgidee verenigings geaffilieer by SAOC het aan die uitstalling deelgeneem, asook Thailand en Maleisië. Die skou was later oop vir die publiek, en het geweldige belangstelling uitgelok.

Figuur 1 'n Gedeelte van die broodboomstalletjie, met Derik Minnaar (links voor) wat inligting aan 'n besoeker verskaf. Foto: Lynette Minnaar.
Figure 1 Part of the Transvaal Regional Branch's cycad exhibition at the Orchid show (6 to 10 September) in Pretoria. On the left (in the foreground) is Derik Minnaar with two of the visitors (behind the table). Photo: Lynette Minnaar.

Daar was twee dae gegun om die stalletjies te bou, wat dit in 'n maratonstryd laat ontaard het. Woensdagaand 6 September is die stalletjies beoordeel en die aand afgesluit met 'n skemerkelkie, waartydens die burgemeester die konferensie amptelik geopen het. Die skou en lesings het voortgeduur tot Sondagmiddag, waarna daar tot laat opgeruim is.

Verskeie mense het die broodboomstalletjie (Figuur 1, Kleurfiguur 17 op bl. 18) besoek en baie nuwe belangstelling is getoon en lede is gewerf. Hartlike dank aan almal wat gehelp het met die bemanning van die stalletjie en so 'n bydrae gelewer het om die skou so suksesvol te maak. Namens die Broodboom Vereniging wil ons waardering uitspreek vir die Orgidee Vereniging wat ons die geleentheid gegun het om betrokke te wees by hierdie geleentheid.

<u>Toekomstige aktiwiteite</u>:

Daar word gepoog om 'n uitstappie te reël na 'n natuurlike lokaliteit van *Encephalartos laevifolius*. Die reëlings moet nog gefinaliseer word, maar skakel vir Derik Minnaar vroeg in die nuwe jaar vir meer besonderhede. Reserveer asseblief voorlopig die Saterdae in Februarie 2001 vir hierdie geleentheid!

Kontak gerus vir Derik by 082 413 1025 (na-ure) met enige voorstelle rakende sprekers en uitstappies, of vir verdere inligting met betrekking tot opkomende aktiwiteite.

THE TYPIFICATION OF *CYCAS MIQUELII*

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Received 2 September 2000

The typification of *Cycas miquelii* Warb. has been much confused. There are various reasons for this and the records need to be set straight. The name was given by Warburg (Monsunia I: 1900, p. 179) in a footnote under *C. inermis*: "... both in Tongking and S. China there are endemic species, ... the first I will designate *C. Balansae*, the latter *C. Miquelii*." Within Warburg's above text concerning *C. inermis* he refers to "... the thornless plant

