ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

NO. 43 SEPTEMBER 1995 ISSN 1012-9987

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9 Hobson Street / Hobsonstraat 9
2550 Stilfontein
Tel.: 018-4841565

Editor of "*Encephalartos*"
Redakteur van "*Encephalartos*"
Isabella Claassen
P.O. Box / Posbus 25688
0105 Monumentpark
Tel.: 012-453350

Printing & dispatch officer
Druk- en versendingsbeampte
Piet Vorster
Botany / Plantkunde Dept.
University of / Universiteit van Stellenbosch
Private Bag / Privaatsak X1
7602 Matieland
Tel.: 021-8083056

Back copies officer
Beampte vir vorige uitgawes
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Paul Kennedy
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Engadine
New South Wales 2233
Tel.: 02-520-7690

U.S.A. and Canada

Willie Tang
Fairchild Tropical Garden
11935 Old Cutler Road
Miami, Florida 33156
Tel.: 305-667-1651

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COVER / VOORBLAD : ***Encephalartos friderici-guilielmi*: a luxuriant female. Each cone is about 400 mm long.**

Photo: Piet Vorster

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CONTENTS / INHOUD (continued / vervolg)

***Encephalartos* 42 (June 1995): We apologize that the two photographs depicting Figures 5 and 6 on page 13 were switched by mistake when printed.**

FROM THE PRESIDENT

Referring to my previous minute (*Encephalartos* **42**: 3), I mentioned the dissatisfaction of some members regarding the wording on the coloured pages in "*Encephalartos*". As you will notice in this issue of the journal, the wording has been changed and we now also have separate forms for the **renewal of membership** and **application for new membership**. I hope you will find the forms more "user friendly" while you all have the opportunity to use the **renewal of membership** form for the first time to renew your membership for 1996. Please also note that we regrettably had to increase membership fees for the second consecutive year. This increase is a direct result of the increase in postage. The most expensive item is the distribution of "*Encephalartos*". At the moment we are paying R20.90 for airmailing one single copy of the journal overseas. A more detailed explanation for the increase is given on page 34 of this issue.

Regarding the availability of pollen, seed and seedlings, also mentioned in my last minute, I received a letter from Cynthia Giddy and an extract from this letter appears on page 37 of this issue.

The term of office for Council members of the Society is two years and the term of the present Council is expiring the end of this year. On page 34 of this issue we invite nominations for the election of a new Council. Please give this matter some serious thought since a competent Council will give you less problems.

Hannes Robbertse

VAN DIE PRESIDENT

In my vorige skrywe (*Encephalartos* **42**: 3) het ek genoem dat van ons lede beswaar gemaak het oor die bewoording wat voorkom op die gekleurde bladsye van die tydskrif. Soos u sal opmerk, is die bewoording nou verander en is daar ook nou afsonderlike vorms vir die **hernuwing van lidmaatskap** en die **aansoek om nuwe lidmaatskap** beskikbaar. Ek vertrou dat u die vorms nou meer "gebruikers-vriendelik" sal vind veral waar u almal nou die vorm vir die **hernuwing van lidmaatskap** vir die eerste keer gaan gebruik om u lidmaatskap vir 1996 te hernuwe. Let ook asseblief daarop dat ons ongelukkig die lidmaatskapgeld vir die tweede agtereenvolgende jaar moes verhoog. Die verhoging is 'n direkte gevolg van die verhoging in postariewe. Die duurste item is die versending van "*Encephalartos*". Op die oomblik betaal ons R20.90 om een enkele eksemplaar van die tydskrif per lugpos na die buiteland te stuur. 'n Meer volledige uiteensetting van die verhoging word op bladsy 34 in hierdie uitgawe van die tydskrif gegee.

Na aanleiding van die probleem in verband met die beskikbaarheidvan stuifmeel, saad en saailinge, soos ook in my vorige skrywe genoem, het ek 'n brief van Cynthia Giddy ontvang. 'n Uittreksel van die brief verskyn op bladsy 37 van hierdie uitgawe van die tydskrif.

Die dienstermyn van lede van die Vereniging wat op die Raad dien, is twee jaar en die termyn van die huidige Raad verstryk die einde van die jaar. Op bladsy 34 van hierdie uitgawe van die tydskrif vra ons vir nominasies vir die verkiesing van 'n nuwe Raad. Gee asseblief ernstig aandag aan hierdie saak want 'n bevoegde Raad kan vir u baie minder probleme besorg.

Hannes Robbertse

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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:

CYCAS SIAMENSIS Miquel

William Tang and Si-Lin Yang

Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156, U.S.A.

Received 14 July 1995

INTRODUCTION

"*Cycas siamensis*" is a species name that has been abused and misused. It is a label that has been placed on any *Cycas* from Southeast Asia that has a short squat stem. In China, for example, several forms of cycads are referred to by this name. Recent genetic analysis of these Chinese species (Yang *et al.*, in prep.), however, indicates that they are in fact species distinct from one another as well as from the "true" *Cycas siamensis* Miquel which was originally described from Thailand.

In a recent expedition to Southeast Asia, funded jointly by the Montgomery Foundation and Fairchild Tropical Garden of Florida, U.S.A. and Nong Nooch Tropical Garden, Thailand the authors had the opportunity to examine this species in the wild both in Thailand and Vietnam.

HISTORY

In 1862 J.E. Teijsmann, an European plant collector travelling in what is today Kanchanaburi Province, Thailand, collected an unknown cycad and sent the specimen back to Europe where, in 1863, one of the leading cycad taxonomists of the era, F.A.W. Miquel, described it as a new species, *Cycas siamensis* Miquel. In 1912 W.G. Craib described another *Cycas* from Thailand, *C. immersa*, based on the collection of A.F.G. Kerr from a locality between Phrae and Lampang, northern Thailand. This species was later recognized as a synonym of *C. siamensis* (Schuster 1933, Smitinand 1971).

Figure 1 Distribution map of *Cycas siamensis* based on herbarium studies and field observations. Localities in Burma are based on Pant (1971).

HABITAT AND DISTRIBUTION

Based on herbarium specimens, various reference works and our field observations the distribution of *Cycas siamensis* extends from Burma to Thailand, Laos and Vietnam and probably Cambodia (Figure 1).

Figure 2 *Cycas siamensis* **in habitat in the dry season in Kanchanaburi Province, Thailand, near the type locality. This site was recently burned and the plant is flushing new leaves. Photo: W. Tang.**

Cycas siamensis is adapted to rather restrictive environmental conditions. In Thailand it is a lowland species found below 300 m elevation. It is an inhabitant of the seasonally dry monsoon forests of Southeast Asia, which have a warm humid rainy season extending from June to October followed by a hot season of drought from November to February, when much of the forest, including the cycads, becomes deciduous (Figures 3, 11). This vegetation is fire-prone in the dry season. This forest type originally covered the low plains of central and northern Thailand as well as portions of southern and northern Vietnam and Burma. In Thailand we found the species growing on limestone-derived soils and in the crevices of limestone boulders (Figure 2) in sites where limestone rocks were exposed on the surface. Much of the soils of Southeast Asia are derived

Figure 3 A large specimen of *Cycas siamensis* in Uttaradit Province, Thailand during the dry season with W. Tang. Photo: S.L. Yang.

from limestone. Our examination of remnant patches of this forest indicate that *C. siamensis* was once a common and abundant inhabitant of this forest type and probably once numbered in the millions in Thailand, before much of this forest was cleared in the last three decades. In Thailand it is known by several local names including Prong, Phong, Ma phrao tao, Phrao tao and Talapat ruesi (Smitinand 1971).

In Vietnam this species was observed in two areas: the north near Gui Hiep and Nha Hung where they grow in sandy, rocky soil in a disturbed grassland (Figures 13, 14) and the Southern Central Annam Highlands in Gia Lai Province and Dac Lac Province (Figure 15). In Dac Lac Province a healthy population exists in Roc Don National Park where the cycads occur in the understorey of dry, rocky, open forest. As in Thailand, Vietnamese populations of *C. siamensis* occur below 300 m.

DESCRIPTION

1. STEM

The feature that perhaps most characterizes *Cycas*

Figure 4 *Cycas siamensis* **in monsoon forest during the dry season in Tak Province, Thailand with S.L. Yang in the background. This site was recently burned and the cycads are *flushing new leaves. Photo: W. Tang.***

siamensis is its stem. In Thailand the stems of this species grow to 1.5 m tall (Figures 3, 16), but are usually much shorter. The stem is covered with a thick layer of leaf bases, but most importantly these leaf bases retain a dense layer of hair between them (see Figure 6) and these together insulate the delicate interior of the stem and protect it from the fires that often sweep through the monsoon forests in the dry season. The base of the stem is bulbous and subteranean (Figures 7, 16). They are usually solitary, however, branched trunks are commonly seen in the wild (Figure 7). Branching presumably arises after damage to the meristem during fires.

2. LEAVES AND LEAFLETS

We took measurements of the leaves and reproductive parts of ten mature plants at two sites in Thailand. The leaves range from 780-970 mm long with 7-11 pairs of spines on the petiole and 86-107 pairs of leaflets. The median leaflets typically range from 80-110 mm long 5-6 mm wide. The leaflets have a thinner, softer texture than most *Cycas* species and the undersides of the leaf and leaflets is a lighter green colour than above and is sparsely covered with hair (Figures 5, 12). These hairs are usually orange or brown but some populations have leaves with silver hair underneath, giving the foliage a distinctive silvery appearance, especially when a new flush of leaves emerges. The silver-hair form does not appear to differ from the orange-hair form in any other features and at this point in our studies do not warrant any distinctive taxonomic status.

Figure 5 Close-up of a newly formed leaf of *Cycas siamensis* in habitat in Tak Province, Thailand. Photo: W. Tang.

3. REPRODUCTIVE STRUCTURES

The male cones of this species are relatively small compared to most species of *Cycas*, ranging from 80-220 mm long and 40-85 mm in diameter (Figures 8, 9, 15). The outer surface of the cone is covered with tan-coloured felt which gives the cone the tan colour typical of the cones of many *Cycas* species. The terminal blade of female sporophylls (Figures 10, 11, 14) range from 30-80 mm long and 30-70 mm wide and are deeply divided with 18-22 pairs of lobes and are also covered with tan-orange felt which weathers off with age. The lobing of the female sporophylls varies from plant to plant. At maturity the outer coat of the seeds are dark brown and

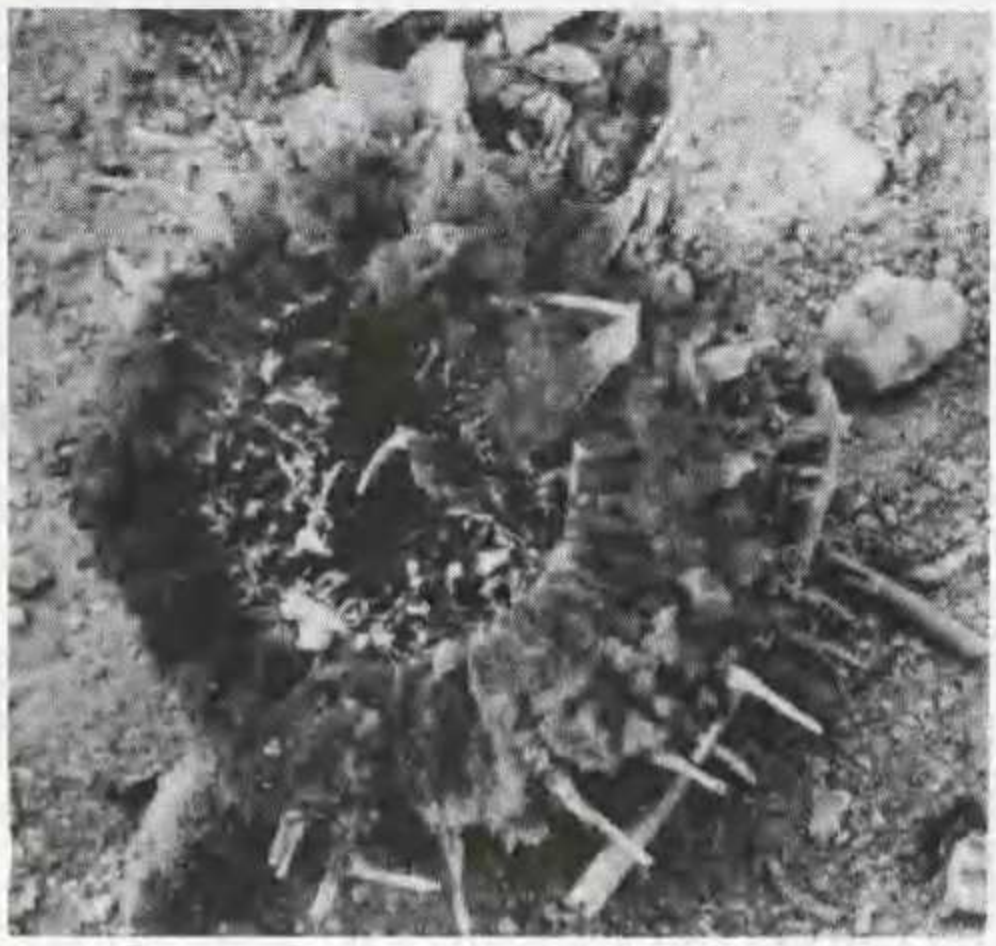

Figure 6 A dead trunk of *Cycas siamensis* in cultivation in Thailand revealing the outer ring of leaf bases and dense hair. This layer helps protect the trunk against fire. Photo: W. Tang.

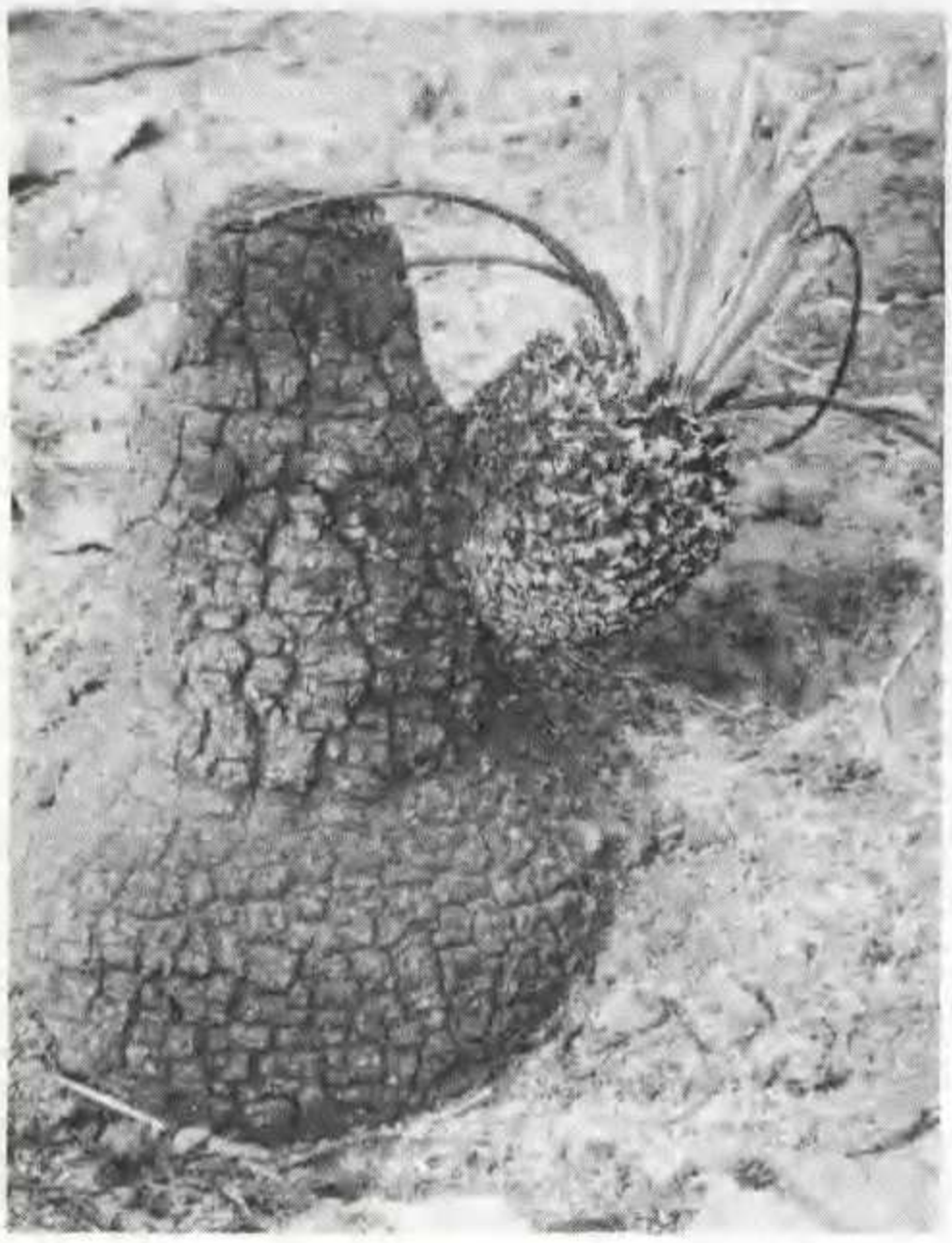

Figure 7 Close-up of the stem of *Cycas siamensis* in habitat between Phrae and Lampang, Thailand. Note the charred surface and the bulbous base, which is normally subterranean. Photo: W. Tang.

Figure 8 Male *Cycas siamensis* with immature cone in recently burned habitat in Tak Province, Thailand. Photo: W. Tang.

Figure 9 Male cone of *Cycas siamensis* at the pollen shedding stage in habitat in Uttaradit Province, Thailand. Photo: W. Tang.

crinkled (Figure 11). Seed size, with the outer fleshy coat removed, (based on 8 seeds) ranges from 27-29 mm long by 22-30 mm wide. The ripe seeds are exposed to sun, desiccating conditions and even fire in the dry season. However, some seeds that we collected, that had experienced fire and rattled when shaken, germinated when given moist favourable conditions, suggesting that the seeds of this species have resistance to the harsh conditions of its natural habitat.

Vietnamese populations have leaf and reproductive parts similar in size and morphology to those in Thailand. The largest Vietnam specimen observed had leaves up to 1.3 m long with 113 pairs of leaflets. Its female sporophylls had a stalk 60 mm long and a terminal blade

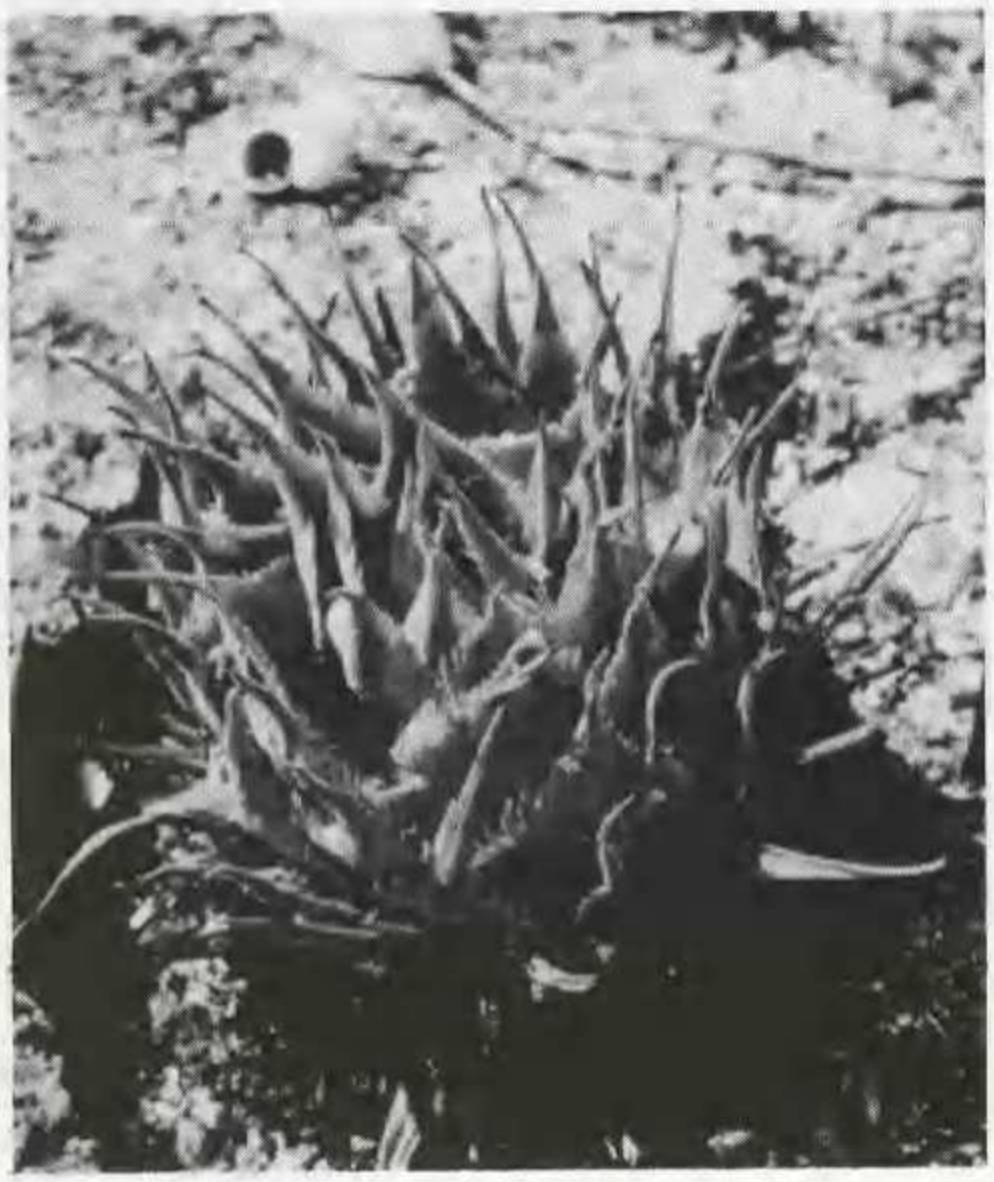

Figure 10 Female "cone" of *Cycas siamensis* during receptivity to pollination in habitat in Tak Province, Thailand. Photo: W. Tang.

Figure 11 Female with ripe seeds in habitat near Phrae, Thailand. Photo: W. Tang.

50 mm long by 45 mm wide.

AFFINITIES

In a cycad with a range as extensive as that for *Cycas siamensis*, geographic variants and possibly some hybridization may be expected where populations come in contact with related species. This appears to be the case for *C. siamensis*.

Figure 12 Orange Chrysomelid beetle larvae feeding on a new leaf of *Cycas siamensis* in monsoon forest between Phrae and Lampang, Thailand. Photo: W. Tang.

Genetic analysis, using protein gel electrophoresis, of populations of *C. siamensis* and other Southeast Asian *Cycas* species are currently underway (Yang *et al.*, in prep.). Preliminary results indicate that plants from the vicinity of the type locality of *C. siamensis* (Kanchanaburi) and the type locality of *C. immersa* (between Phrae and Lampang) are of the same species, supporting the earlier conclusion by Schuster (1933) that these names are synonyms for the same species. Furthermore, results indicate that the Vietnam populations, although showing some morphological differences are genetically similar to Thailand populations.

Field observations indicate that *Cycas siamensis* forms a hybrid zone with an undescribed cliff-dwelling *Cycas* species north and east of Bangkok. Populations showing intermediate leaf, stem and cone characters between these two species were observed. Genetic analysis also indicates that *C. siamensis* is related to *C. pectinata* (Yang *et al.*, in prep.). In Thailand, *C. pectinata* is a mountain species, usually found in cooler moister forests at elevations above 600 m while *C. siamensis* inhabits hotter, more seasonally dry lowlands.

Figure 13 *Cycas siamensis* **near Gui Hiep, Vietnam. This specimen has been freshly dug up from its disturbed grassland habitat. Note that the base of the stem is not expanded as in Thailand specimens. Photo: S.L. Yang.**

Cycas miquelii, a species native to the border region of China and Vietnam, has been confused with *C. siamensis*. It is similar in appearance to *C. siamensis*, possessing a short stem with an expanded base. Its leaves are of similar size, however, they are thicker and stiffer than those of *C. siamensis*. Genetic analysis, however, indicates that this species is not closely related to *C. siamensis* (Yang *et al.*, in prep.)

ASSOCIATED INSECTS

Two species of weevil were found to be abundant in the male cones of *Cycas siamensis* in Thailand. Both are in the genus *Tychiodes*. This genus of weevils appears to specialize on the male cone of *Cycas* species in Southeast Asia and both species on *C. siamensis* are new to science (Rolf Oberprieler, pers. comm.). The larvae of these weevils burrow and feed within the sporophylls of the male cone. They are abundant on the male cones during the pollination season, which is January and February in Thailand. We suspect that they are the pollinators of this species.

Figure 14 **Female *Cycas siamensis* with a clump of sporophylls at the post-pollination stage in habitat near Gui Hiep, Vietnam. Photo: S.L. Yang.**

An orange-red Chrysomelid beetle was occasionally found on the new soft leaves of *Cycas siamensis* in populations in Thailand that had recently been burned and where plants were flushing new leaves. The orange larvae of this beetle hang from the undersides of the leaves (Figure 12) and as they feed on the new leaves they wag their abdomen frequently. Apparently this wagging and their bright colour is a warning display to potential predators that they are toxic to eat. Like the leopard moth *Zerenopsis leopardina* in South Africa and the *Eumaeus* butterfly in the New World tropics this beetle is probably able to sequester the toxins from the cycad leaves they eat and store them in their tissues. This beetle, or species very close to it, has also been seen in other species of *Cycas* in Vietnam and southern China (Smitinand 1971).

CULTIVATION

Cycas siamensis is a species adapted to a highly seasonal climate with extremes of conditions ranging from torrential rainfall to parching drought and it is very successful in its natural habitats. In cultivation it has proven to be a difficult species to grow. It has a high mortality rate when transplanted from the wild. When grown in pots it requires excellent drainage and its stem is prone to rotting out, especially if given too much moisture during its dormant season. This species is deciduous and its previous season's leaves usually die and shrivel before a new flush of leaves emerges (Figures 3, 11), therefore plants of this species are a poor selection as an ornamental plant, especially as a centerpiece for a display area. Its bulbous stem, however, gives it an unusual appearance and it can be quite striking when it puts out a flush of new leaves.

CONSERVATION STATUS

Although once widespread and abundant in Thailand,

Figure 15 *Cycas siamensis* **in habitat with immature male cone in Dac Lac Province in the Southern Central Annam Highlands of Vietnam. Photo: S.L. Yang.**

Figure 16 *Cycas siamensis* **being sold on the roadside near Chang Mai, Thailand. These plants were recently dug up from the wild. Note the expanded stem base, which is usually subterranean. Photo: S.L. Yang.**

probably originally numbering in the millions, most of the habitat of this species has been converted to farmland for rice and sugar cane. In some areas this species may still be locally abundant, however, destruction of populations is currently an ongoing process. For instance, one moderate-sized population observed by Dr. Ken Hill less than a year before our visit had been cleared for agriculture and was on the verge of extermination during our visit. *Cycas siamensis* still occurs in patches of forests that have been set aside as preserves or where the ground is too rocky for agriculture.

In these remnant forests, however, *Cycas siamensis* is subject to at least two human disturbances that may affect its long term prospects for survival. The lowlands of Thailand are burned every dry season. In fact, during our visit to the country the air in the north and central regions were filled night and day with smoke from the numerous brush fires intentionally set by farmers and other local people. Although fires are a natural phenomenon experienced in the monsoon forests, the unnatural high frequency produced by human action may be disrupting the regeneration of the species and preventing the establishment of seedlings. In fact we saw very few young seedlings in the populations we examined. The second factor is the harvesting of these plants by locals for sale as ornamentals. In various areas we observed wild-collected plants being sold by locals along the roadside, in city markets and in nurseries (see Figure 16). Since these plants transplant poorly, most of

these probably soon die and fail to become established in cultivation. Because of the relatively slow regeneration of this species, wild populations may be rapidly depleted by such harvests.

As in Thailand, Vietnam populations of *Cycas siamensis* have suffered from human disturbance. In the northern populations that were observed, plants had been decimated by human activities. In Gia Lai Province populations that were observed two years previously by Dr. Nguyen Tien Hiep have been completely removed by locals for cultivation. In the Southern Central Annam Highlands the population in Roc Don National Park holds promise as a long term preserve for this species.

*Cycas siamensis*is listed as not threatened in the most recent world census of cycads (Osborne 1995) because of the relatively high number of plants still remaining in the wild. However, in our view, numbers alone should not be the sole factor in determining andangered status. Because of the vulnerability of the habitat of *C. siamensis* to human disturbance and wholesale destruction and the current rapid decline of populations we consider this species vulnerable to extinction both in Vietnam and Thailand. Its status in Burma, Laos and Cambodia is unknown. Decades of political instability and war in these countries have prevented botanical exploration of these areas and may continue to do so for some time to come.

ACKNOWLEDGEMENTS

The authors wish to thank Mr. Kampon Tansacha of Nong Nooch Tropical Garden and his guide Mr. Poonsak Vatcharakorn for their invaluable support in Thailand; Dr. Nguyen Tien Hiep of the Institute of Ecology and Biological Resources, Hanoi for his logistical support in Vietnam, and The Broward County Palm & Cycad Society for financial assistance for genetic research. We also benefitted greatly from discussions with Dr. Ken Hill and Dr. Rolf G. Oberprieler. Thanks are also due to Mr. Anders Lindstrom and Mr. Michael Perry for assistance in the field and to Dr. Terrence Walters for review of the manuscript.

REFERENCES

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

PANT, D.D. 1971. *Cycas* and the Cycadales 2nd Ed. Central Book Depot, Allahabad.

SCHUSTER, J. 1933. Cycadaceae. In Engler, *Das Pflanzenreich* 99: 64-84, Weinheim.

SMITINAND, T. 1971. The genus *Cycas* Linn. (Cycadaceae) in Thailand. *Nat. Hist. Bull. Siam Soc.* 24: 163-175.

WALTERS, T. & YANG, S.L. 1994. The cycads of China: findings from The Montgomery Foundation/Fairchild Tropical Garden 1992 expedition. *Journal of the Cycad Society* 1: 6-11.

YANG, S.L., WALTERS, T. & DECKER-WALTERS, D. The systematic implications of allozyme patterns in Southeast Asian *Cycas*. (In preparation).

ARTICLES / ARTIKELS

CYCAS SEGMENTIFIDA, A NEW SPECIES FROM CHINA

Ding-yue Wang[1] & Cao-yi Deng[2]

[1]Shenzhen Fairy Lake Botanic Garden, Shenzhen 518004, Guangdong Province, People's Republic of China
[2]Forest Research Institute of Southwest of Guizhou, Xingyi, Guizhou Province 562400, People's Republic of China

Received 14 February 1995; refereed 4 April 1995; revised 16 June 1995

In this article we describe a new cycad species from Guizhou and Guangxi Provinces in China:

Cycas segmentifida D.Y. Wang et C.Y. Deng, sp. nov., Fig. 1-2.

Cycas hainanensis var. *latifolia* C.Y. Deng, *nom.*; S.L. Yang in *Journ. Cycad Soc.* 1: 9. *Cycas guizhouensis* var. *latifolia* C.Y. Deng, *nom.* Species similis *Cycas szechuanensis* Cheng et L.K. Fu, sed foliolis frondium latior ad 14-17 mm, megasporophyllorum lamina terminali segmentata manifesta, segmenta margine gracilibus, ovulis (2-) 4-6 differt. Affinis *Cycas guizhouensis* Lan et R.F.

Zhou sed differt microsporophyllis parvior, macrosporophylla lamina terminali segmenti fidi plerumque tenuis.

TYPUS.— Guangzhou: 16th May 1994 (female), *D.Y. Wang & H. Peng 2967* (SZG, holotypus; NF, XIN, GZAC, FTG, NSW, isotypi).

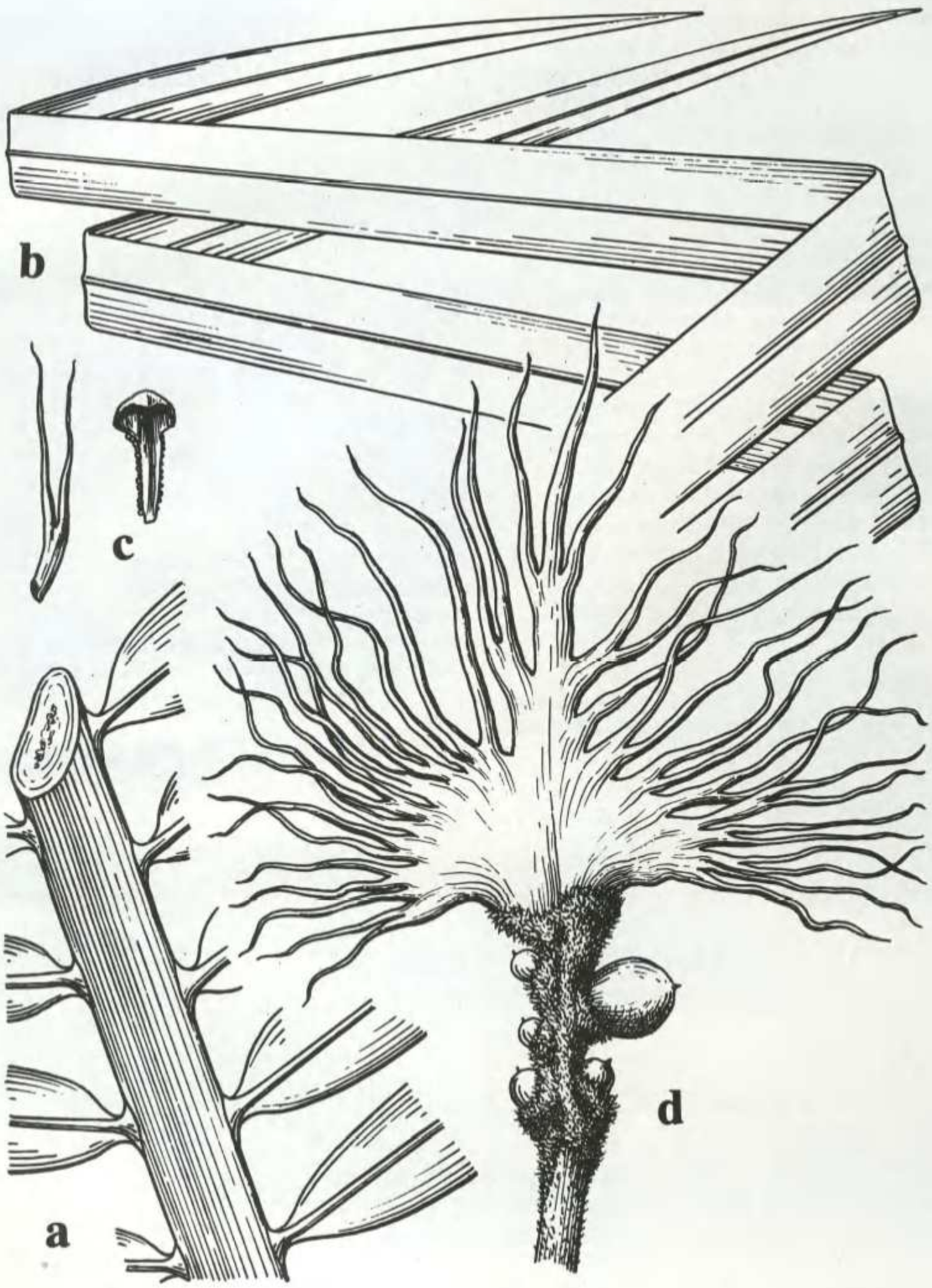

Figure 1 ***Cycas segmentifida*** **D.Y. Wang & C.Y. Deng. Line drawings representing part of leaf rachis (a), leaflet (b), microsporophyll (c) and megasporophyll (d) detail. Drawing by Shi-jing Zhang.**

Trunk cylindrical up to 500 mm in diameter. *Leaves* 2.6-3.3 m long with 57-96 pinnae, petiole 800-1100 mm long with 35-55 pairs spines at the sides, spines up to 4 mm long, pinnae 330-400 mm long, 14-17 mm wide, glabrous,

a

d

b

c

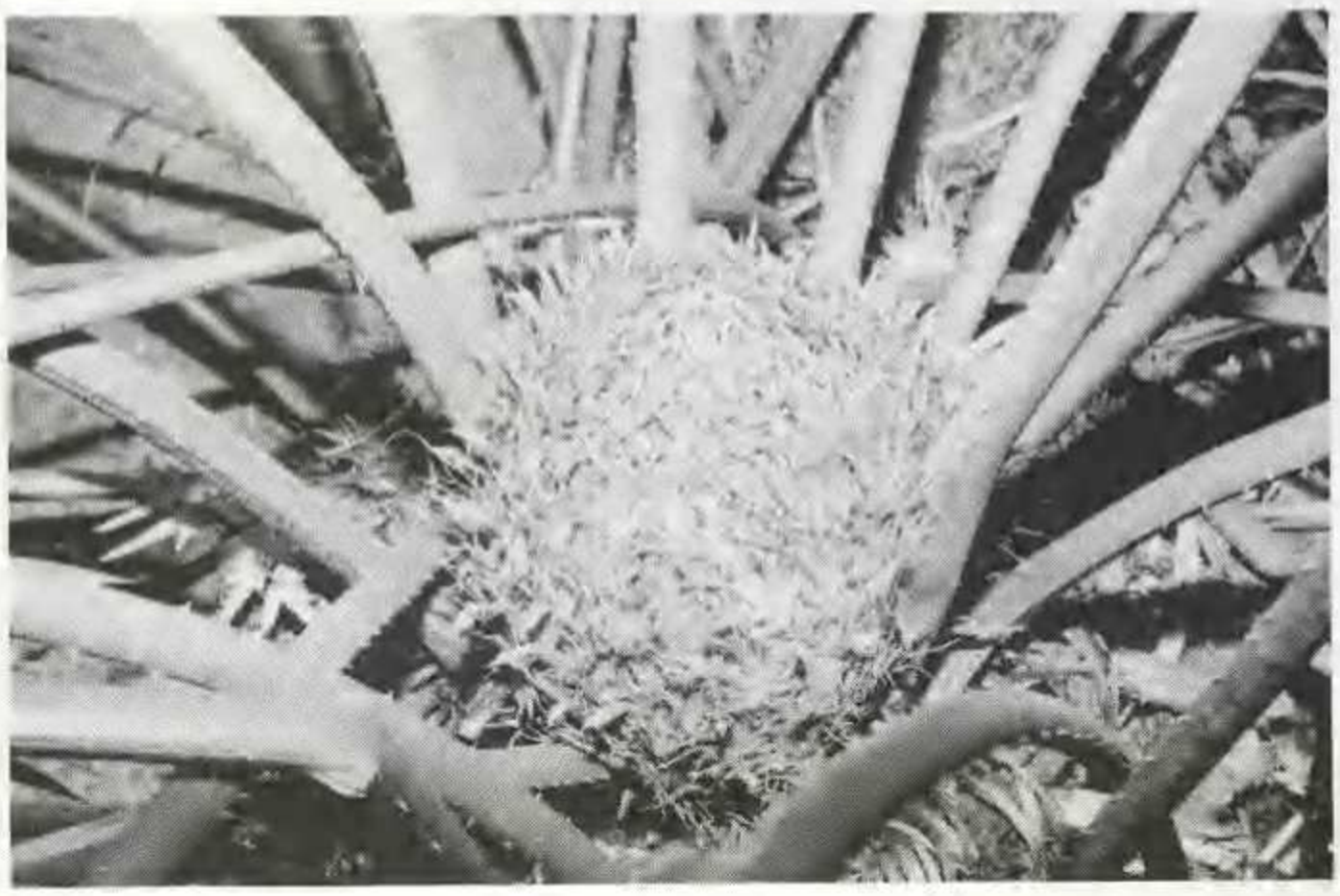

Figure 2 *Cycas segmentifida* **D.Y. Wang & C.Y. Deng**

a) Top left: Specimen in cultivation at South China Botanical Garden, Guangzhou, Guangdong.

b) Centre left: Specimen with new and old male cones.

c) Below left: Apical cluster of megasporophylls.

d) Above: Single megasporophyll with ovules.