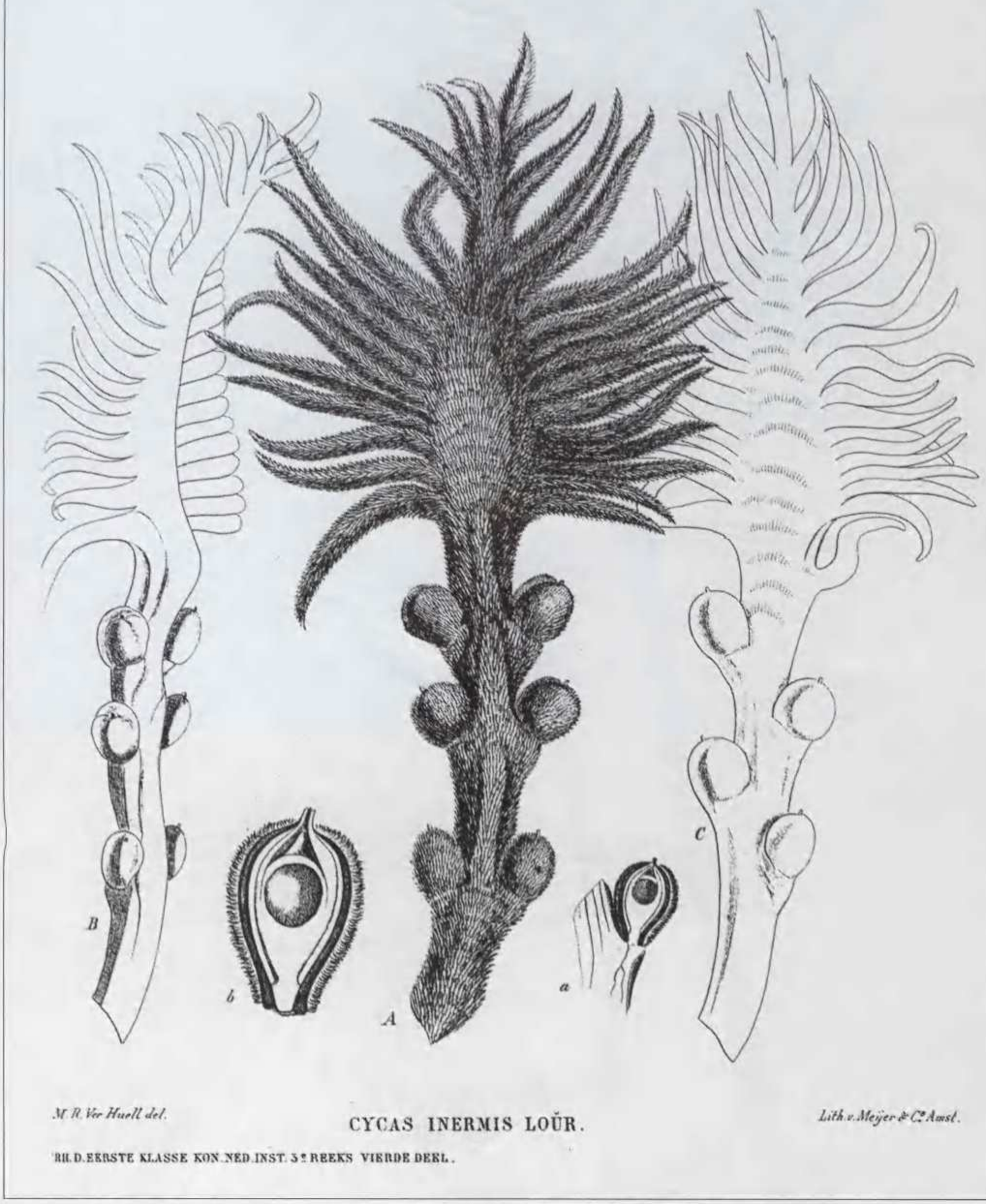

Figure 1 Miquel's illustration (1851: t. IV), chosen by the author as the type for *Cycas miquelü*.

Figure 2 (on page 24) a. Bifurcated leaflets in *Cycas miquelii* (60% natural size). From Miquel (1851) t. III.

from south China described as *C. inermis* Lour. by Miquel in Analecta II, page 40 ..." and "... involving the illustration of a female scale ..." which he does not believe "... truly corresponds to Loureiro's species, but apparently consists of a new species ..." Clearly, the illustration in Miquel (1851: t. IV) is the type for *C. miquelii* (Figure 1). Warburg was very unclear concerning the nature of various *Cycas* species and his discussion is confused. That confusion may have influenced later authors.

The specimen described as *C. inermis* Lour. by Miquel was sent as a living plant to Amsterdam from the Bogor Garden about 1847, its origin given as China. Note that it was Warburg who specifeid the south of China. This reference to China has stimulated various Chinese authors to search among Chines plants for the corresponding taxon. Most of what I have seen of this material corresponds to *C. guizhouensis* and none to the description by Miquel. It is unlikely that material of *Cycas* from China had been incorporated at Bogor at such an early date, particularly identified as *C. inermis*. Rather the origin was probably Cochin China (fide Loureiro) and the Bogor gardeners shortened it to China — it was all the same to them. It is even possible that the Bogor material had been contributed by Loureiro himself. Loureiro did specify the habitat for his species as Cochin China & China, with further discussion of use in Cochin China and Tonkin.