Photos: D.Y. Wang.

acuminate at the apex and widely cuneate at the base, margins flat, midrib prominent both above and below surface, deep green above, light green below. *Male cones* narrowly cylindric, 300 mm long, 50-120 mm in diameter, microsporophylls cuneate, 10-17 mm long, the apex nearly truncate, 5-12 mm wide, with dense brown pubescence, mucronulate at the apex, mucrones 2-3 mm long. *Megasporophyll* with upper sterile lamina oval-orbicular, 95-105 mm long, 90-100 mm wide, pectinately partite, segments 30-65 mm long, subulate, gracile, apically acuminate to aristiform, usually bipartite or serrate at the apex or middle (sometimes at the base), stipe of megasporophyll 60-85 mm long, yellow-brown tomentose. *Ovules* (2-)4-6, glabrous and sphaeroid, 5 mm long, 6 mm wide, mucronulate apically. *Seeds* 28-35 mm in diameter, spherical and yellow when mature.

Diagnostic features and affinities

The new species is similar to *Cycas szechuanensis* Cheng & L.K. Fu but has wider pinnae (14-17 mm), the apical segment of upper sterile lamina of the megasporophyll obviously thicker than the side ones and the segments subulate and gracile and fewer ovules [(2-)4-6]. In *Cycas szechuanensis* the pinnae are narrower (8-14 mm), the apical segment is not obviously thicker and there are more ovules [(5-)7-8(-10)]. However, the new species is also similar to *Cycas guizhouensis* Lan & R.F. Zhou, but the latter has narrower pinnae and the segments of its megasporophyll lamina are not gracile and subulate, and not bipartite or serrate.

Distribution

This species occurs in Wangmo and Ceheng of Guizhou Province and Xilin and Leye of Guangxi Province. It is also cultivated in Guiyang (Guizhou Province), Nanning (Guangxi Province), Guangzhou and Shenzhen (Guangdong Province).

Conservation status

Endangered.

Material studied

Guangzhou: *D.Y. Wang & H. Peng 2967* (♀ in SZG, NF, XIN, GZAC, FTG, NSW), collected May 16 1994, cultivated in the cycad collection of Southern China Botanical Garden. *D.Y. Wang & H. Peng 2968, 2969* (♂ in SZG, FTG, NSW), *2970* (♂ in SZG, FTG, NSW) at the same location. Shenzhen: *D.Y. Wang & F.Q. Liu 2991* (SZG, FTG, NSW), collected May 31 1994. *F.Q. Liu 3005* (SZG, FTG, NSW), June 25 1994, cultivated at the cycad collection of Shenzhen Fairy Lake Botanical Garden. Guiyang: *D.Y. Wang & H. Peng 4003* (SZG), collected October 8 1994; *C.Y. Deng 2785* (XIN), February 17 1993, both cultivated in Guizhou Botanical Garden. Wangmo: *D.Y. Wang & H. Peng 4012, 4013, 4014, 4015* (SZG), October 13 1994. Cultivated in the town of Wangmo County. *C.Y. Deng 1674* (XIN), May 14 1987, in the wild at Yanjia, Wangmo. Ceheng: *C.Y. Deng 84089* (XIN), August 26 1984, in the wild at Qiaoma, Ceheng. Xilin: *Y.C. Zhong 80865, 80866* (GXF), July 1 1994, cultivated in the town of Xilin County. Naning: *D.Y. Wang 4029* (SZG), October 25 1994, cultivated at Guangxi Forestry College.

Literature

WALTERS, T. & YANG, S.L. 1994. The Cycads of China. *Journal of the Cycad Society* 1: 6-11.

Acknowledgements

We thank Professor Roy Osborne for his assistance with this text, Professor Shi-jing Zhang for preparing the line drawings and Professor Ye-chong Zheng for access to plant material.

A SUPPLEMENTARY DESCRIPTION OF THE GUIZHOU CYCAD FROM CHINA

Ding-yue Wang[1] & Cao-yi Deng[2]

[1]Shenzhen Fairy Lake Botanic Garden, Shenzhen 518004, Guangdong Province, People's Republic of China
[2]Forest Research Institute of Southwest of Guizhou, Xingyi, Guizhou Province 562400, People's Republic of China

Received 14 February 1995; refereed 4 April 1995

The Chinese Guizhou cycad, *Cycas guizhouensis* Lan & R.F. Zhou, was first named in May 1983 in *Acta Phytotaxonomica Sinica* by Professor Lan Kai-min and Mr. Zhou Rong-fu. However, they did not describe either the male cone or the seeds at that time. Unfortunately nobody continued the work and thus

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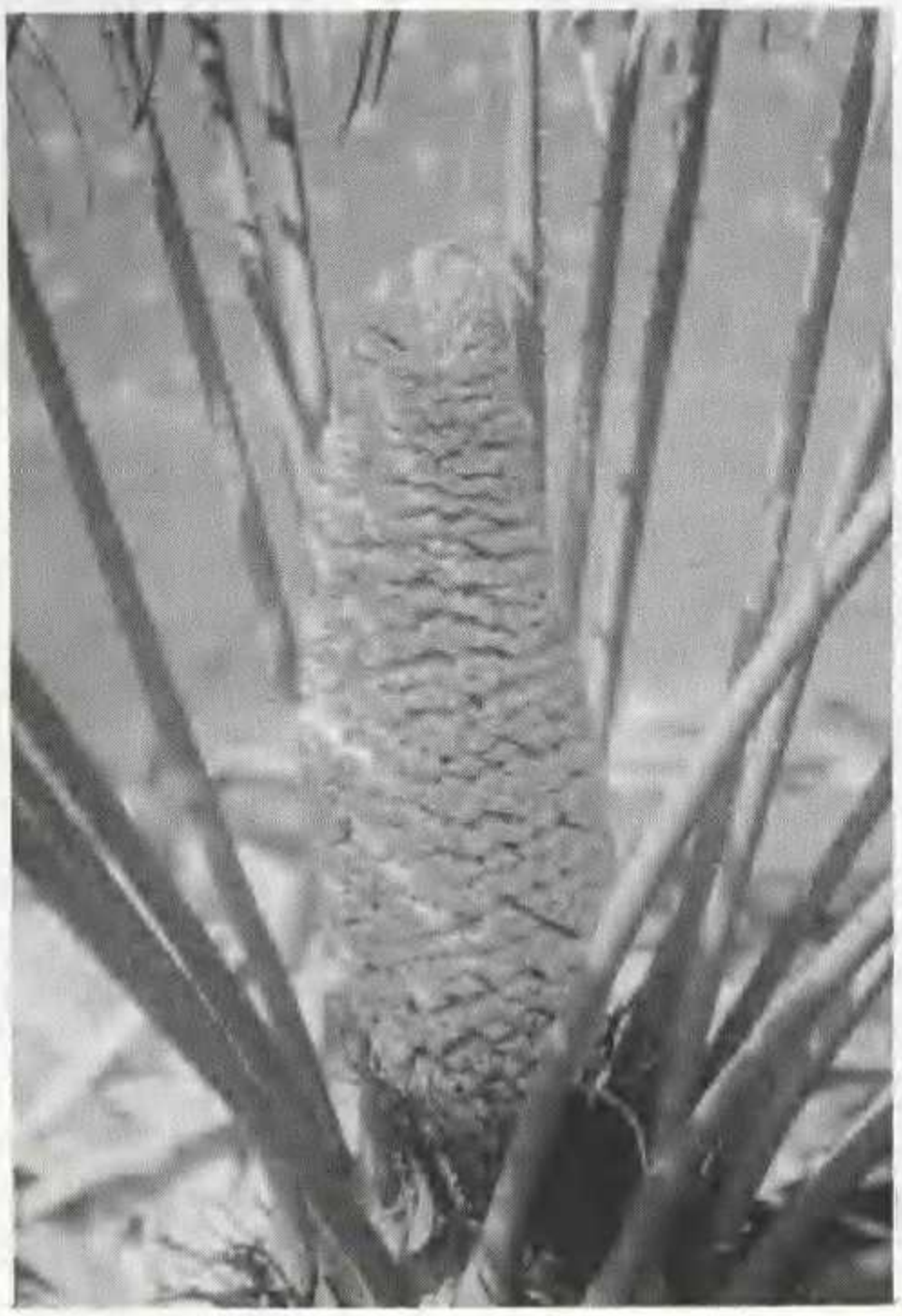

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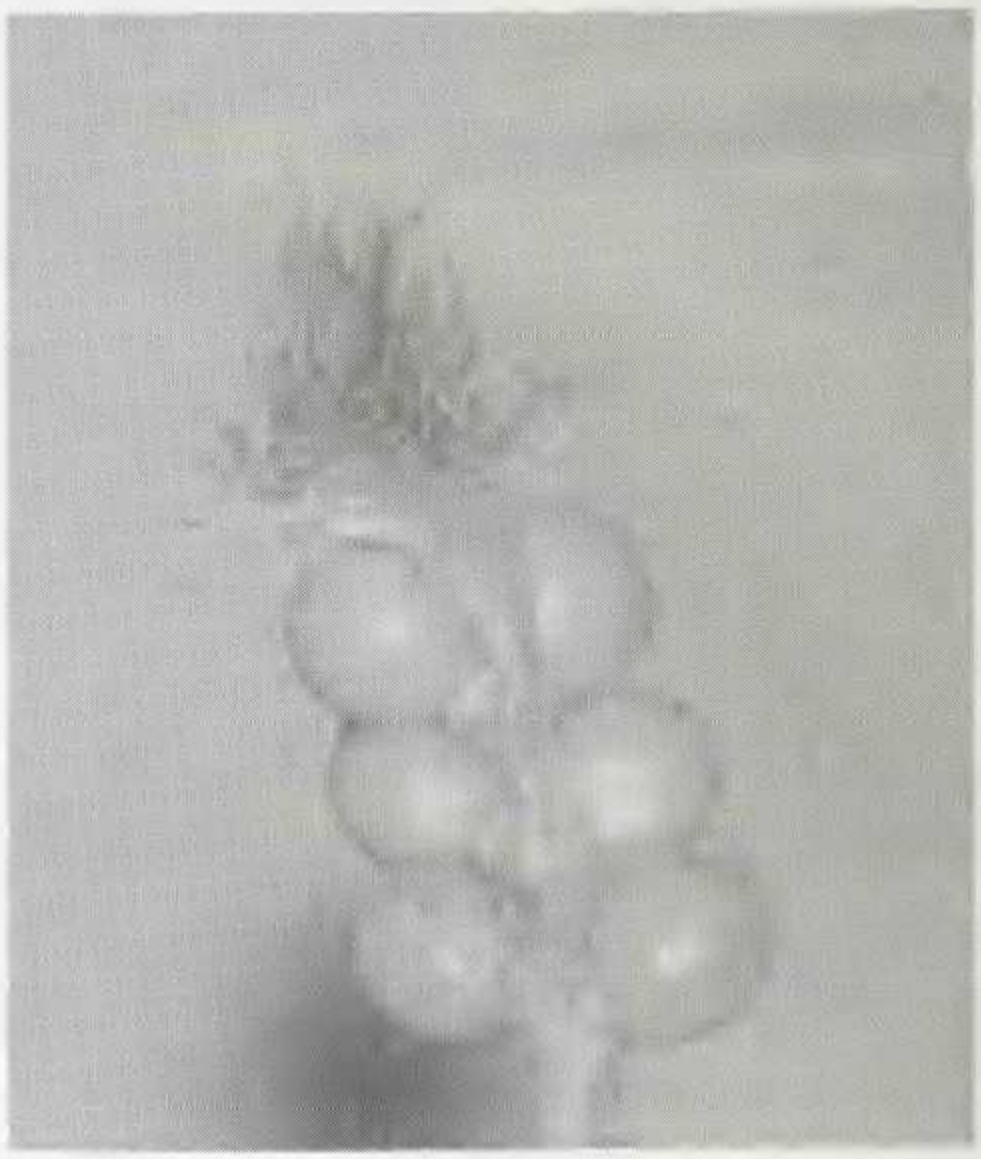

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Figure 1 ***Cycas quizhouensis*** **Lan & R.F. Zhou. a: Plant in cultivation at Forest Research Institute of Southwest of Guizhou, Xingyi, Guizhou Province, China. b: Male cone detail. c: Cluster of megasporophylls on female plant. d: Single megasporophyll with six seeds. Photos: D.Y. Wang.**

a supplementary description is now required. As we have now collected many male cone specimens, together with photographs, we are able to make this description.

Strobilus masculus in apice terminalis truncorum fusiformi-cylindricus vel ellipsoideo-cylindricus, flavus, 200-530 mm longus et 50-110 mm in

diametro; pedunculatus 30-40 mm longus; microsporophyllis imbricatis, demun deflexis, anguste cuneatis, 15-40 mm longis et 9-17 mm latis, superne abortivis late triangulari-rotundatis 3-5 mm longis, pungentis apice 1-3 mm longis, subtus densissime flavo-brunneo villosus. Semina globosa vel ovidea, flava, circiter 19-23 mm in diametro.

Male cone single, at trunk apex, fusiform-cylindrical or ellipsoid-cylindrical, yellow, 200-530 mm long, 50-110 mm in diameter with peduncle 30-40 mm in length. Microsporophylls imbricate, deflexed at the apex, narrowly cuneiform, 15-40 mm long by 9-17 mm wide. The apical abortive part is triangularly-rotundate, 3-5 mm long, densely brown villose at the rear, with a 1-3 mm pungent tip. Cones are present from April to July. Seeds ovoid or globose, about 19-23 mm in diameter, yellow when mature. (Figure 1.)

Material studied

Yunnan: Kunming, *D.Y. Wang 2671* (SZG, FTG, NSW), *2894* (SZG, FTG, NSW). Guizhou: Xingyi, *C.Y. Deng 2575, 2809, 51216, 51217, 86104, 88292* (XIN); *K.M. Lan & R.F. Zhou* 81-8-001 (GZAC, XIN). Guangdong: Shenzhen, *F.Q. Liu 2996* (SZG, FTG, NSW), *2998* (SZG).

Literature

LAN, K.M. & ZHOU, R.F. 1983. A new species of *Cycas* Linn. from Guizhou Province. *Acta Phytotaxonomica Sinica* 21(2): 209-210.

Acknowledgements

We wish to thank Professor Roy Osborne for assistance in the preparation of this text and Professor Lan Kai-min for access to plant material.

THE HEENAN EXPEDITIONS REVISITED

Roy Osborne
Department of Chemistry, University of Natal, Durban, Private Bag X10, 4014 Dalbridge

Received 19 May 1995

INTRODUCTION

Many readers will know of the two "Heenan" expeditions in the early 1970's to east and central Africa. Indeed, a number of subscribers to this magazine are owners of plants collected from those expeditions. The more academically-minded cycad enthusiasts have also probably studied the report "Some observations on the cycads of central Africa" which appeared in the *Botanical Journal of the Linnean Society* in 1977 (Heenan 1977). Tragically, however, a great deal of information (and a large number of plants) has been lost in the 20-odd years since the time of the expeditions. Furthermore, substantial changes have been made in the taxonomy of the east and central African representatives of the genus *Encephalartos*. In an attempt to re-evaluate the expeditions, I have spent some time tracking down the present whereabouts of the plants, trying to validate their identification and promoting artificial seed production where appropriate male and female plants from the same original populations can be located. Unfortunately, only limited success has been achieved in all these objectives. In addition, I have visited and corresponded extensively with both Denis and David Heenan. Detailed field notes recorded by Don Stallard, who accompanied the first expedition, have also been most useful in reconstructing the events. Finally, because of the substantial developments in the taxonomy, the earlier reports can now be put into a current perspective in this respect. This report is thus an attempt to bring readers up-to-date with such progress as has been made.

BACKGROUND

The expeditions were planned by Denis Heenan and lead by his son, David, just 20 years old at the start of the first trip. Denis Heenan did not accompany the party but co-ordinated and directed activities from his home base in Swaziland. One can but admire the efforts of the younger Heenan and his team, with no botanical training, venturing into unknown and often hostile territory, and having to face immense difficulties in terms of bureaucratic obstacles, communication barriers, transport problems, climatic extremes, petty thefts, wild animals, health difficulties and a host of logistic problems which would have caused many others to give

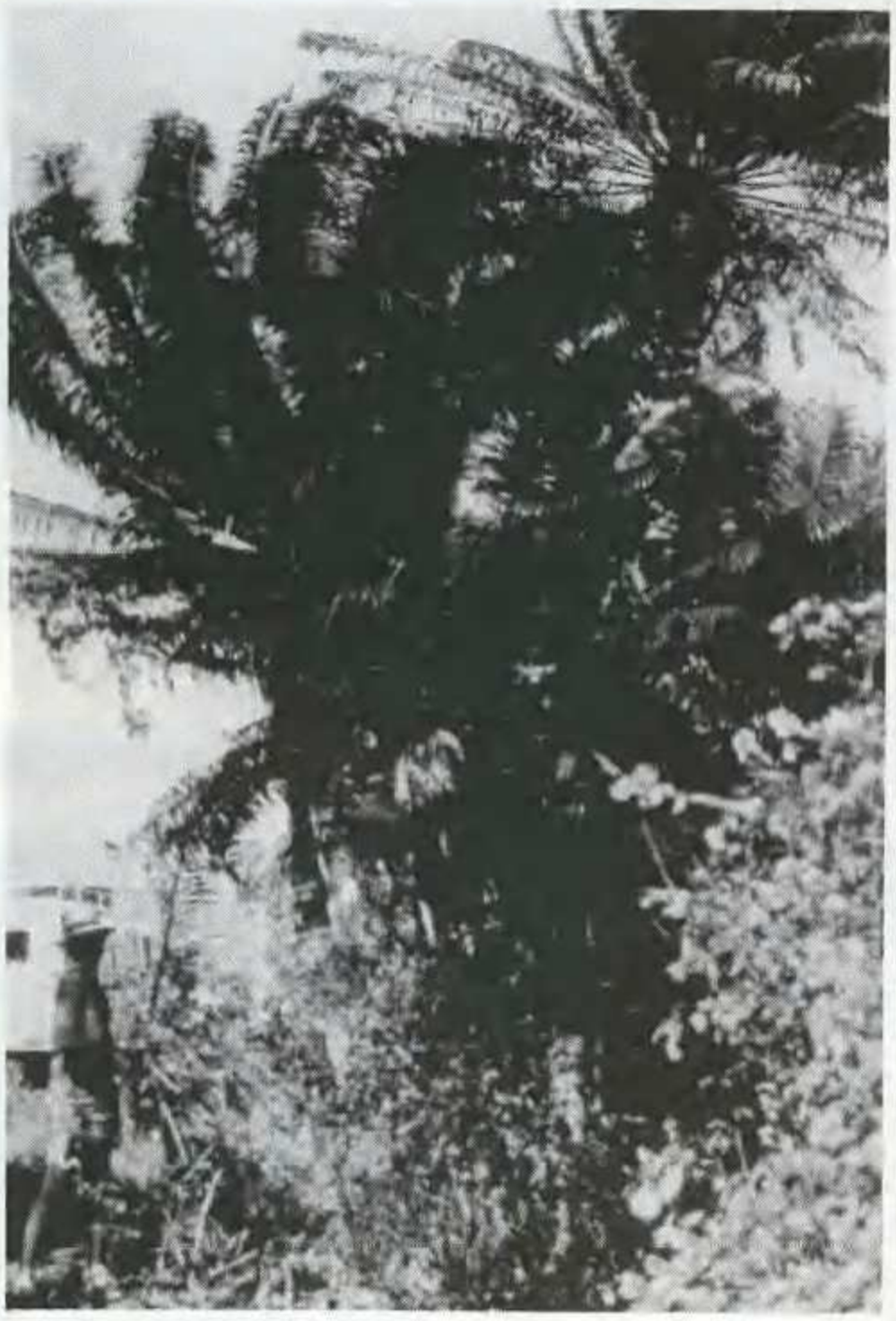


Figure 1 A large specimen of *Cycas thouarsii* in cultivation in a garden in northern Mozambique.

up in despair at an early stage.

"Up-front" funding was provided by the Italian Professors Angelo Verga and Luigi Califano, Burt Greenberg and Bob Rapp from the U.S.A., Commander Watana Sumawong of Thailand, Mr J.A. Smit from Pietersburg and a Mrs Ponellis from Zimbabwe, all of whom were to receive plant specimens in return for their financial assistance. A young Australian architect, Don Stallard, accompanied David Heenan on the first expedition, a 10-month trip over the period 8 December 1972 to 29 October 1973. Tony Katende, a botanist from Uganda, joined the group during the fieldwork in his country. Alastair Graham, a learner forester from the United Kingdom, travelled on the major portion of the second expedition, a 6 month trip in 1974.

The main botanical reference on the central African cycads at the time was from the work of the Kew botanist, Dr. Ronald Melville (1903-1985), who compiled the following list of cycads in two publications relating to the *Flora of Tropical East Africa* (Melville 1957, 1958): *Cycas thouarsii* (sic) Gaud., *Encephalartos barteri* Carruth. ex Miq., *E. bubalinus* Melville, *E. gratus* Prain, *E. hildebrandtii* A. Br. & Bouché, *E. hildebrandtii* var. *dentatus* Melville, *E. laurentianus* De Wild., *E. manikensis* (Gilliland) Gilliland, *E. poggei* Aschers., *E. septentrionalis* Schweinf., *E. tegulaneus* Melville and *E.* "species A" Melville.

THE 1972/1973 EXPEDITION: MOZAMBIQUE AND MALAWI

[*Cycas thouarsii* and *Encephalartos gratus*]

The cycad-exploration part of the first expedition commenced in December 1972 with a two month period in the northern coastal areas of Mozambique, from the Zambezi delta to near Pebane. The first objective, to find *Cycas thouarsii* in habitat, was not successful - although numerous cultivated specimens were seen in coastal gardens in the area (Figure 1). Subsequently, it has transpired that the party missed a colony of about 1000 *Cycas thouarsii* in the swamp and riverine forest just to the southwest of Quelimane, and that other colonies of this species occur near Pebane (Hurter, *pers. comm.*).

The first "wild" cycad colony seen was a scattered group of plants, some 35 km northwest of Mopeia in the Zambesi river valley. The plants were of robust form but their identity, possibly *Encephalartos gratus* or *E. manikensis,* was not verified at the time. Recent work has shown this population to be *E. gratus* (Hurter, *pers. comm.*).

Moving away from the coastal regions in January 1973, the party located further colonies of *E. gratus* along the roadside near Milange and across the border into Malawi. After collecting specimens there, the travellers returned to Mozambique and headed for the Namuli mountains (alt. 2400 m), near the town of Guruè. Towns and farm estates in this area had many cultivated specimens of *E. gratus* but it seemed that agricultural development had had a negative impact on wild stands. The cultivated specimens were noted as being particularly robust, with trunks up to 2.2 m in height and 0.6 m in diameter. Interestingly, female cones all showed the prominent apical leaf development. Some of the cultivated specimens, together with local aloes, were collected for shipment home at that time.

In his report, Denis Heenan also mentions "a form of *E. gratus*" being reported much further to the south, from near Mavita and about 75 km southwest of Chimoio, but this was not confirmed as the area was not visited by the younger Heenan and his group. This stand has subsequently been shown to be *E. manikensis* (Hurter, *pers. comm.*).

In the same sense, Denis Heenan alludes to the plant now known as *E. turneri* (Lavranos & Goode 1985),

from a site near Nampula in Mozambique. However, the precise locality for this population was not made available to members of the expedition and hence this species was not seen at the time.

THE 1972/1973 EXPEDITION: TANZANIA

[*Encephalartos hildebrandtii* var. *dentatus*, *E. hildebrandtii*, *C. thouarsii*, *E. sclavoi*, *E. bubalinus*]

The expedition travelled north up the western shores of Lake Malawi to enter Tanzania in March 1973. Some 70 km from Morogoro, on the road to Dar-es-Salaam, some cycads were seen but no details seem to have been recorded. The first main objective in Tanzania was to locate the old Islamic cemetery, about 15 km south of Dar-es-Salaam, where Melville had reported the presence of six plants, in cultivation at the site, which he had named *E. hildebrandtii* var. *dentatus*. A site (Figure 2) was eventually tracked down with help from local university staff but there is now some doubt if this was the cemetery visited by Melville. Melville's choice of name for this taxon seems unfortunate: these plants seem to be a distinct species in its own right and, in addition, the varietal name "dentatus", based on the ornamentation of the cone scale faces (and not, as some believe, on leaflet morphology), has resulted in some confusion. It is now believed that wild stands of this taxon are located inland from the coast, probably including the population seen near Morogoro (Hurter, *pers. comm.)*. Work is progressing on the botanical status of this taxon.

Figure 2 David Heenan with an *Encephalartos* in an old Islamic Cemetery south of Dar-es-Salaam. It is not known if this is the same site from which Melville described *E. hildebrandtii* var. *dentatus*.

Moving northwards, the expedition found large stands of *E. hildebrandtii* near the Tanzanian coastal towns of Mwera and Tanga. An interesting recent observation is that a great many of the specimens of *E. hildebrandtii*, presently growing in fairly open sites, have twisted stems due to the prior presence of lianas encircling the trunks (Hurter, *pers. comm.*). This is an clear indication that the sites were previously thickly forested and that the exposed plants are relics from times prior to deforestation.

Plants of *Cycas thouarsii* were also seen near Tanga, but it was not clear if these were cultivated, "escaped" or wild.

Figure 3 The rugged terrain of Tanzania's western Usumbara mountains, where *E. sclavoi* was found at 2500 m. A group of these plants is seen behind the vehicle and to the right of David Heenan and Don Stallard.

Figure 4 The impressive trunks of *E. bubalinus* near Lake Natron in northern Tanzania.

In April 1973, near Lushoto in the western part of the Usumbara mountains, at a site appropriately called "World's View" (alt. 2500 m), the group located the plants referred to by Melville as *E.* "species A", now named *E. sclavoi* (Stevenson, Moretti & De Luca 1989) (Figure 3). There appeared to be two forms in the area; plants growing on exposed ridges have short, leathery leaves with nearly ovate pinnae while plants in sheltered valleys are more robust in leaf and pinnae length. The presence of a separate species, in the eastern

Usumbaras, has been noted by more recent visitors (Hurter, *pers. comm.*). The Heenan party collected specimens of *E. sclavoi* for shipment; in one case 18 heads were removed from a single rootstock. A second consignment was collected towards the end of the first trip, in August 1973.

After a "quick detour" to climb Mount Kilimanjaro (alt. 5895 m), a visit across the border to Nairobi to attend to shipment of plants, and visits to the Gorongoro Game Reserve, Serengeti Plains and Olduvai Gorge, the expedition was back on the cycad trail. In an area 20 km to the west of Lake Natron, the expedition found *E. bubalinus*. Trunks of the older plants, 2 m in recumbent length and 45 cm in diameter, were considerably larger than the dimensions given in Melville's description of the species (Figure 4). Specimens of smaller plants and suckers were collected and taken to Nairobi for phytosanitary clearance and export.

THE 1972/1973 EXPEDITION: UGANDA
[*Encephalartos septentrionalis, E.* "Lake George", *E. equatorialis*]

In the early 1970's, Uganda was politically in a state of turmoil: President Idi Amin had expelled the Asian community from the country which was then virtually "closed" to non-Ugandans. To smooth the bureaucratic process, the expedition was joined by botanist Tony Katende from Makerere University, who proved to be a major asset. Setting out from Kampala in May 1973, via Lake Albert and calling in to see the Murchison Falls, the group proceeded north to an area near the Sudanese border, where groups of plants representing the first of the two main populations of *E. septentrionalis* were located about 5 km west-southwest Moyo, in the west of the Nile valley and at an altitude of about 1000 m (Figure 5). A fair number of plants was collected, mostly from the site near Moyo, and crated for export.

Whilst in northwest Uganda, the party followed up leads of *E. barteri* being found in Sudan and Uganda (Melville 1957, 1958) but, not surprisingly, no evidence was forthcoming and it is thought that the report of this species in central Africa arises from an earlier misidentification of sample material.

After returning briefly to Kampala, the expedition then headed westwards at the end of May 1973, via Fort Portal in the Toro district to Lake George, seeing magnificent views of the Ruwenzori Mountains as the destination drew nearer. A large colony of cycads was found near the Mpanga River Falls (Figure 6). These impressive plants, with plentiful male and female cones, were located at about 1230 m in rocky places in grassland and forest margins; several specimens were collected. Prain (1917) and others had grouped the Lake George population with *E. laurentianus* while

Figure 5 *E. septentrionalis*, **near Moyo in Uganda, with Don Stallard. This may represent the population from which the species was described by Schweinfurth in 1871.**

Figure 6 Trunks of the *E.* **"Lake George" species in Uganda. The remains of an old male cone are seen on the right hand side. The main trunk has since been measured as having grown another 2 m.**

Melville (1957) included it in his very broad concept of *E. hildebrandtii*. It was subsequently claimed that this taxon was more closely related to *E. ituriensis* from the

Figure 7 *E. septentrionalis*, **in the Imatong Mountains, Uganda, with Don Stallard. This population may represent a different species.**

Figure 8 **Plants of** *E. equatorialis* **in the Busoga Forest Reserve, near Jinja, Uganda.**

Ituri Forest in northeastern Zaire, about 200 km northwest of Lake George (Bamps & Lisowski 1990). More detailed current work, however, points to a relationship with the two other known Rift Valley species, *E. bubalinus* and *E. tegulaneus* (Hurter, *pers. comm.*). The Lake George species is shortly to be described as an "official" species.

After a visit to the Ruwenzori National Park and Kigezi Game Reserve in June 1973, the Heenan party headed north again, this time along the eastern side of the Nile valley towards the Imatong Mountains and the Sudanese border. At a site 7 km north-northeast of Lotuturu and at an altitude of 1850 m, the group located and collected plants from the second main population of *E. septentrionalis* (Figure 7). Denis Heenan remains of the opinion that the two *E. septentrionalis* populations, separated by a distance of 140 km, are genetically different. The taxonomic problem is compounded by the facts that the original description does not specify from which of the two localities the original type material was collected and that the type specimens have since been destroyed. Further field work is necessary to address this issue.

Returning once more to Kampala, the group then moved eastward in mid-June. A colony of large and robust cycads was found 20 km to the east of Jinja and 5 km east of the ruined Fort Thuston, at an altitude of 1200 m and within 1° of the equator, near the Busoga Forest Reserve (Figures 8, 9). A number of plants were collected at this site. This cycad population was located in rocky outcrops adjacent to an abandoned leper settlement. Another group of plants was believed to be present about 5 km southwest of the old village. Denis Heenan, on the basis of discussions with Tony Stuart-Smith of the Ugandan Forestry Department, speculated that there was a connection between the Jinja plants and the group of six specimens found at the old Islamic cemetery in Dar-es-Salaam (see previously in this text) and thus he referred to the population as *E. hildebrandtii* var. *dentatus* Melville. A recent investigation has shown that there are clear differences between these taxa; the Jinja plants are currently being described under the name *E. equatorialis* (Hurter & Glen, in press).

THE 1972/1973 EXPEDITION: KENYA

[*Encephalartos tegulaneus, Cycas thouarsii, E. kisambo*]

Towards the end of June 1973, the expedition moved on to Archer's post in Kenya's Mathews Range, where the population of *E. tegulaneus*, the Kenyan "Giant cycad" (first publicised by Mrs Joy Adamson) was located in high rugged terrain on Mount Lolokwe (2000 m) (Figure 10). An interesting observation made here was that the local Samburu herdsmen occasionally hollowed out procumbent cycad trunks to make cattle drinking troughs and that the plants sometimes remain alive in this undignified situation! A second population, at Kichi near Barsaloi, comprised plants with noticeably bigger trunks. It has since been found that *E. tegulaneus*

Figure 9 The female cone of *E. equatorialis* from the Jinja site in Uganda.

is common and widespread in this general area.

After returning to Nairobi, the expedition travelled eastward in mid-July to the coast, where specimens of the Kenyan *Cycas thouarsii* were seen and collected in forested sites just above the hightide level.

The next site for cycad exploration was inland, near the town of Voi. Plants were found approximately 25 km southeast of Voi at an altitude of about 1000 m in the mist forest of the Maunga Mountains. This species appeared to extend over a wide area with other populations at Mlilonyi (Mliyoni?) (where specimens were collected), Nyangala, Sagala and Kasigau. The "Voi" cycad, referred to in Heenan (1977) as *E.* "species B" and also later referred to as *E.* "voiensis", is now correctly known as *E. kisambo* (Faden & Beentje 1989).

The expedition then proceeded back to the coast, noting the presence of many specimens of *Cycas thouarsii* on the road between Kilifi and Malindi, and collecting plants for export. Since these plants were usually associated with some sign of human habitation, the question has been raised whether this species is indigenous in these areas or whether it was transported to the continent through the activities of Arab traders several centuries ago. Recent surveys have revealed more colonies in swampy areas (unlikely sites for Arab traders to have visited) where some of the specimens are too large to be consistent with a recent or anthropomorphic origin (Hurter, *pers. comm.*). At the moment, the balance of evidence thus favours the view that this species is naturally indigenous to the African mainland.

Figure 10 The Kenyan "giant cycad", *E. tegulaneus*, from the Mathews Range in central Kenya. Several trunks measured up to 10 m in height.

In August, the group made a short, second visit southwards into Tanzania in order to collect a further consignment of *E. sclavoi* in the Usumbara Mountains.

THE 1972/1973 EXPEDITION: ZAIRE
[*Encephalartos poggei*]

At the end of August 1973, the expedition then made a circuitous trip around the south of Lake Victoria into Rwanda and Burundi, meeting up with the team studying gorillas under the leadership of Diane Fossey. They

entered Zaire at Goma, on the northern part of Lake Kivu and travelled the long and difficult road westwards to reach Kananga at the end of September. Cycad activities were concentrated in an area south of Kananga. Unfortunately, all the party's cameras had been "liberated" *en route* and no further photographs could be taken. In this area, three populations of *E. poggei* were visited. The first was approximately 70 km southeast of Kananga on the Luisa road, the second was near the waterfall, Chûtes de Katende, on the Lulua River, while the third was further to the southeast, some 5 km southeast of Mwene Ditu. It was noted that stems of these plants reached up to 2 m, much taller than figures reported previously.

Since permission could not be obtained to visit the sites of *E. marunguensis* and *E. schmitzii*, and since there were insufficient funds to continue across Zaire to attempt to locate *E. laurentianus*, the expedition was then terminated and the party commenced the trip homewards via Zambia and Zimbabwe.

THE 1974 EXPEDITION
[*Encephalartos septentrionalis, E. hildebrandtii, E. delucanus, E. schmitzii* and other species]

The second expedition covered much of the same territory as the first, especially in respect of the cycad sites in Kenya and Uganda. Some work was done with respect to soil analysis at the various cycad localities; *e.g.* soil from the *E. septentrionalis* site in the Imatong mountains gave a pH of 5.9, a phosphorus deficiency and a soil composition of 55% sand, 21% silt and 24% clay, while soil from the Gedi site of *E. hildebrandtii* gave a pH of 6.0, 65% sand, 17% silt, 21% clay and deficiencies in nitrogen, phosphorus and potassium.

One important new site visited was in the savannah-bushveld in the Mpanda district of southwestern Tanzania. The expedition was following a lead reported by the lepidopterist, Kielland, of a "different" kind of *Encephalartos* in the area. After five difficult weeks ("conditions were the worst encountered, with roads and bridges totally washed away, grasses up to 3 m making visibility almost impossible; normally dry areas were waterlogged and, as a result, mosquitoes and tsetse flies were in their glory" - Heenan 1977) only one plant was located and much bargaining for its possession ensued with a local medicine-man. Regrettably, the specimen subsequently died. This plant was named by Heenan as *E.* "species C" and considered to have affinities with *E. poggei*. Recently, new specimens from this locality have been discovered and the species has now been named *E. delucanus* by Malaisse, Sclavo & Crosiers (1992).

On the return trip, the group visited Mpika in Zambia, but was unable to locate the curiously-disjunct stand of *E. schmitzii* subsequently reported by Malaisse, Sclavo & Turner (1990) from that area.

DISPOSAL OF PLANTS

A total of something like 1000 plants from the various sites of the two expeditions was ultimately distributed, mainly to the Italian, American and South African sponsors who has provided the "up-front" money for the venture. Other specimens were sold subsequent to the expedition, mainly to American nurserymen or in small consignments locally in southern Africa.

It is significant that, at that time, there were no CITES laws restricting international trade in cycads. The plants removed were, on each occasion, properly inspected by officials from the relevant Department of Agriculture and especial care was taken to see that documentation was correctly prepared for each consignment exported.

CONCLUSION

There are some who maintain that the Heenan expeditions were simply a commercial venture to get the capital reward from the sale of cycad specimens taken from habitat. Certainly, there was an aspect of commercialism about the project. However, the costs of the expedition had to be financed, directly or indirectly, from the value of cycad specimens collected. Denis Heenan himself comments: "The personal gain factor was immense, but not financial. We ran till funds were exhausted and, in both instances, I personally funded the bottom legs of the trips to get them [the participants] home. The real gain was in experience, knowledge, meeting new friends, etc. etc. Of course, there was a certain amount of commercialism, e.g. we supplied two nurserymen in America, but that was where it ended. We did the best we could with our limited knowledge and funds. One offshoot from the expedition was that it gave David [Heenan] a definite direction ... he studied landscaping and horticulture, and, after 20 years' experience, started his own business in this field."