The actual description by Miquel of his living plant fits well with the original description of *C. inermis* by Loureiro (1790). The fact that Warburg believed otherwise is of no consequence because *C. inermis* is an invalid name, having been given in synonymy with *C. revoluta*. In fact, some or all of the recent species: *C. clivicola* including the variety *lutea, C. chamaoensis*, and *C. nongnoochiae* variously from Cambodia and nearby parts of Thailand described by Hill and Yang (*Brittonia* 51: 1999, pages 48–73) are the same. That is, *C. miquelii* is well represented in and near Cochin China which, of course, includes Cambodia.

Whether *C. miquelii* belongs in *Dyerocycas* (*Epicycas*) is unclear. It and *C. siamensis, C. elongata*, and *C. lindstromii* stand apart from the type species *C. micholitzii* plus *C. tonkinensis* and *C. multipinnata*, in spite of their bulbous bases, and may be more closely related to the bulk of the genus *Cycas*. Note, however, that bifurcated pinnules have been seen in both *C. miquelii* (Figure 2) and *C. siamensis*.

CYCAD CONE BEETLES SHIFTING TO NEW SPECIES

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In a recent article in this journal Piet Vorster (2000) reported his observations of *Encephalartos* cone beetles visiting cycad cones of other species and genera in his garden. Here I report some similar observations and research in Florida. Over the past two decades, especially in the early 1980"s I've removed and inspected hundreds of cycad cones from 10 genera of cycads, mainly from Fairchild Tropical Garden and the Montgomery Botanical Center, for close scrutiny in the lab.

There is a native weevil pollinator, *Rhopalotria slossoni*, on the native Florida *Zamia* species. I have seen it on one occasion visiting *Zamia vazquezii* (formerly *Z. fischeri*) cones in a nursery setting. *Zamia vazquezii* has a pollination period that overlaps with that of the native *Zamia*. There are few other cycad species with an early winter coning period. Some *Ceratozamia* will cone during this period, but I have never observed zamia beetles on them.

Of greater interest is the natural pollinator of *Zamia furfuracea, Rhopalotria mollis*, both of which were introduced into south Florida from Mexico. Norstog and Stevenson (1980) documents *R. mollis* in south Florida as early as 1980. *Zamia furfuracea*'s pollination period is in summer, beginning here in June and ending by mid September. Knut Norstog and Priscilla Fawcett (1989) have studied the life cycle of this beetle in great detail. Pupae of this beetle remain dormant in the cone debris from the previous pollination season. At the start of the new pollination season some internal clock [see Tang (1997) for further discussion] or environmental cue, such as odour from new cones, stimulate the adults to emerge. They reproduce in male cones, completing several generations in one season. When their host plants finish coning what happens to the adult beetles? The instinct to survive and continue reproducing is very strong. These beetles do not simply drop dead. What are they doing? UV light traps placed out at the end of *Z. furfuracea*'s coning season

indicate that large numbers of these beetles are still very active and searching for mates and cones to lay eggs in. Even many months after the last cone has passed it's pollination period these beetles have been captured in flight intercept traps (C.W. O'Brien, pers. comm.). These captures indicate that they were still actively flying and probably searching for cones. It is at the end of *Z. furfuracea*'s pollination period, when beetle numbers are high and their natural host plant's cones become scarce, that I observe them on cones of other cycad genera. I have found them from late July through August in female and male *Dioon spinulosum* cones cut open at the pollination phase. This may explain the occasional production of fertile seed in this species at Fairchild Garden and the Montgomery Botanical Center when no hand-pollination was performed. This species only opens to pollination at the base of the cone [see Tang (1997) for more details], and wind is unlikely to be causing pollination. In 1995, also at the end of *Z. furfuracea*'s pollination season I was amazed to see one morning *Rhopalotria* beetles hovering around the base of female *Encephalartos hildebrandtii* cones receptive to pollination! When not hand-pollinated, this species produces fertile seeds at Fairchild Garden and Montgomery Center on an erratic basis, but its pollinator was a mystery (Tang 1994). These particular cones were not hand-pollinated, and months later when mature, fertility of the seeds was found to be 78%! In mid-September 1983 at Fairchild Garden and again this year at the end of August in my garden, with Eddie Williamson present, I observed *R. mollis* beetles on male cones that were shedding pollen.

These beetles, like most weevils, are primarily nocturnal. They probably locate their host by odour. In 1991 Swedish coleagues and I managed to complete a chemical analysis of male cone odours of *Z. furfuracea* and *Encephalartos altensteinii* (Pellmyr *et al.* 1991). *Encephalartos hildebrandtii* has a cone odour similar to that of *E. altensteinii*, suggesting that there is some similarity in the chemical composition of cone odours of these two species. Interestingly, the main chemical constituent of both *Zamia furfuracea* and *E. altensteinii* cone scents is the same, a hydrocarbon we identified as 1,3-Octadiene. This chemical does not appear to have a strong odour to the human nose. The second main chemical in the *Z. furfuracea* cone, making up a third of the odour, is linalool, an alcohol with a sweet scent. The *E. altensteinii* cone also has linalool, but in much smaller amounts, making up only 0.8% of the total. These two species also share two other chemicals, limonene and trans-β-Ocimene, which are found at levels between 0.3–3.1%. Limonene has a resiny or citrus odour to the human nose. If indeed *E. hildebrandtii* and *E. altensteinii* have similar cone scents, these odour analyses explain a lot. When its natural hosts become scarce or are no longer available at the end of the pollination season, the *R. mollis* beetles will search out whatever has the closest scent. In Miami, Florida this is probably *E. hildebrandtii*.

To my knowledge, no chemical analysis of *Dioon* cone scents have been published, however *Dioon spinulosum* is visited in the wild and apparently pollinated by an as yet undescribed species of *Rhopalotria* beetle (Tang 1997). This suggests that there are similarities between *Dioon spinulosum* and *Z. furfuracea* cone scents as well.

I have not found any larvae or pupae of *Rhopalotria* in *Dioon spinulosum* or *Encephalartos hildebrandtii* suggesting that this beetle does not successfully complete its life cycle on these other species. Some insect species, such as aphids, have been known to shift from one host to another, especially after they have been inadvertently intoduced to a new habitat. During the millions of years of cycad evolution, this kind of host shift of insects from one species to a new species of cycad has undoubtedly happened many times. The main barrier to a successful host shift is probably the chemical defenses in cycad tissues. If the insect can adapt itself to the combinations of toxic chemicals that are peculiar to each species of cycad, it may be able to colonize and use another cycad species to complete its life cycle. In the process the plant may also benefit by gaining a new pollinator and eventually evolve by natural selection to accommodate the insect. Those individual cycad plants that are less toxic to the new beetle may have more success in reproducing if the new beetle visitor increases its pollination success.

LITERATURE CITED

NORSTOG, K. & FAWCETT, P. 1989. Insect-cycad symbiosis and its relation to the pollination of *Zamia furfuracea* (Zamiaceae) by *Rhopalotria mollis* (Curculionidae). *American Journal of Botany* 76: 1380–1394.

NORSTOG, K. & STEVENSON, D. 1980. Wind? Or Insects? The pollination of cycads. *Fairchild Tropical Garden Bulletin* 35(1): 28–30.

PELLMYR, O., TANG, W., GROTH, I., BERGSTROM, G. & THIEN, L. 1991. Cycad cone and angiosperm floral volatiles: inferences for the evolution of insect pollination. *Biochemical Systematics and Ecology* 19: 623–627.

TANG, W. 1994. Feral cycads. *Encephalartos* 39: 10–12.