More importantly, however, the expeditions provided data and plant material which, in many respects, was new to science and contributed greatly to our previously limited understanding of African cycads. For example, Douglas Goode's "Cycads of Africa" (1989) would not have been possible were it not for the Heenan expeditions. Many of the plant specimens collected are now in major international botanical gardens and are accessible for research studies. Many of these, and plants in private gardens, have reached reproductive maturity and provide the potential for seed production. A limited number of herbarium specimens were filed at Nairobi and the Makerere University in Uganda, but recent attempts to trace these have proved unsuccessful (Hurter, *pers. comm.*).

ACKNOWLEDGEMENTS

The preparation of this report was at the instigation of Mrs Libby Besse, Sarasota, Florida, U.S.A., but would not have been possible without the full and enthusiastic co-operation of Denis and Jean Heenan, David and Erica Heenan, all now resident in Swaziland, and Don Stallard, now living in Perth, Australia. I thank Don Stallard for access to his extensive field notes and Denis Heenan for the kind loan of the photographs which accompany this text. Johan Hurter (Lowveld National Botanical Garden, Nelspruit) assisted greatly by providing information based on field trips he has made to several of the "Heenan" localities.

REFERENCES

BAMPS, P. & LISOWSKI, S. 1990. A new species of *Encephalartos* (Zamiaceae) from northeastern Zaire. *Memoirs of the New York Botanical Garden* 57: 152-155.

FADEN, R.B. & BEENTJE, H.J. 1989. *Encephalartos kisambo*, a new cycad from Kenya, with a note on *E. tegulaneus*. *Utafiti* 2: 7-10.

GOODE, D. 1989. Cycads of Africa. Struik Winchester, Cape Town.

HEENAN, DENIS. 1977. Some observations on the cycads of central Africa. *Botanical Journal of the Linnean Society* 74: 279-288.

HURTER, P.J.H. & GLEN, H.F. In press. *Encephalartos equatorialis* (Zamiaceae): a newly described species from Tropical Africa. *South African Journal of Botany*.

LAVRANOS, J.J. & GOODE, D. 1985. *Encephalartos turneri* (Cycadaceae), a new species from Mozambique. *Garcia de Orto, Ser. Bot. (Lisboa)* 7: 11-14.

MALAISSE, F., SCLAVO, J.P. & CROSIERS, C. 1992. Recherches sur les *Encephalartos* Lehm. (Zamiaceae) d'Afrique Centrale. 1. - Un nouvel *Encephalartos* de Tanzanie. *Annales de Gembloux* 98: 153-157.

MALAISSE, F., SCLAVO, J.P. & TURNER, I. 1990. Zamiaceae, a new family for Zambia. *Memoirs of the New York Botanical Garden* 57: 162-168.

MELVILLE, R. 1957. *Encephalartos* in central Africa. *Kew Bulletin* 12: 237-257.

MELVILLE, R. 1958. Gymnospermae/Cycadaceae, in *Flora of Tropical East Africa*, eds W.B. Turrill & E. Milne-Redhead, pp. 1-10.

PRAIN, D. 1917. Cycadaceae, in *Flora of Tropical Africa*, ed D. Oliver, 6(2), pp. 344-354.

STEVENSON, D.W., MORETTI, A. & DE LUCA, P. 1989. *Encephalartos sclavoi* De Luca, D. Stevenson & Moretti (Zamiaceae), a new species from Tanzania. *Delpinoa* 29/30: 3-5.

MACROZAMIA LUCIDA (ZAMIACEAE) AND ITS SOUTHERN LIMIT IN NEW SOUTH WALES, AUSTRALIA

Paul I. Forster[1] and David, L. Jones[2]

[1]Queensland Herbarium, Meiers Road, Indooroopilly, Qld 4068, Australia

[2]Australian National Botanic Gardens, G.P.O. Box 1777, Canberra, ACT 2601, Australia

Received 8 June 1995

The precise distribution of *Macrozamia lucida* L. Johnson, particularly its southern limit, has been a subject of considerable confusion in both the scientific and popular literature. This confusion undoubtedly stems from the erroneous statement of Johnson (1961) whereby a number of specimens from near Dalmorton west of Grafton were identified as *M. lucida* and that species' distribution mapped so as to include New South Wales. *Macrozamia lucida* was included in the recent "Flora of New South Wales" based on Johnson's account (Harden 1990). This information was also repeated uncritically by Butt (1984, 1991), who in the latter publication made the rather incredible statement "Sightings of *Macrozamia lucida* have occurred from Hervey Bay west to Carnavon Gorge, then southward in the low ranges to the New South Wales border including around Brisbane. A prominent New South Wales botanist states that hybrids exist between *M. lucida* and *M. moorei* ....." Needless to say these latter comments by Butt are not supported by vouchers in herbaria and appear to be a result of popular myth rather than a reflection of the actual distribution of the species.

With the recent description of the Dalmorton plants as a separate and totally dissimilar species *M. johnsonii* D.L. Jones & K.D. Hill, it was revealed that the particular specimens previously identified as *M. lucida* represented juvenile fronds of this new, much larger, trunked cycad (Jones & Hill 1992). This morphological phenomenon of the juvenile plants possessing dissimilar foliage to the adults also occurs in the related species *M. douglasii* W. Hill & Bailey from south-eastern Queensland and *M. moorei* F. Muell. from central Queensland. These three particular species are quite massive when mature and the juveniles are correspondingly quite large, or at least much larger than

Figure 1 *Macrozamia lucida*. **Large individual at the only known locality in New South Wales. Photo: P. Machin.**

Figure 2 *Macrozamia lucida*. **Close-up of frond bases demonstrating the multiheaded nature of the plant. Photo: P. Machin.**

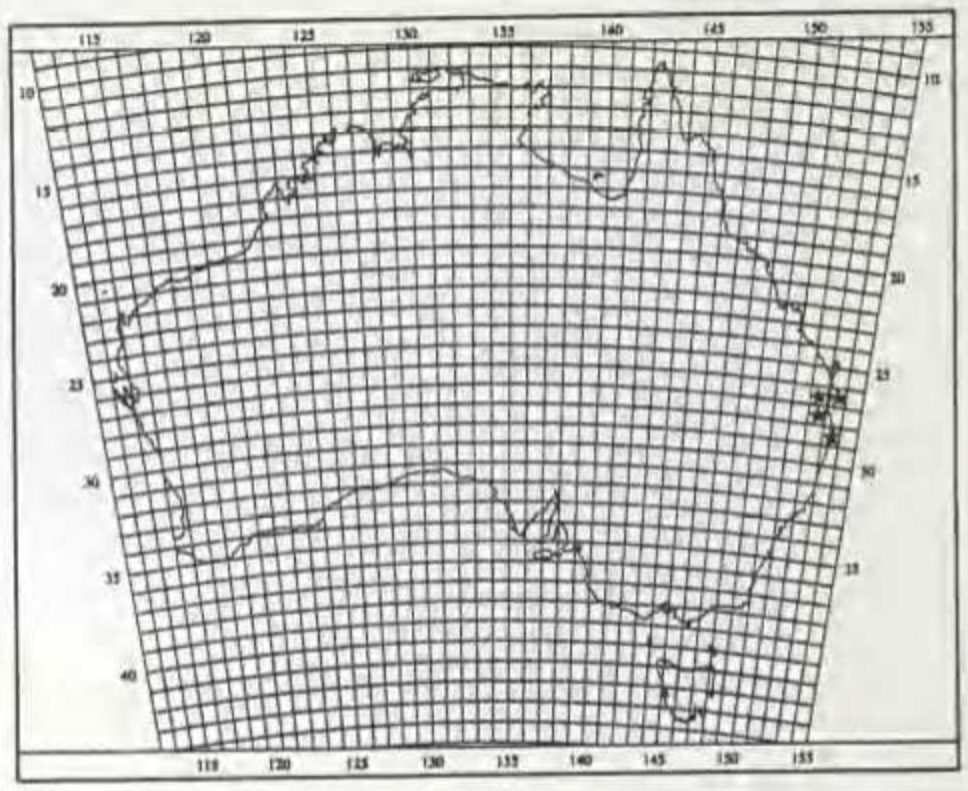


Figure 3 Distribution (★) of *Macrozamia lucida* **in 1° grid squares.**

juveniles of most other species of *Macrozamia* that are found in eastern Australia. As a result of the resolution of the so-called New South Wales populations of *M. lucida*, this species has been recently listed as having a distribution from Gympie to Brisbane (Jones 1993).

The saga of the southernmost population of *M. lucida* does not end there. It was recently brought to our attention by Peter Jones that a population of *M lucida* does indeed occur in northern New South Wales near

Coolangatta (Figure 1). Investigation of this population by Peter Machin revealed that it occurred under a kilometre within the boundary of New South Wales and consisted of only two individuals. The plants occur in deep sandy soil with a high mineral content ("mineral sand") in somewhat swampy conditions with *Livistona* palms, ferns and various sedges. We believe that the population was once more extensive but the surrounding habitat has been largely cleared and there is evidence that there has been heavy poaching of the remaining plants.

The two remaining plants are very unusual for *M. lucida* in that they are extensively multiheaded (16 heads on one of them) (Figure 2), but otherwise they are typical of the species in morphological features and genetic structure. The continued existence of this disjunct southern population is beset with difficulties due to land development in the area and its future appears grim. Nevertheless it is now possible to state that *M. lucida* occurs in south-eastern Queensland from south of Gympie just into north-eastern New South Wales in over 20 disjunct populations (based on herbarium vouchers at the Queensland Herbarium (BRI)) in four 1° grid squares (Figure 3).

ACKNOWLEDGEMENTS

Thanks to P. Jones for drawing our attention to this population, P. Machin for relocating it, collecting voucher material (P. Machin #PM10 lodged at the Queensland Herbarium (BRI) and providing photographs, Y. Smith (BRI) for Figure 3, and the landowners for permission to enter their land.

REFERENCES

BUTT, L.P. 1984. Cycads of Australia. *Australian Plants* 13: 3-22, 28-36.

BUTT, L.P. 1991. An introduction to the Zamiaceae in Australia. *Palms & Cycads* No. 31: 1-58.

HARDEN, G.J. 1990. Zamiaceae. In G.J. Harden (ed.), *Flora of New South Wales* 1: 74-78. University of New South Wales Press: Kensington.

JOHNSON, L.A.S. 1961. Zamiaceae. *Contributions from the New South Wales National Herbarium, Flora Series* 1: 21-41.

JONES, D.L. 1993. Cycads of the World. Reed: Chatswood.

JONES, D.L. & HILL, K.D. 1992. *Macrozamia johnsonii*, a new species of *Macrozamia* section *Macrozamia* (Zamiaceae) from northern New South Wales. *Telopea* 5: 31-34.

C. J. CHAMBERLAIN AND THE LADIES

Knut J. Norstog
6656 Gladel Dr., Waterloo, IL 62298, U.S.A.

Received 8 May 1995

I realize that in making up this title I probably am giving some false impressions. First, I doubt very much that Chamberlain was a "ladies man" as we think of that genre today. Of course, I don't know since I never met the man, but those who knew him always spoke well of him. Secondly, the term "lady" has fallen into disfavor here in the U.S. Most women prefer to be addressed as "women," not as "ladies," and, especially not as "girls." So it is something of a booby-trapped trail that a man in his 70's now walks when he sets out to write under a title like that above.

What actually set me off on this subject was reading Chamberlain's list of references in his lovely book "Gymnosperms, Structure and Evolution." I suppose I have looked for authors and subjects in this bibliography dozens of times but this time it occurred to me that there is something very odd about it. I wonder if any others also have noticed anything peculiar about his list of references? But, before you go rushing off to look at your copy of the book, or, heaven forbid, trek to the library, let me just say that the old boy made a distinction between the way he cited most of the female authors in comparison with those of most of the males.

Now as you know from experience, when you read a list of references in most scientific articles, you can't tell who is male and who is female -- there, given names are only represented by initials. But let's take another look at "Gymnosperms, Structure and Evolution." In the references are 713 entries and most of them appear to be male, although unless you know, one can't really tell whether Bower, F.O. is male or female, but of course we know he's a he, because of his fame. What sex would you think Bancroft, N. was? How about Bancroft, Nellie, as Chamberlain cites her work? Or Chick, E., except that she has gone down in cycad lore and literature as Chick, Edith, as do Henning, Hulda; Arber, Agnes; Aase, Hannah; Bartholomew, Mary; Benson, Margaret; Barkley, Grace, and others, thanks to old C.J.. Some of the women get a

Figure 1 **Charles Joseph Chamberlain. Photo: Paul Voth.**

slightly more embellished treatment though, as in the cases of Browne, "Lady" Isabel; Langdon, "Dr." LaDema; Dorety, Helen A. "(Sister Helen Angela)", and a dear old woman (I almost said dear old girl) Lamb, "Sister" Mary Alice, with whom I took an electron microscope class years ago, when I was young and she was in her 60's and Mother Superior of a Catholic Woman's College. I'm sure you remember her vegetative key to the cycad genera. Dr. LaDema Langdon was the finest illustrator of cytological and anatomical subjects I know of. Chamberlain used some of her drawings in his papers and books.

I wonder why Chamberlain cited female authors this way? Possibly there is a clue. Nearly all male authors are simply listed as Lang, W.H., Arnold, C.A., Le Goc, M.J. or Worsdell, W.C., etc., but a few get the full treatment: Coulter, John; Caldwell, Otis; Buchholz, John T., and Bailey, Irving W. How odd! Why? - - - - - Maybe these are men he especially respected or was particularly fond of, or both. Buchholz and Coulter were his colleagues at the University of Chicago and both worked on gymnosperms, as did all of the women. Does it follow, then, that he was also especially fond of all those women? Perhaps he was, or at least of some of them, but I shouldn't think he had any memorable experiences with Agnes Arber, or Lady Isabel Browne and I doubt that either Sister Mary Lamb or Sister Helen Angela Dorety ever unbent beyond a friendly exchange of greetings. Well, what I think is that Chamberlain felt the women weren't getting a fair shake in Academia and in Science and he wanted his and their contemporaries to notice that they also could do good science. Anyway, its a lovely thought to go on with.

P.S. Since writing the above, I received this comment and photograph of Chamberlain (Figure 1) from Sally Voth, now in her 90's, who with her late husband Paul knew Chamberlain as a friend and colleague.

"My dear Priscilla and Knut: Your long and interesting letter has lifted my spirits no matter what problems I had to face. When I read the part about Chamberlain I almost split my sides laughing! Everyone at the University of Chicago loved him. I knew he was single. He lived on the south side of the Midway, which at that time was a dangerous area -- much crime and shooting going on. The University of Chicago did not own any property there then. So Chamberlain got permisson from the Powers That Be to carry a pistol at all times. Since he was always very prompt he also carried a gold watch which he prized. So when he crossed the Midway he was on the lookout! One day he stopped at the stop sign and while waiting for the sign to change a man acting strange stopped there also. Chamberlain reached into his pocket and his watch was not there. Aha! He stuck his pistol into the man's ribs and asked him to give him his watch -- which the man did and rushed away. When Chamberlain came home he went to a highboy where he always kept it when not wearing it and lo and behold there lay his own watch! How he ever lived that down I don't know. He was the kindest man I ever met.

Selma Voth, April 22, 1995."

LEAVES ON CYCAD CONES

Hannes Robbertse
167 Astrid Street, 0184 Meyerspark, Pretoria

Received 11 July 1995

Ordinary, pinnate leaves appearing on cycad cones is, although infrequent, a well-known phenomenon. Reports on leafy cones and excellent photographs have been published in different issues of "*Encephalartos*" (**12**: 4; **13**:18; **20**:20; **22**:23; **26**:36; **32**:22). Speculations on the possible reasons for this phenomenon was published by Robbertse, Claassen & Schoonraad (1988) in the *South African Journal of Botany*. The latter paper was a more technical paper and may not be accessible to most of the members which could explain why several recent requests have been received from members for more information about this phenomenon. I have not yet done a complete study on leaf and cone development in cycads and therefore this paper is partly based on experience gained from such studies on other plants.

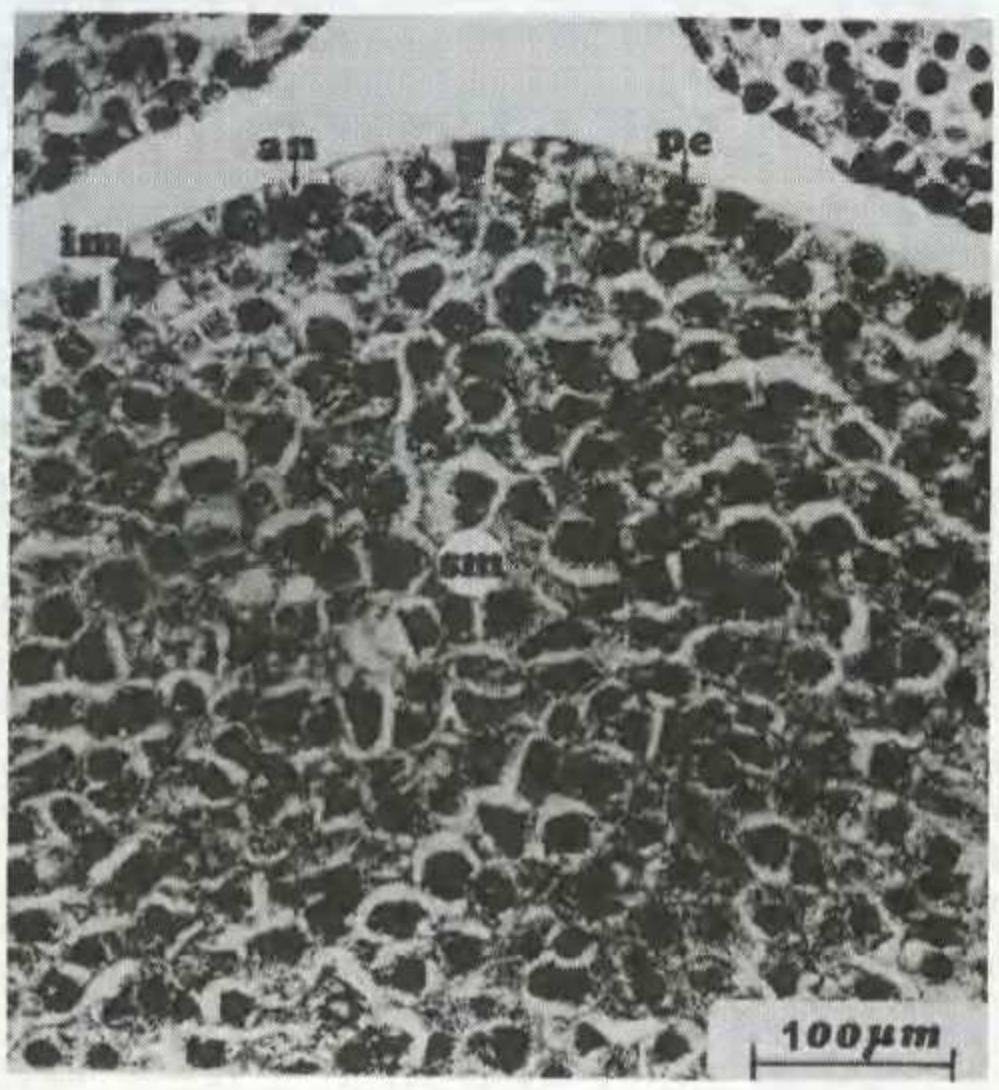


Figure 1 Section through the cell dome in the apical bud of *Encephalartos dyerianus*. (From M.Sc. thesis by Suzelle van der Westhuizen, 1976. Ignore the lettering.)