TANG, W. 1997. Pollination in *Dioon*. *Palms and Cycads* 57: 12–13.

VORSTER, P. 2000. Learning pollinating insects. *Encephalartos* 62: 8–9.

THE THREATENED CYCADS OF MEXICO

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Received 22 June 2000

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Concern for wild populations of cycads in Mexico has a history dating back to at least 1940 as evidenced by a letter I found at the Field Museum in Chicago from C.A. Purpus to Charles Chamberlain. Though Purpus' scrawl is difficult to decipher, the note reads as follows:

"Huatusco, Veracruz, Mexico 25 June, 1940
Professor Charles Chamberlain

Dear Professor Chamberlain

My neighbour, M._____ sends out men to collect thousands, 4000 or even more, of *Dioon edule* to be sent to the States. This *Dioon edule* is confined to the state of Veracruz. I saw a few specimens near the Hacienda G_____ in the state of San Luis Potosi. This cycad will be exterminated and that nuisance(?) must be stopped under all circumstances. I am sure Professor Chamberlain, you will be able to have it stopped by writing to the Depart. de Agricultura Mexico not to give M_____ permission to export the cycad and other rare plants. But please do not mention my name.

Very sincerely yours,

C.A. Purpus"

Apparently the volume of cycads being collected for exportation was of considerable concern to Purpus even some 60 years ago; at time of much more extensive habitat in Mexico and many fewer collectors abroad. Certainly since then nearly all the wild populations of Mexican cycads have declined, some much more dramatically than others, due to a host of reasons. The recent distribution of cycads in Mexico is a consequence of dramatic historical changes in climate, temperature, and topography. Most populations are now restricted to extremely narrow zones within a plant community. Many species had a very limited distribution before man altered any habitat or collected any plants. Mix in millions of people and a few hundred avaricious cycad collectors and the result is a group of plants that is gravely threatened; some to the brink of extinction in the wild. The primary threat to most Mexican cycads is habitat destruction. The pressure on natural resources is tremendous. Mexico's population is growing at an alarming rate. Rural populations are expanding rapidly into remaining areas of undisturbed habitat. And where villages and towns exist near minimally disturbed forest, the ever-increasing demand for land pushes the evidence of habitat destruction further afield, into increasingly less desirable areas, once the stronghold of many Mexican cycad populations.

The *Ceratozamia* are the most threatened by habitat destruction because they tend to occur in forest that is the most suitable land for agriculture and grazing. By far, the most common *Ceratozamia* displacement crops are coffee and corn. Over the last 25 years, I have witnessed the destruction of many formerly large populations of *Ceratozamia* that have been extirpated by clearing for these two important crops. In recent years a great deal of agriculture has encroached into areas that previously seemed safe from clearing because of the incredibly steep exposure and/or the presence of kaarst; limestone formations that predominate the landscape with rocky outcroppings which make farming an extremely difficult, time-consuming operation. Once upon a time, the vast majority of farms and ranchlands covered only the lower, flatter regions of Mexico. Driving through the country today reveals a patchwork of clearings that climb up from those more desirable areas to the surrounding hills and mountains and on to almost unbelievable exposures. In many areas, caution must be exercised to keep from falling off the farm. This continuous encroachment is driven by a rapidly-expanding population in need of food and firewood. The most threatened species of *Ceratozamia* are most of those in the "miqueliana" group; *C. miqueliana*, *C. whitelockiana*, and *C. euryphyllidea*. Two other species in the "miquelliana" group (which are in publication at present) are cliff-dwelling and, though extremely limited in their distribution, are not under the same kind of pressures as the above species. However, even the limestone cliffs that these and other Ceratozamias favour are not safe from destruction. There is now a small scale invasion by cement manufacturers into areas of limestone cliffs and outcroppings to grind up the kaarst for use in concrete. Most *Ceratozamia* are confined to the tops of hills and ridges and clearing proceeds unchecked all around. To find populations of *Ceratozamia mexicana*, *C. robusta*, and *C. mixeorum* one must hike through endless areas of coffee and pasture to find increasingly smaller patches of remnant forest that might contain pocket populations consisting typically of several hundred plants at best. Habitat destruction does threaten many of the *Dioon* species but to a lesser extent than the *Ceratozamia* because most grow on steeper exposures and in less desirable habitat. In central Oaxaca, the growing popularity of mezcal (a tequila-like distillate) is causing the clearing of prime cycad habitat to

be replaced by the agaves from which mezcal is made. In some populations of *Dioon*, notably *D. merolae*, heavy grazing by goats and cattle results in a paucity of seedlings. Active recruitment is apparently non-existent in many areas for this reason. Along the Pacific slope, both *Dioon tomasellii* and *D. holmgrenii* are restricted to a very limited distribution in oak forest and are now threatened by clearing for ranching and farming as is *D. merolae* in eastern Oaxaca and Chiapas. The type locality of *D. holmgrenii* was once well-populated, consisting of thousands of plants. However in recent years, the population has been reduced to less than 100 coning-sized individuals. The bulk of the plants are now contained on a single family's property. The family is aware of the status of these cycads and seem committed to preserving them but what about long term? The preservation of almost all the Mexican cycads rests with ejidos (villages) and rancheros that know little or nothing about the nature of the treasure that is growing on their land. Other than the biosphere in the Canada de Cuitcatlan in Oaxaca which ostensibly protects the *D. purpusii* contained within, I know of no other Mexican cycad species that are under specific protection.

The other significant threat to the Mexican cycads is poaching by collectors. Large-scale removal of the most road-accessible species took place in the pre-CITES free-for-all of the mid-seventies. Through the years I heard numerous descriptions by people living near cycad localities throughout the country of semi-trucks loaded with stems amassed by entire villages; sold for a few pesos each and sent packing northward to the US. Even more distressing are tales of mounds of cycads collected by locals who waited in vain for days by the side of the road for the return of the collectors who passed through, promising to come back, pay for, and pick up huge numbers of plants. Eventually the locals gave up and left the cycads to rot. I have heard this story told at localities of *Dioon tomasellii, D. edule, D. spinulosum, Ceratozamia norstogii* (and *C.* "plumosa"), *C. kuesteriana*, and *Zamia furfuracea*.

Because of their distribution, Zamias face many of the same threats as *Ceratozamia* and *Dioon*, depending on the species. The *Zamia furfuracea* that once covered the roadside dunes near Alvarado, Veracruz are now gone; taken away by the truckload. *Zamia inermis* is nearly extinct in the wild due to wholesale poaching.

The relentless depredations of collectors have taken their toll. Many of the known localities of Mexican cycads that once occurred by the side of the road are now gone. Sadly, mass collecting still occurs. Cycad dealers (who should know better) traffic in significant numbers of mature, obvious recent field-collected Mexican cycads which continue to find their way to the US. And, most insidiously, the rarer the species, the higher the value it commands, and therefore the greater the pressure to collect mature plants from the wild.

Other threats to the Mexican cycads include the use of herbicides and pesticides in fields adjacent to cycad populations. I have seen the premature degeneration of cones and cohorts of leaves in the Pacific population of *Ceratozamia* sp. in Oaxaca as well as other species due to the use of herbicides such as paraquat in coffee areas. And the lack of viable seed in some populations of cycads is quite possibly due to the local extinction of insect pollinators resulting from the heavy use of pesticides in nearby farms. Erosion from ill-considered land alteration is also a serious threat in some instances. Lastly, the creation of reservoirs has resulted in the destruction of several populations of both *Dioon* and *Ceratozamia* species; notably *Dioon spinulosum* in Veracruz and *Ceratozamia miqueliana* in Tabasco.

The good news is that no Mexican cycad that I know of is extinct in the wild and hopefully protective measures of various types will ensure that the wild populations will remain.