Before endeavouring to explain this anomalous behaviour in cycads, there are a few basic facts that must be fully understood. The first is to understand the structure and functioning of a **bud**; secondly, to understand the concept **rhythmic growth**; thirdly, to understand the origin and development of leaves and lastly, to understand the origin and development of cones.

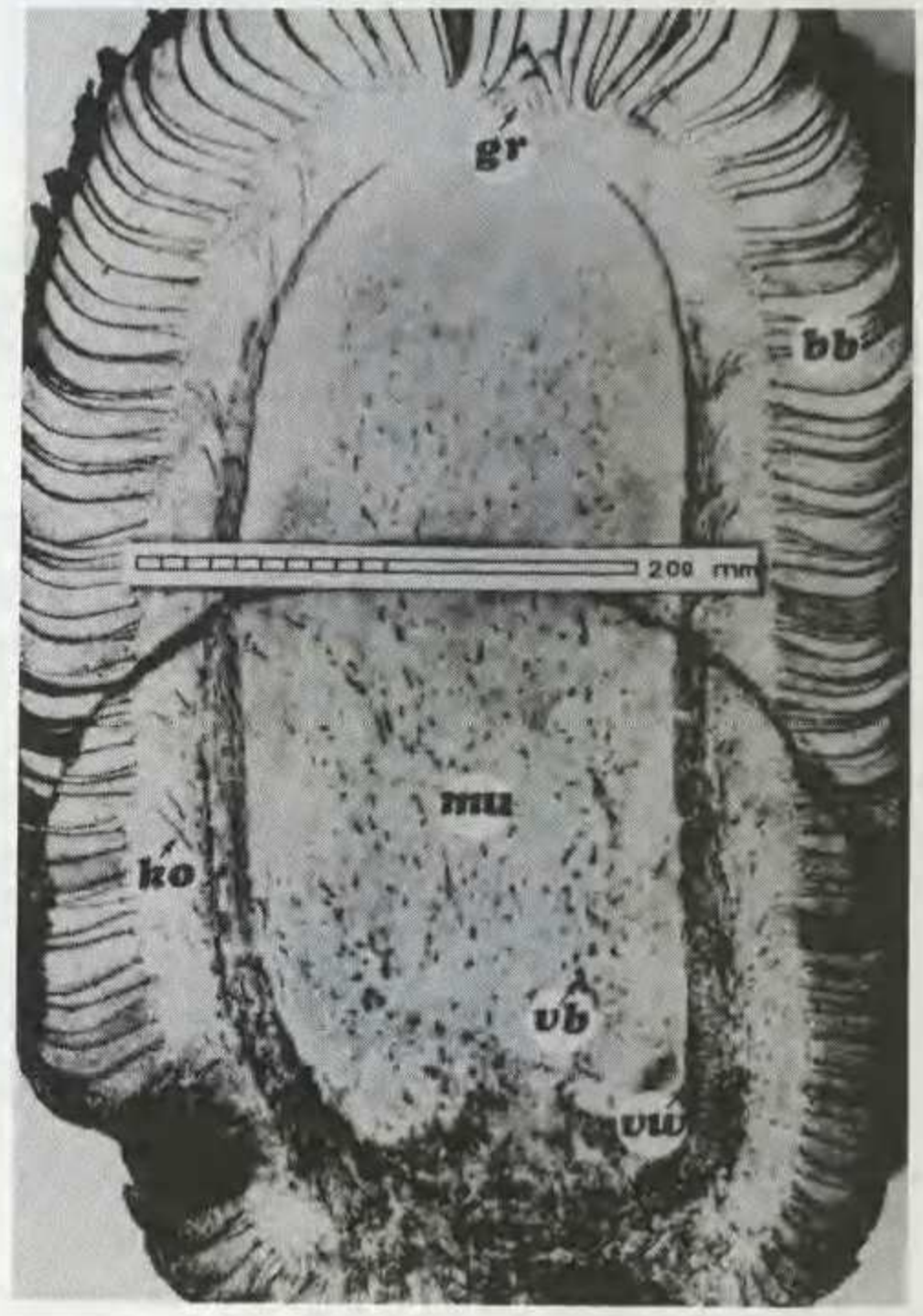


Figure 2 Longitudinal section through the stem of *Encephalartos dyerianus* to show the position of the apical bud (gr). bb = Bases of foliar leaves and cataphylls; mu = Pith with vascular bundles (vb), surrounded by vascular cylinder (vw) and cortex (ko). (From Suzelle's thesis).

What is a bud?

A bud consists of a dome of meristematic (actively dividing) cells (see Figures 1 and 4A) surrounded by either underdeveloped leaves, called bracts, scales or cataphylls (Figures 1, 2), or by developing leaf primordia as shown in Figure 4A. The crucial part of the bud is, however, the dome of meristematic cells. They divide

regularly and at intervals will form bulges of even more active cells. These bulges are called leaf primordia or leaf initials and will develop into either foliar leaves or bracts (cataphylls). In the rest of this paper I will stick to the term **cataphylls** instead of bracts or scales.

Rhythmic growth

Rhythmic growth or episodic growth is characterised by regular periods (episodes) of "rest" during which no new leaves appear at the tip of a growing branch, followed by a sudden flush of new leaves and internode elongation. Plants with this growth mode usually have two leaf types, namely cataphylls as well as green, foliar leaves. The cataphylls protect the bud during the resting phase and there is an abrupt transition from cataphylls to foliar leaves. Cycads are typical rhythmic growers. In contrast, eucalypts are exponents of continuous growth, where the apical buds are not protected by bracts but by young developing leaves which are continuously produced.

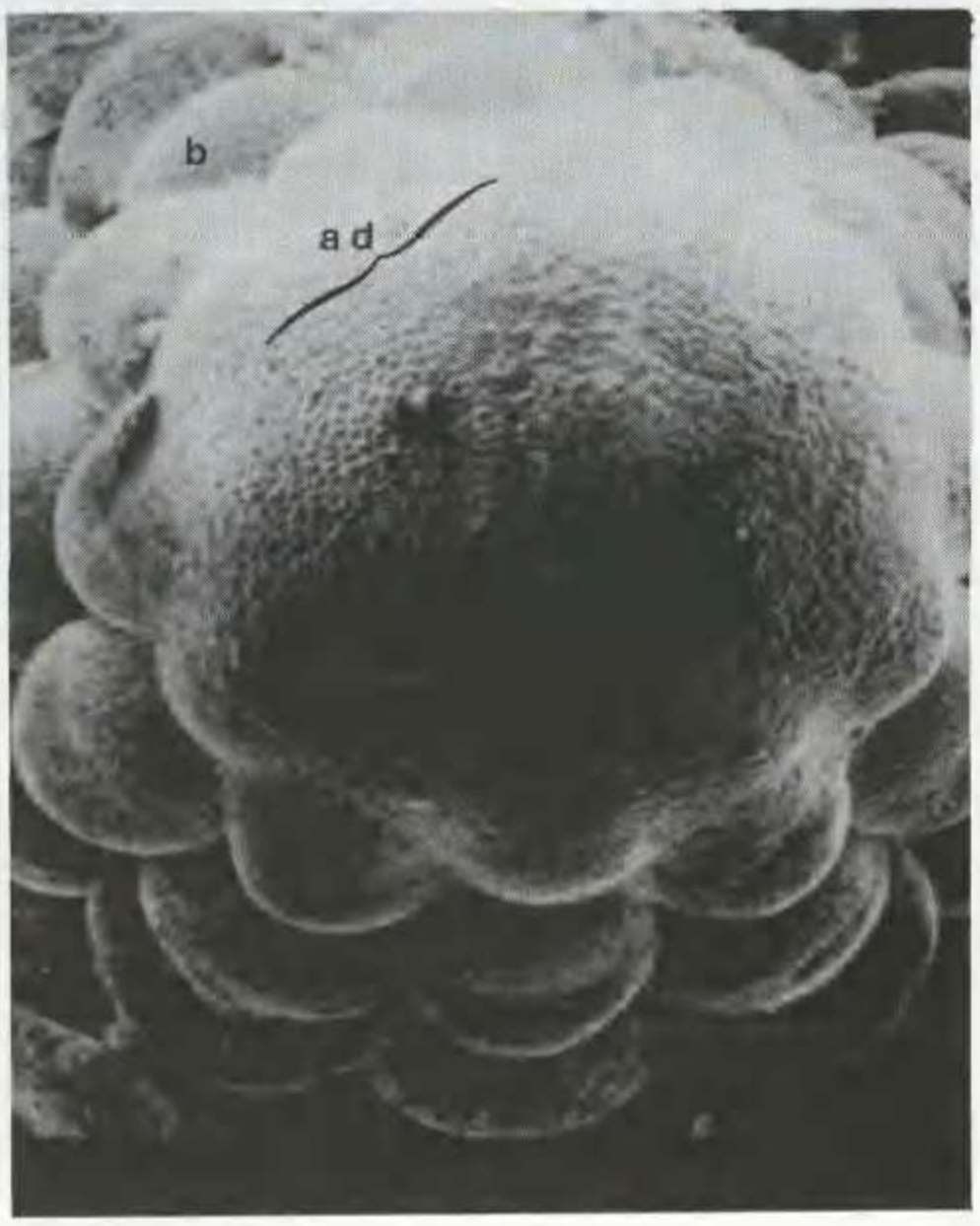


Figure 3 Scanning electron micrograph of very young, developing inflorescence of a *Bulbine* species, showing apical cell dome (ad) and flower bract primordia (b) produced by the apical cell dome.

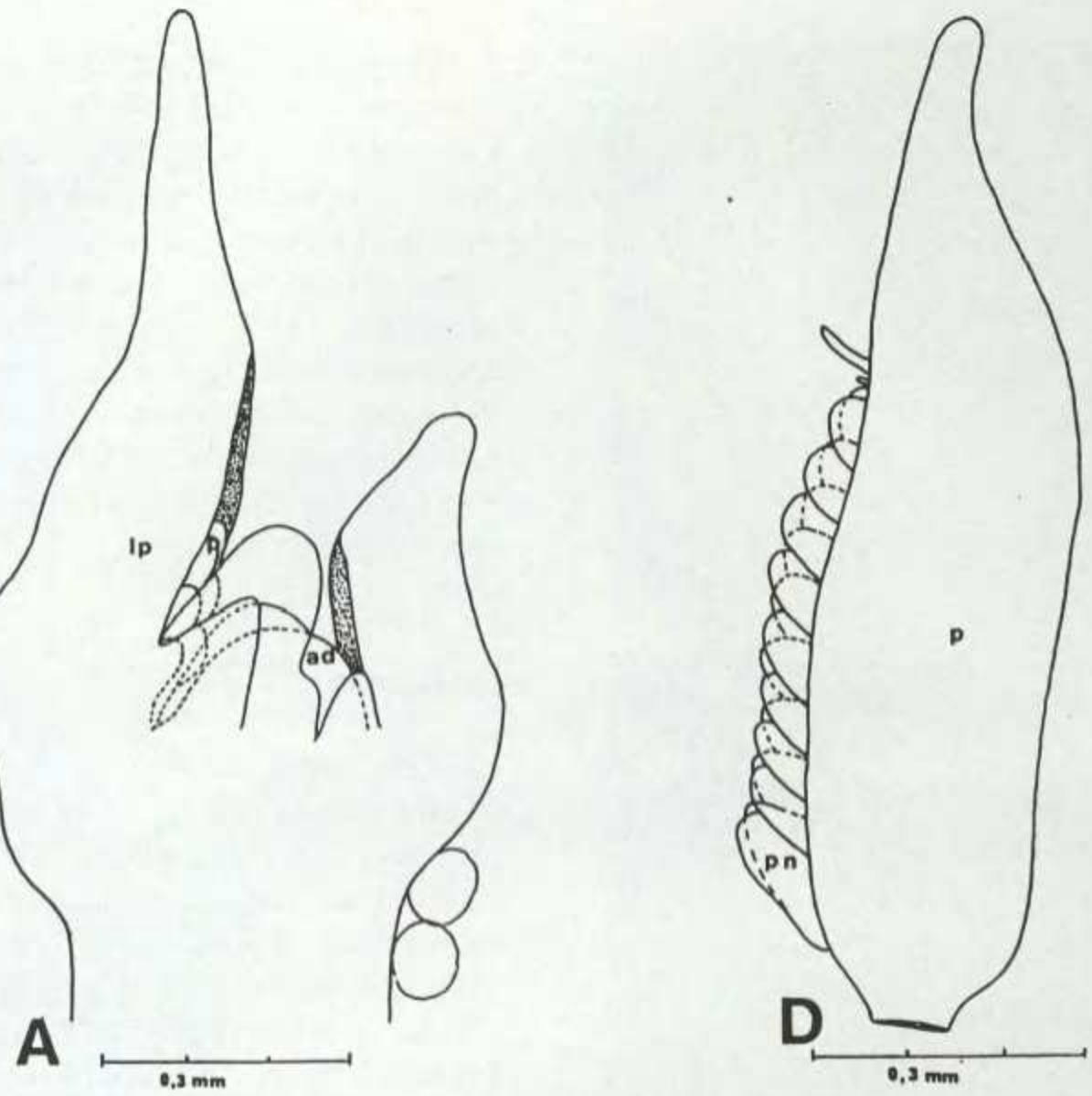
Origin of leaves

Leaves can only be formed by bud meristems on a plant. In cycads there is usually only one active bud meristem situated at the very apex of the stem. It consists of a small dome of cells as shown in Figure 1 and its position is shown in Figure 2. This dome of cells is carefully protected by cataphylls. The meristome (cell dome) shown in Figure 1 was in a resting phase when it was collected and do not show developing leaves. The first signs of leaves developing from the dome, is the appearance of small bulges on the periphery of the dome as illustrated in Figure 3. (Figure 3 is actually the young inflorescence of a *Bulbine* species, but clearly explains the process of *en mass* leaf formation as it occurs in cycads.) After a number of these bulges, which are called leaf primordia, have been formed, the dome will stop producing them, and will go into another resting phase. Starting from the basal end of the dome, each bulge will elongate, bend over the dome and will produce two lateral rows of small protuberances (see Figure 4B) which will later develop into the two rows of pinnae (leaflets), typical for cycad leaves. A number of the most apical bulges will, however, not develop pinnae, but will remain peg-like to form the new rosette of cataphylls (bracts) that will protect the apical cell dome during the next resting phase. The basal leaf primordia will later all start elongating simultaneously and "burst" through the protecting cataphylls to produce, a dramatic, leaf flush. At the same time, the axis below the dome will elongate and expand, while the cataphylls surrounding the cell dome will harden off to fulfil their protecting function.

It is important to note that the entire apical cell dome is not depleted or "used up" during the process of primordia formation, but it is continuously restored to its original size by means of the dividing cells. If ever the cell dome should be "used up" or damaged, no further growth would be possible by the same meristem (cell dome).

Cone formation

In *Cycas revoluta* as well as in probably most other *Cycas* species, the female cones are produced by the apical meristem. Foliar leaves are produced in the same way as explained above, but at intervals, instead of producing foliar leaves, a rosette of "seed leaves" or sporophylls are produced. The sporophylls form the loose, cone-like structure which produce the seeds. After ripening and dispersal of the seed, the apical meristem will continue to produce foliar leaves and cataphylls since the cell dome was not "used up" during cone formation. The old sporophylls will remain around the stem for some time and on older female plants one will notice alternate rings of foliar leaves, cataphylls and old sporophylls. Male cone formation is a bit different. When a young male plant reaches sexual maturity for the first time, the cone will develop from the apical bud (cell dome), but during this process the entire cell dome will be "used up"



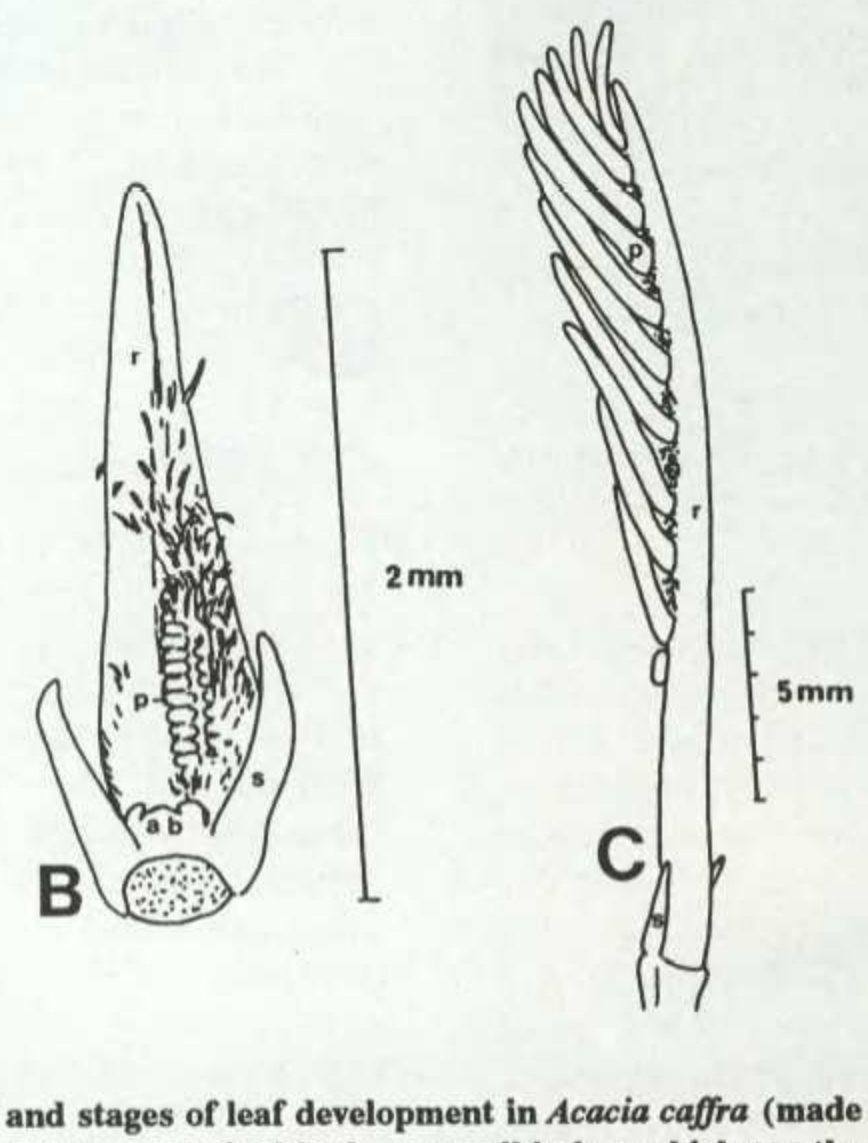


Figure 4 Sketches of the apical bud and stages of leaf development in *Acacia caffra* (made in 1972, unpublished). A. Apical cell dome (ad) covered by leaf primordia (lp) in a terminal bud. p = cell bulges which are the pinna primordia. B. One of the leaf primordia showing the peg-like rachis (r) and two rows of developing pinna primordia (p), stipules (s) and axillary bud (ab). Note the apical cell dome of the young bud and the first two leaf primordia (prophylls). In *Encephalartos* this bud will remain dormant in most leaves, except when cones are produced. C. Leaf primordium young leaf stage, showing pinnae (p) on leaf rachis (r). In the acacias the leaves are bipinnate and therefore each pinna will produce two rows of pinnules (leaflets) as shown in figure D.

to produce cone scale primordia. (Compare Figure 3 where the dome survives.) The result is that no further growth is possible after the cone has produced its pollen. To continue new growth, one of the rudimentary axillary buds in the axis of a leaf close to the base of the cone, is stimulated to develop a prominent cell dome and will start producing leaf primordia, thus taking over the function of the previous apical bud. After a few

Figure 5 Leaves on top of a female cone of *Encephalartos villosus*, in a Nelspruit garden. Photo: Colin Pinker.

episodes of leaf flushing and resting, this substitute terminal bud will also end up in a male cone (Halle *et al.* 1978).