THE EXPORT OF INDIGENOUS CYCAD OMNELS (SEED KERNELS)

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At a Reference Group Meeting of the South African CITES Implementation Project, held in Pretoria on 25th July, 2000, it was announced that permission can be obtained from the local Provincial Nature Conservation Authority to export cycad omnels provided that the following procedure is adopted: Apply for an export permit whilst the female cycad cone is still attached to the parent plant. The Nature Conservation authority will then send an official to verify the identity of the species and note the number of cones. On the basis of this inspection you will be issued with a permit to export an estimated number of omnels of the species concerned.

This is a welcome development which should go a long way in alleviating the frustration of many cycad lovers who would like to export omnels derived from their garden

plants. Apart from the above, CITES is also hard at work to get the different Provinces of South Africa to adopt the same set of regulations regarding cycads and to apply the regulations in a consistent manner.

A NOTE FROM THE FIELD

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We have long wondered what the historic dispersing agents of cycad seed have been. That many populations are so patchily distributed is certainly due in part to long term changes in the environment. Retreating tropical climates and forests and the advent of flowering plants have teamed to severely limit the extant cycads to remnant pocket populations. We conclude that things were not always so. One largely unknown variable to understanding the distribution of the world's cycads is identifying the mechanism of dispersal in the first place.

Cycad seeds are huge compared to the seeds of most other plants. Size severely limits the list of potential dispersing agents. Perhaps most, if not all of those agents are long extinct. The great distances between disjunct populations of the same species suggest that either a once continuous distribution is now punctuated due to climatic and/or floristic changes or that the agents responsible for dispersal covered large tracts of land. Birds, which are the most likely candidates for long-distance dispersal of many plants would have a tough time carrying the relatively unwieldy seeds of cycads. Mammals are likely candidates for shorter-range dispersal. Much field observation needs to be compiled to work out this vital component of cycad life history. Do the agents still exist and if so, who are they? I stumbled perhaps onto the answer to this question in the case of *Ceratozamia whitelockiana* while visiting the type locality in Oaxaca, Mexico last December. A local coffee grower named Jorge that I routinely visit in the area had some large feathers ornamenting his wall. As an avid birder, I took notice and inquired as to their origins. "Faisan" was the answer. In a moment with the field guide we worked out that his faisan was the Great Curassow (*Crax rubra*), a very large ground bird that once inhabited large tracts of undisturbed tropical forest throughout southern Mexico and Central America to Ecuador. The subsequent destruction of most of those forests coupled with extreme hunting pressures on the Great Curassow (they are famously tasty) have nearly extirpated the species. Fortunately, it does still persist in remote areas. What Jorge next said was fascinating. He informed me that when he cleaned the bird he found a half-dozen or so *Ceratozamia whitelockiana* seed in its stomach! This bit of knowledge from Jorge, who fortunately knows both the bird and the plant, is invaluable. It is very likely then, that the Great Curassow is a dispersal mechanism for this species of cycad. A large forest-dwelling ground bird (about the size of a turkey) is a very good candidate. Soon the forests in that area will be too fragmented to support viable populations of curassows. Any left will likely wind up on the dinner table. So the probable seed-dispersing agent for *Ceratozamia whitelockiana* will disappear along with the plants which are also disappearing at an alarming rate due to the destruction of the local habitat. I wonder if other members of the curassow family (Cracidae) might also consume cycad seeds and serve as the vital link in their life history. The time is now to discover.

KELPAK — NATURE'S WAY TO INCREASE ROOT GROWTH AND PLANT PERFORMANCE

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Kelpak is a plant growth stimulant made from the seaweed species *Ecklonia maxima*, commonly known as kelp, and found in the cold waters of the South African West Coast. This species has a prolific growth rate, due mainly to the presence of the plant hormone groups auxins and cytokinins. The cell sap containing these hormones is extracted from freshly harvested kelp with the unique cell burst technology, patented worldwide. No heat, freezing or harsh chemicals are used to break the cell walls in the extraction process. This ensures that the delicate compounds found in the kelp are maintained in their active form in Kelpak. The natural high auxin to low cytokinin ratio in the fresh kelp is therefore maintained in the end product. Both the UK Soil Association as well as KRAV in Sweden therefore has accredited this organic product for use in organic agriculture.