In the genus *Encephalartos*, male as well as female cones are not formed by the apical meristem, but from lateral bud meristems situated close to the apical meristem in the axils of either foliar leaves or cataphylls. All leaves, irrespective of whether they are foliar leaves or bracts, are supposed to contain a bud in its axil (Figure 4B). The buds in the axils of cycad leaves are very rudimentary (underdeveloped) and therefore do not give rise to lateral branches as in most trees. When cones are produced, the apical meristem remains in the resting phase, but for some reason one or more of the lateral, axillary buds become active and start to produce primordia in a similar way as illustrated in Figure 3. These primordia, which can now be called cone scale primordia, do not develop lateral protuberances as explained for foliar leaf formation, but will either produce ovules in the case of a female cone, or pollen sacs in the case of male cones. A number of the most terminal cone scales are sterile and can be compared to cataphylls. The "flush" in this case will not produce a rosette of foliar leaves, but a cone. During the process of cone scale production by the cell dome in *Encephalartos*, most or all the cells in the apical dome are "used up" and no further growth can take place after seed or pollen shed.

Leafy cones

In very rare cases, during the process of cone production, something goes wrong. Leaf primordia are formed as shown in Figure 3 and depending on the sex of the plant, the primordia will develop into either male sporophylls or female sporophylls as mentioned under "cone development" but the difference comes in during the differentiation of the terminal cone scale primordia. Some of them will remain peg-like and sterile while some will start to behave like foliar leaf primordia by developing pinna protuberances as illustrated in Figure 4B. When cone flushing occurs, they will develop into true foliar leaves. The end product will be a "normal" cone with a few foliar leaves on its top (Figure 5). Since most or all the cells in the apical dome has been utilized for the formation of new primordia (contrary to what is shown in Figure 3, where the apical cell dome remains), no further growth is possible, and this explains why attempts to grow these leafy cone tips, were unsuccessful.

Comparing the early stages of leaf and cone development, there is structurally no difference between cone scale primordia and foliar leaf primordia. In *Cycas* they develop from the very same terminal bud cell dome and in *Encephalartos* foliar leaves develop from the terminal bud dome while cone scales develop from lateral buds, but similar cell domes. The factors or impulses that triggers the primordia to develop either into cone scales, cataphylls or foliar leaves is, as yet, unknown. The fact is, however, that during cone development, it is theoretically possible that any of the cone scale primordia can be triggered to develop into a foliar leaf, although it has only been noticed happening with the most terminal cone primordia.

MONTGOMERY *MICROCYCAS CALOCOMA* SEEDS

Roy Osborne
20 Maryvale Road, 3630 Westville

Received 31 May 1995

The Montgomery Foundation, in association with Fairchild Tropical Garden, Miami, Florida, U.S.A., reports that the second generation of plants from their "seed orchard" of *Microcycas calocoma* (see *Encephalartos* **42**: 10) has borne cones. A crop of seeds has been obtained and has been distributed to selected botanical gardens and cycad growers in South Africa, Zimbabwe, China, Thailand, India, Australia, Mexico and the U.S.A. Since the seeds were artificially produced, they are classified on the CITES Appendix II and full documentation was provided for each parcel.

The Foundation is congratulated on this wonderful gesture, which will result in the not-too-distant future in crops of these seeds for further local distribution. Previously hardly known outside Cuba, this species will now be well-represented in all major international cycad collections.

CYCAD 96 CONFERENCE

Professor Chia Jui Chen

As at mid-June 1995, 80 persons have indicated their interest in attending the CYCAD 96 Conference in China. These comprise 21 from Africa, 8 from Australia, 5 from America, 2 from India, 2 from Mexico, 1 from New Zealand and 1 from Philippines. In addition, 35 local Chinese botanists have expressed their interest in attending the meeting.

Keynote speakers at the Conference will be Dennis Stevenson, Ken Hill, Cynthia Giddy, Roy Osborne, D.D. Pant, William Tang and others. It is hoped that seeds and seedlings of Chinese cycads will be available for sale or exchange during the meeting.

The Conference will be under the auspices and support of the Ministry of Forestry of the Peoples Republic of China. It is noted that further exploration has lead to the discovery of new cycad taxa in southern China. Furthermore, *ex situ* cycad collections at the Shenzhen Fairy Lake Botanical Garden and at Panzhihua City are underway and that a *Cycas multipinnata* reserve is planned for Manhao-Pingbian in Yunnan Province.

A second circular will be mailed in November 1995. Please note change of telephone details as below:

Professor Chia Jui Chen, CYCAD 96 Conference Chairman, c/o Institute of Botany, Academia Sinica, Xianshang, Beijing, 100093 China.
Tel: 0086-010-2591431 ext 2110; Fax: 0086-010-8319534
Internet EM: lics@botany.ihep.ac.cn or ningjc@botany.ihep.ac.cn

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0039 Lynn-Oos

Ontvang 2 Julie 1995

U word vriendelik aan die volgende herinner:

4 November 1995 - Afsluitingsfunksie wat om 16h00 by Hollandhuis aan die noordelike kant van die rant in die terrein van die Nasionale Botaniese Instituut, Pretoria, gehou sal word. Mnr Bernard Fischer sal 'n skyfievertoning oor "***Zamia* species of the Americas" aanbied. Vir die braaivleis sal slegs pap en vleis gratis voorsien word. Persone met vanne wat op **A-M** begin moet asseblief mengelslaai saambring. Persone met vanne wat op **N-Z** begin moet asseblief vrugteslaai saambring. R.S.V.P. aan Hanneke by (012) 8080995 voor 27 Oktober 1995. **'n Bestuur vir 1996/1997 sal tydens die byeenkoms verkies word. Dink dus asseblief vroegtydig oor geskikte kandidate vir die nuwe bestuur.**

20 Januarie 1996 - Vergadering in hoofgebou van die Nasionale Botaniese Instituut, Pretoria om 14h00. Dr Elsie Steyn sal 'n lesing en skyfievertoning oor "**Bevrugting by *Encephalartos villosus***" aanbied. **Let asb. op die datumverandering (was vroeër 6 Januarie).**

Table 1 Characteristics of the Transvaal blue-grey to glaucous green leaved *Encephalartos* species with broad leaflets

	E. eugene-maraisii	*E. middelburgensis*	*E. dolomiticus*	*E. dyerianus*	*E. "venetus"*	*E. cupidus*
Grow at altitude	1400 m	1000-1400 m	1200 m	700 m	1000 m - robust form higher - normal form	700-800 m
STEM:	2-3 m	3-6 m (large)	0.8-1.2 m	2-4 m	1 m	subterranean-10cm (dwarf)
LEAVES Length:	1.0-1.5 m	1-2 m	60-80 cm	1.0-1.5 m	1.5-2.0 m	80-90 cm
Vee-ed:	deeply	deeply	shallowly	shallowly	deeply	deeply
Colour:	grey-green	bluish-green	green	green	grey-bluish-green	bluish-green
Type:	• gentle upward curve • held outwards	• completely straight • held upwards	• twisted and recurved	• straight • slightly twisted	• gentle upward curve • slightly twisted	• erect, somewhat untidy, spread horizontally and touching ground • tips turn gently upwards
Leaflets:	• entire, overlap upwards • occasional basal teeth. • reduce gradually into 2-3 prickles.	• entire, overlap downwards • teeth: rare • end abruptly - no prickles	• sharply pointed • occasional teeth lower margins • do not overlap • reduce in size • end abruptly - no prickles	• do not overlap • toothed both margins - irregular: 1-2 teeth • reduce in size to end in prickles and thorns	• overlap upwards Blue: smooth - toothed both margins: 2-3 teeth Robust: reduce in size - end in prickles and thorns: toothed both margins: 4-6 teeth	• 3-4 teeth on both margins - upper and lower • reduce in size - ending in 3-8 prickles
Petiole:	10-16 cm swollen base - sometimes covered with wool	25-40 cm	9-14 cm red-brown collar at base	1-4 cm prominent brown collar at base	Blue: 15-24 cm, Robust: 6-8 cm, swollen base: brown collar at base	8-12 cm swollen base
CONES: Female:	1-4	4-5	1-2	1-4	2-5	solitary - 1
Colour:	covered with maroon-brown hair	bright green	blue-green	bluish-grey-green	light green to bluish-green	green - turning yellow-green
Shape:	egg-shaped	cylindrical	short & broad ovoid	cylindrical	egg-shaped	oval
Seed:	brown-yellow	light brown-yellow	pale yellow	yellow	yellow	yellow
Male:	4-5 do not taper	3-5 brown tapered upper end	1-3 barrel-shaped	4-7 cylindrical	3-5 cylindrical	1-2 cylindrical

LEDE WORD UITGENOOI OM PLANTE EN/OF SAAD NA BEIDE BYEENKOMSTE VIR UITRUILDOELEINDES TE BRING.

Praatjie deur dr Gerrie de Haas van Pietersburg op 6 Mei 1995: Nie minder as 46 persone het die besonder interessante praatjie oor die grys Transvaalse broodbome met breë pinnas bygewoon nie. Afgesien van die pragtige kleurskyfies en vars blaarmonsters van al die spesies wat bespreek is, het Gerrie ook die tabel (Table 1) wat hiermee saamgaan aan die aanwesiges beskikbaar gestel. In die tabel word heelparty kenmerke van die verskillende spesies saamgevat.

Afgesien van die spesies wat in die tabel gelys word, het Gerrie ook 'n foto van die nuwe grys broodboomspesie wat in Venda ontdek is vertoon. Ongelukkig kon hy nie 'n volledige blaar van die nuwe spesie vir die praatjie bekom nie maar hy het tog 'n segment uit die middel van 'n blaar vertoon. Daaruit blyk dit dat die grysgroen pinnas wat ongeveer 110 mm lank en 15 mm wyd is ongetand is met 'n terminale doring. 'n Opvallende kenmerk was die bruin wollerigheid aan die abaksiale (onderste) oppervlak van die ragis en die verdikte onderste rand van die pinnas. Daar word verneem dat die spesie tans amptelik as 'n nuwe takson met die naam *Encephalartos decurrens* beskryf staan te word.

Na 'n lewendige bespreking het die aanwesiges gesellig verversings geniet en broodboomsaailinge uitgeruil.

NEWS FROM THE NATAL REGIONAL BRANCH

Avis Meresman
P.O. Box 4726, 400 Durban

Received 3 July 1995

We have had a very exciting meeting here in Durban. Cynthia Giddy presented a slide show on "Exotic Cycads", and this has really awakened the interest in non-indigenous cycads.

At this same meeting we had a plant judging competion - people brought their exotic cycads and ferns for the rest to see and there were really wonderful prizes. Some of the plants (Figure 1) which were on show were *Zamia pygmaea, Z. fischeri, Z. lindenii, Cycas lane-poolei, Bowenia spectabilis*, etc.

Ithuba donated scratch cards for the evening and everyone had a card given to them - they then went ahead and started to scratch and 13 people won prizes.

Figure 1 Some of the exotic cycads on show.

This year has been quite busy for Natal members of the Cycad Society. In Durban we have had a braai at a member's home, an open day at another, a picnic lunch at a nursery in Kloof, the plant show at Queensburgh Library, plus the Executive Committee have presented a slide show at Kloof Garden Club, a talk on the difference between *Cycas* and other cycads, how to pollinate cycads at the Northdene Women's Institute, a slide show for 23 members in Cape Town presented by Danie Nel, a donation of a cycad for raising funds at the Kenwood Remedial School - which raised quite a packet, a slide presentation at the Hillary Women's Institute, and, believe it or not, we are now gearing up to another Wildlife Expo in September - so it is quite hectic.

NOMINATIONS FOR COUNCIL

Hannes Robbertse
167 Astrid Street, 0184 Meyerspark

Received 11 July 1995

The new COUNCIL for the next two years has to be elected at the end of this year. Representatives from the Regional Branches are elected by the branches and is a Regional matter.

Members are invited to nominate candidates to be elected as:

PRESIDENT
SECRETARY-TREASURER
EDITOR FOR "ENCEPHALARTOS"
PRINTING AND DISPATCH OFFICER
BACK COPIES OFFICER

With the exception of Roy Shooter (present "Back copies officer") all other present Council members are available for another term, but since the election is a very important matter, please give this some serious thought and nominate the person(s) you think can do the job. We need the nominations before the end of October.

The proposer must provide the name and address or membership number of his/her nominee(s) together with a written undertaking by the nominee that he/she is willing to stand for the post for which he/she is being nominated. A nominee can make himself/herself available for more than one post simultaneously.

[Please send your nominations to Prof. Hannes Robbertse, 167 Astrid Street, 0184 Meyerspark. - **Editor.**]

INCREASE IN MEMBERSHIP FEES

Hannes Robbertse
167 Astrid Street, 0184 Meyerspark

Received 15 July 1995

Due to a considerable increase in postal tariffs, our budget can no longer cope with the present mailing costs, in spite of the increase in membership fees the beginning of this year.

Printing costs for "*Encephalartos*" works out at R10.00 per copy, which amounts to R40.00 per member per year. Mailing costs for local members is about R8.00 per year and if the 10% levy for branches is added, the total amount exceeds R50.00.

For members living in the U.S.A. and Far East, airmail costs exceeds R100.00 per year. Surface mail is much cheaper and to encourage members to make use of surface mail, membership fees will only be increased by a small amount for those members who prefer to receive "*Encephalartos*" by surface mail.

The new membership fees appear on the **renewal** form as well as on the **application for new membership** form on the coloured pages of this issue.

[American and Australian members please note that the South African Rand/Australian Dollar rate of exchange has changed considerably during the last year and is now the same as the South African Rand/American Dollar rate of exchange. - **Editor.**]

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

MEDITERRANEAN CONE SCULPTURES

In *Encephalartos* **39**: 24 (September 1994), you printed a photograph of an old stone cone sculpture from the Villa Floridina, Naples and commented on the popularity of modern versions of this object, inviting comments on its origin and significance.

The species in question is in fact *Pinus pinea*, a conifer which produces cones about 2 kg in mass. The seeds (or pine kernels) of this species have been used since Roman times in kitchens and pastry shops for special culinary dishes. For instance, in one cookbook, I found 27 different recipes which included the pine kernels as ingredients. One popular recipe is "pesto alla genovese", which is a sauce for pasta, obtained by thoroughly mixing fresh basil, olive oil, parmesan and pecorino cheeses, garlic and pine kernels. The culinary use has contributed to the spread of the species which now occurs widely in Mediterranean coastal areas, so much so that the origin of the species is uncertain, although probably Italian. Its usage has also led to the common name "Italian Stone Pine" for *Pinus pinea*. It was also believed that the portrayal of the cones on edifices

would bring about a plentiful harvest.

The circular support on which the cone is mounted seems to be the fruit of a cucurbit. The Venetians cultivate a variety called "di chioggia" which is practically identical to that in the photograph.

***Ottorino Stainer**, Via Lisbona 25, Treporti 30010, Venezia, Italy.*

Received 12 June 1995

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Dear Editor

ODOUR OF MALE *ENCEPHALARTOS CONCINNUS* CONES

Over quite a few years, I have noticed a very distinctive "aniseed-like" odour to the male cones, at the time of pollen-shedding, of what I believe are *Encephalartos concinnus* plants in local gardens. I wonder if this is characteristic of and exclusive to this species? Can any readers add any information in this respect?

***Roy Osborne**, 20 Maryvale Road, 3630 Westville.*

Received 3 March 1995

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Dear Editor

ENCEPHALARTOS WOODII

Enclosed is a page from **NEWSWEEK** . . . . . a major news-magazine in the U.S. (and worldwide). It is not too often - if ever - that a cycad gets a colour photo in an issue. I want to be sure you saw it.

***William Burnett**, P.O. Box 12431, Memphis, Tennessee 38182-0431, U.S.A.*

Received 17 June 1995

[Please see "**RARE PLANT**" under "Newspaper clippings" on page 42. - **Editor.**]

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Dear Editor

LEAVES ON CONE

Just over three years ago (*Encephalartos* **29**: 25, March 1992) I sent a photo of my *Encephalartos villosus* female plant showing a cone with leaves sticking out the top. This plant has now coned again and again the leaves are sticking out the top of the cone. This time the leaves are larger (see Figure 5 on page 30). I have hand pollinated the cone and it will be interesting to see how many seeds are fertile. The cone size appears to be the same as in 1992.

Any comments?

***Colin Pinker**, P.O. Box 2115, 1200 Nelspruit.*

Received 21 June 1995

[Please see "Leaves on cones" by Hannes Robbertse on page 27 in which he explains this phenomenon. Your photo printed in 1992, shows a female cone with some of the most terminal sterile cone scales (cataphylls) elongated, rather than true foliar leaves, on top - **Editor.**]

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Dear Editor

MANGANESE DEFICIENCY IN *CYCAS REVOLUTA*

Piet Vorster made some very interesting comments on manganese deficiency suffered by *Cycas revoluta* on limestone soils (*Encephalartos* **42**: 25, June 1995). I have been struggling with this topic for some time without a satisfying conclusion. Many of the *Cycas*, not just *C. revoluta*, growing in south Florida on our oolitic limestone and sand suffer from "frizzle top" (the browning and drying up of new leaves) that, from what I can gather, is a symptom of manganese deficiency in palms and presumably cycads as well. Manganese as well as other trace elements appear to become unavailable to plants in these alkaline soils. On my recent trip to Thailand all the *Cycas* species I observed there grew naturally on limestone or limestone derived soils. Dr. Si-Lin Yang, who has visited many *Cycas* populations in China and Vietnam, reports the same in these countries too. There is a difference, however, that may be significant. The limestones in Southeast Asia tend to be hard, metamorphic limestone. In fact I saw many of the Thai *Cycas* growing on marble. Perhaps there is some qualitative difference between different types of limestone - there may be chemical and nutritional differences in soils derived from limestones of different origins. This is my best guess.

***Willie Tang**, Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 331156-4299, U.S.A.*

Received 15 June 1995

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Dear Editor

PSEUDO-DEVELOPMENT IN CYCAD SEEDS

Whilst John Donaldson and Nat Grobbelaar seem concerned about the name for the phenomenon of embryoless seed development in cycads (*Encephalartos* **40**: 24-25 and **41**: 36-37), I am interested in the possibility of using such seeds for possible propagation.