This auxin-dominated extract stimulates prolific adventitious root formation when Kelpak is applied to almost any plant. This drastic increase in root tips leads to an increased level of cytokinins in treated plants, as this group of hormones is mainly produced in root tips. The increased root volume and number of root tips also increase moisture and nutrient uptake from the soil. The improved nutrient status together with the higher level of cytokinin in the plant gives better top growth that causes the increase in yield and quality of crops. The improved root system also makes the plant more resistant to stresses such as drought, waterlogging, soil nutrient deficiency and salinity, nematode infestations and soil borne diseases.

Kelpak applied to plants in nurseries not only shortens the period in the nursery prior to plant-out, but also produces plants with a stronger root system showing enhanced transplant shock resistance. Fruit and nut trees, vines, coffee, tea, tobacco, ornamentals and flowers such as roses and forestry plants are treated by watering the plants with a 1:500 dilution of Kelpak at monthly intervals. When these plants are planted out into the field, a soil drench with a 1:200 dilution of Kelpak is recommended to reduce transplant shock and to increase initial growth of the plants.

Kelpak is used worldwide on potatoes, onions, tomatoes, leaf vegetables, maize, wheat, beans, soya and ground nuts. Most crops are sprayed at 2 L/ha with single or multiple sprays with a maximum of 6 L/ha. Increases in yield vary from 10 to 30% depending on the crop. In South Africa Kelpak has L-registration as a plant growth regulator for all these applications, which reflects the consistency in performance of the product.

Cycad species in general do not have a vigorously growing root system and replanted plants tend to suffer from transplant shock. Kelpak therefore is an ideal product to use in cycad nurseries and establishment of new plants. Various members of the Cycad Society of South Africa have used the product with success, while Dwarsweg Nursery in Great Brak River is conducting trials with seed, seedlings and established plants of various species.

The current recommendation for cycad species is a soil drench with a 1:200 solution of Kelpak in the nursery and also directly after transplanting, with a repeat at least three times with 3 to 4 week intervals. Kelpak should also be applied to established plants when signs of soil borne stresses become evident. Kelpak can be applied as a foliar spray and enhances the uptake of nutrients when applied with foliar feeds. The product is also compatible as a tank mix with most pest control products available. Kelpak should not be applied in a spray solution with a pH above 7, never be more diluted than 1:500 and should not be applied more frequently that 14 days apart.

Kelpak's efficiency as a cost effective agricultural biostimulant has been proven internationally in numerous research programs under differing climate conditions and on a wide variety of crops. This natural product has a broad application base, is easy to apply and is compatible with most crop protection chemicals and foliar feeds. Its consistency in result and cost efficiency has lead to its position as market leader in various countries worldwide.

[We ask readers who have used Kelpak to write to us and share their experiences with us. - **Editor.**]

CRUISE SHIP CYCADS

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Figure 1 *Cycas* **sp.** ***rumphii*** **complex in the central atrium of the cruise ship Nordic Empress.**

Figure 2 *Cycas revoluta* **exposed to full sun on the deck of Majesty of the Seas.**

The cruise ship business is an industry that is growing worldwide. One of the busiest ports of call is Miami, Florida, U.S.A., where a dozen cruises depart each week, carrying some 2 million passengers each year to destinations around the Caribbean. Among the foliage plants adorning these ships are cycads (Figures 1–3). The durability of cycad leaves make them resistant to air conditioning, hot air, and the occasional brush from passengers. Travelling repeatedly from Miami to the Bahamas, Jamaica, Mexico, and other destinations, these must be among the most well-travelled of all cycads!

Figure 3 Potted specimens of ***Zamia furfuracea*** **adorn the sun-bathing area on the Majesty of the Seas.**