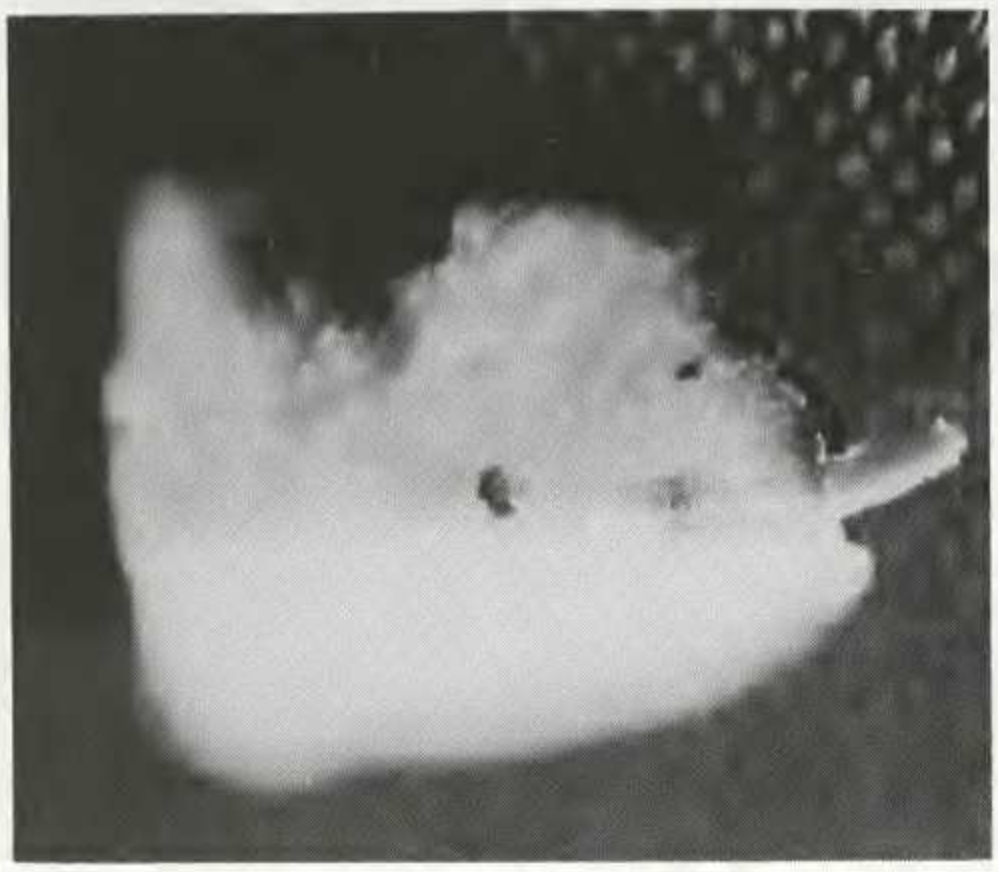

Figure 1 Section of *Cycas revoluta* "normal" seed showing an embryo and the germination process.

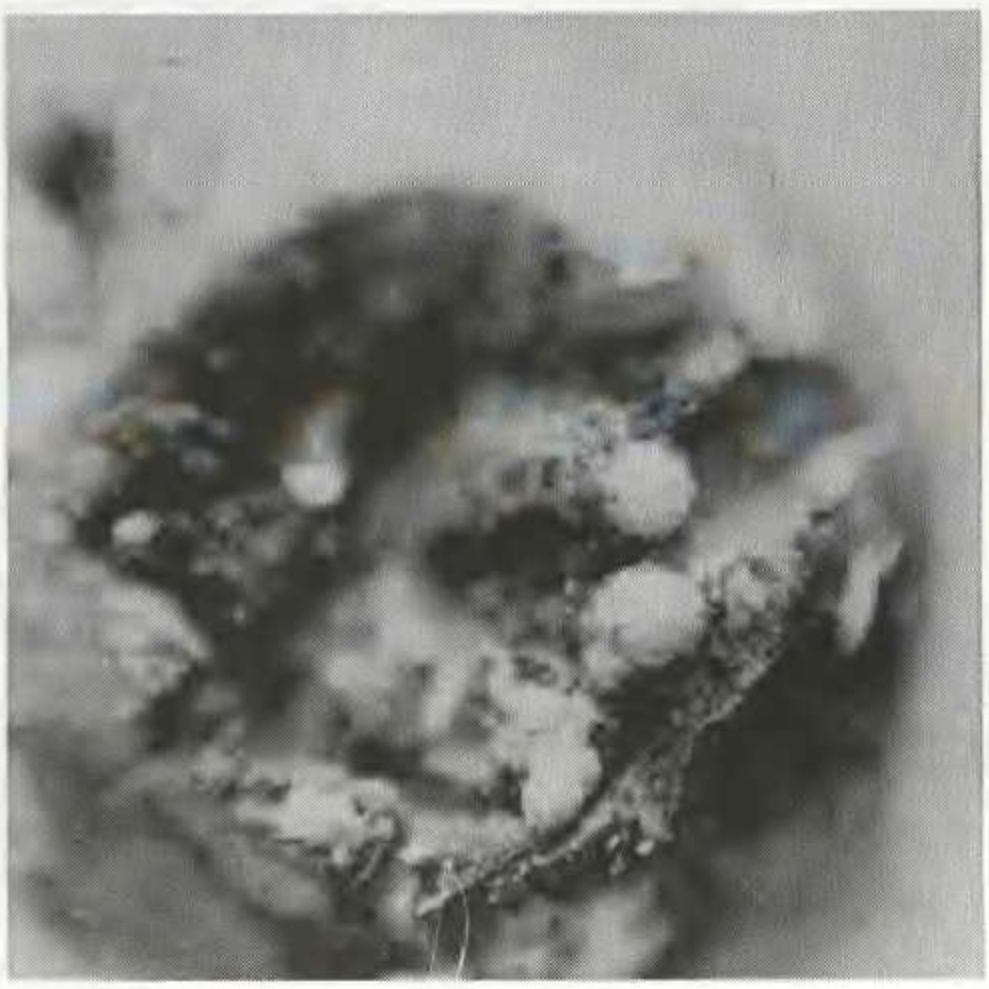

Figure 2 Section of *Cycas revoluta* embryoless seed material with callus protuberances after 2 years.

When I come across such embryoless seeds, it is my habit to dissect out contaminated or fungus-infected areas. This I have done, not only with *Encephalartos, Macrozamia, Dioon* and *Bowenia*, but also with *Zamia* and *Cycas* species, especially *C. revoluta*. When such seeds are maintained for a long period on a bed of damp vermiculite, occasionally sprayed with fungicide and a plant hormone mixture (used also for spraying tomato flowers), callus-like masses eventually appear (Figures 1, 2).

In August 1994, I had the pleasure of a visit from Piet Vorster who inspected my experiments with these embryoless seeds. I thereafter sectioned the seeds to establish the anatomical detail and the absence of the embryos was confirmed. The method of propagation of plants in this manner is, incidentally, well-known in citrus plants where clonal material, genetically identical to the mother plant, can be produced.

***Ottorino Stainer**, Via Lisbona 25, Treporti 30010, Venezia, Italy.*

Received 21 June 1995

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Dear Editor

REGULATIONS CONTROLLING TRADE IN CYCAD SEEDS

Whilst every cycad enthusiast with any conservation morality must agree wholeheartedly with a restriction on, and careful control over, the trade in wild-collected plants, it is abundantly obvious that restriction in international trade in seeds is viewed in a different light. This is clear from numerous recent letters-to-the-editor in "*Encephalartos*" and from common knowledge. The difference between trade in plants versus seeds concerns not only cycads but surely applies to many, if not all, categories of endangered plants.

There is an emerging consensus amongst cycad hobbyists and researchers that restrictions in import and export of seeds should be removed. The only argument against this is that widespread and continuous collection of seed from wild populations will have an ultimate negative impact on recruitment in those populations. However, it is not possible for any authority to determine, by inspection, if seeds are wild-collected or produced from plants in cultivation.

I believe it is the urgent responsibility of the Cycad Specialist Group to address this issue. This is especially true as more and more hobbyists become familiar with the techniques of artificial pollination, as informal pollen banks become established and with the development of communication networks of people sharing a common interest in growing cycads from seed.

My suggestion is that all CITES authorities are advised to issue permits for cycad seed import/export to any persons who can provide reasonable evidence that the seeds in question were obtained from cultivated plants. There surely can be guidelines for what might constitute "reasonable evidence". A rider can be built into the guidelines such that anyone abusing the system is blacklisted and has any further privileges withdrawn.

It is my concern that unless some system like this is instituted, more and more people will ignore any attempt to obtain permits, phytosanitary certificates, etc., and consequent loss of control will be far worse in conservation terms, than a system which could be monitored and would have a large measure of public support.

The Cycad Specialist Group must debate this matter timeously and pragmatically and subsequently make appropriate representations to CITES.

Roy Osborne, 20 Maryvale Road, 3630 Westville.

Received 12 June 1995

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Dear Editor

SOUTH AFRICAN DEPARTMENT OF ENVIRONMENT AND CITES REGULATIONS

As Chair of the IUCN Species Survival Commission's Cycad Specialist Group I would like to respond to Mike Michaelsen of the US Cycad Seed Bank re the problems his organisation has with the import of *Encephalartos* seed to the USA (*Encephalartos* **42**: 27, June 1995).

Under the CITES regulations no trade is permitted in wild collected specimens of Appendix 1 plants. The genera of *Encephalartos, Ceratozamia, Chiqua, Microcycas* and *Stangeria* as well as *Cycas beddomei* are all on Appendix 1. Trade in these species, whether plants or seed, is limited to Artificially Propagated specimens. These would be nursery grown seedlings or seed of garden origin. In terms of the Convention, CITES does therefore not prohibit the export of garden seed.

However, CITES accepts that certain Parties (= countries) may wish to implement Stricter Domestic Measures. In the case of South Africa, the Management Authority has chosen to do so on the grounds that they cannot physically distinguish garden produced seed from seed of wild origin. Two years ago the Department of the Environment which is the Management Authority for South Africa, instructed the Provinces not to issue CITES export permits for *Encephalartos* or *Stangeria* seed.

Since then the Natal Branch of the Cycad Society of South Africa as well as the IUCN Cycad Specialist Group has requested the South African Management Authority to reconsider the "ban". It was suggested that there could be no reason for refusing an export permit if the mother plants were inspected while in cone, in order to establish the bona fides of such seed. I regret to say that there has been no response to this suggestion from the Management Authority to date.

Furthermore it was pointed out to the authorities that refusing to issue CITES export permits for garden seed, has not in any way prevented the less law abiding to export both garden seed and wild collected seed under false declarations. The trade has simply been driven underground. Garden seed in most cases, is merely of horticultural interest as a large percentage is hybridized and as such does not contribute to the preservation of the species. The restriction on the export of garden seed therefore has no conservation merit.

Mr Michaelsen also questions whether the law is broken if seed is exchanged on a seed-for-seed basis. Regrettably this would still fall under the term "trade" in that "goods" to an equal value was received in return, whether money or seeds. However, the CITES restriction pertains only to wild collected seed and Artificially Propagated seed may with the relevant CITES export permits be donated, sold, bartered or exchanged under Article VII.5 of the Convention. The problem here is solely that the South African Management Authority has chosen to implement Stricter Domestic Measures in refusing to issue CITES export permits for garden seed.

***Cynthia Giddy**, Chair: IUCN Species Survival Commission, Cycad Specialist Group, P.O. Box 45, 3730 P.O. Umlaas Road.*

Received 5 July 1995

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Dear President and Editor

COMMENTS ON "FROM THE PRESIDENT" (*Encephalartos* **42**: 3, June 1995)

I presume that paragraph 3 of the editorial with regard to members complaints re the availability of pollen, seed and seedlings refers as much to the lack as to the price of seed and seedlings.

I fully endorse such complaints in that both the Pollen- and Seedbanks of the various branches are not supported by members of the Cycad Society. I served a 3-4 year term as Pollen Officer for Natal and can vouch for the fact that most of the members who returned the questionnaire giving details of their male plants, had less

than 5 mature plants in their collection and these were mainly of the more common species. Those that have large collections were conspicuous by their absence. However, large numbers of members requested (some not too politely) pollen of the rarer species and were vociferous in their condemnation of the Pollenbank if pollen of *Encephalartos latifrons, E. cupidus, E. dyerianus*, etc., was not available. From discussions with some of the other Seedbank officers it appears that they too have an imbalance between satisfying requests and member's donations and/or sale of seed to the seedbank.

In a free economy, market forces dictate the price of goods and this will include cycad seed and seedlings. Regrettably it is true that foreign buyers are prepared to pay more for seed and plants than the local ones on the basis of supply and demand. However, a quick appraisal of seed prices in Australian catalogues will show that their seeds, which are certainly more abundant than ours, are hardly cheap! Likewise buyers who have never grown cycads from seed are often not aware of the losses due to infertility, germination and transport failures, slow growth rates, frost and heat damage, and the cost of disease and insect control measures before the seedling reaches a marketable stage. Let alone obtaining seed of the rarer species!

***Cynthia Giddy**, P.O. Box 45, 3730 P.O. Umlaas Road.*

Received 6 July 1995

BOOK REVIEW / BOEKBESPREKING

HANDBOOK OF CYCAD CULTIVATION AND LANDSCAPING

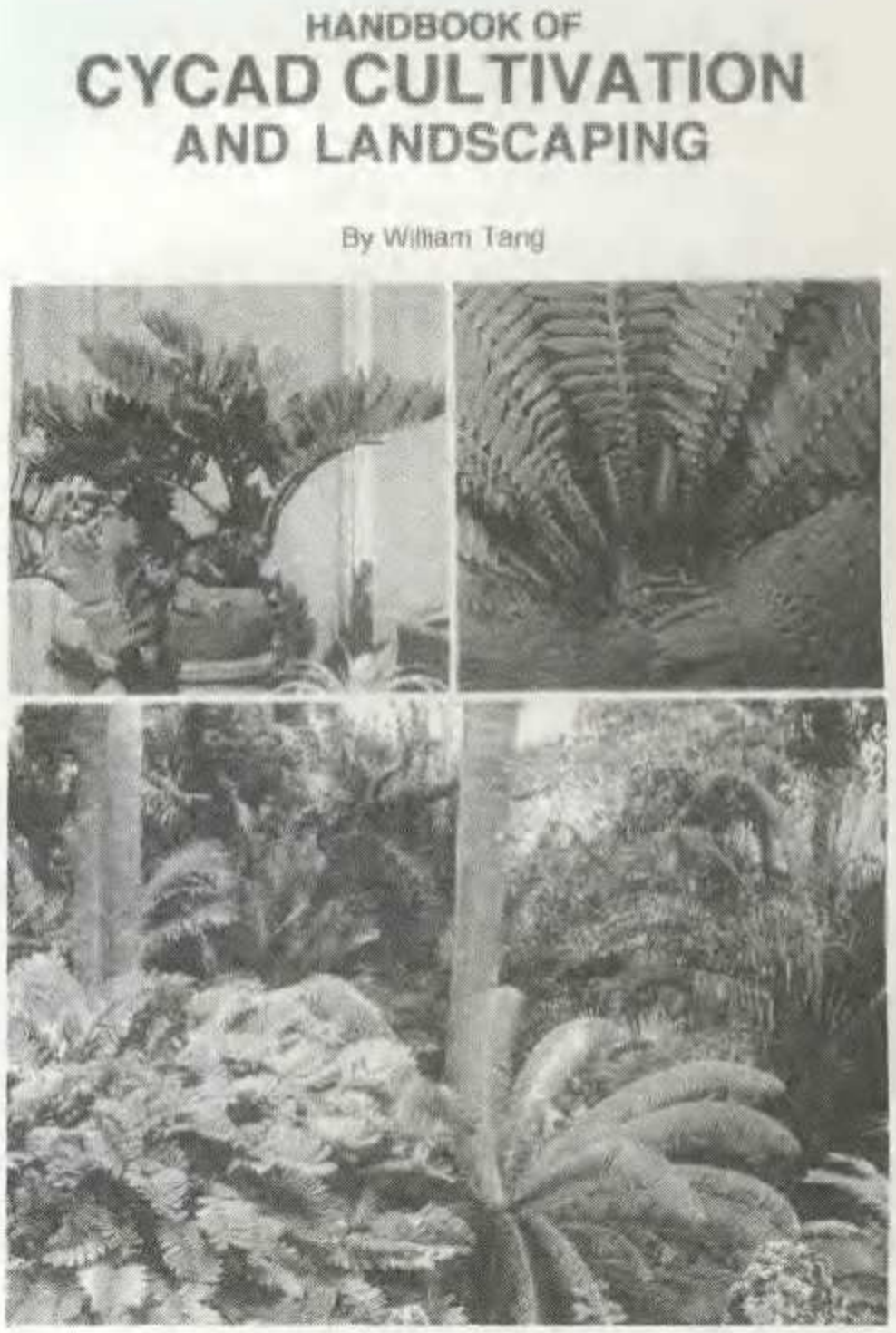
William Tang

Willie Tang is known to almost all members of the informal international cycad "network" for his enthusiasm and dedication to cycads. These qualities are abundantly clear in the production of his new booklet entitled "Handbook of Cycad Cultivation and Landscaping". The text is based on a thorough understanding of the subject and with an obvious assimilation of all the available literature. The 33-page text is copiously illustrated with high-quality full-colour plates. The subject material is logically divided into sections covering roots, stems, leaves, landscaping and propagation with tables giving useful data on growth rate, suitability for landscaping, maturation rate and seed production rate.

I have no hesitation in recommending this as a most useful booklet for the beginner and also for the more-experienced cycad enthusiasts.

Roy Osborne
20 Maryvale Road, 3630 Westville

[The booklet is available in South Africa from the Cycad Centre, P.O. Box 4726, 4000 Durban (phone/fax: 031-442505) at a price of R17.50. International readers may direct enquiries to Willie Tang personally (Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156-1299, U.S.A., phone 305-665-2844 or fax 305-665-8032).



Dehgan, B., Durando, J.E. & Yeager, T.H. 1994. Symptoms and treatment of manganese deficiency in *Cycas revoluta* Thunb. *HortScience* 92: 645-648.
[The authors report on an investigation into the fairly common problem of leaf chlorosis and necrosis in *Cycas revoluta* in the context of container and landscape plantings in Florida, U.S.A. Anatomical studies, analyses of leaf and soil samples and culture experiments were done. The conclusions were that both a high iron-to-manganese ratio (Fe:Mn>10) and a deficiency in managanese supply are implicated in the appearance of chlorotic symptoms, while soil pH, poor root structure and inappropriate irrigation practices have a contributing but less direct effect. Symptoms can be corrected by applying a manganese chelate. The authors conclude by recommending generally that cycads are supplied with a complete micronutrient fertilizer during growth in containers and prior to field planting.]
Authors' address: Dept. of Environmental Horticulture, University of Florida, Gainesville, Fl 32611, U.S.A.

Kawai, K., Furukawa, H. & Hirono, I. 1995. Genotoxic activity *in vivo* of the naturally occurring glucoside, cycasin, in the *Drosophila* wing spot test. *Mutation Research* 346: 145-149.
[The authors prepared a medium containing 10 μmol of cycasin/g feedstuff and fed this to the fruit-fly, *Drosophila melanogaster*. This resulted in the appearance of small and large single spots on the insects' wings, indicating a genotoxic response. Since micro-organisms from the gut of the insects had ß-glucosidase enzyme activity, it was concluded that cycasin is cleaved to the toxic MAM aglycone which then elicited the mutagenic response.]
Authors' address: Faculty of Pharmaceutical Sciences, Meijo University, Yagotoyama 150, Tempaku-ku, Nagoya, Japan 468.

Oh, C.H., Brownson, D.M. & Mabry, T.J. 1995. Screening for non-protein amino acids in seeds of the Guam cycad, *Cycas circinalis*, by an improved GC-MS method. *Planta Medica* 61: 66-70.
[The authors describe a method for the derivitization of the amino acid component after aqueous extraction from the megagametophyte. The derivitized components are then separated and quantified by gas-chromatography mass-spectrometry techniques. In the case of the material tested, the authors found ß-N-methylamino-L-alanine (BMAA) and four other non-protein amino acids. As reviewer, I am distressed to see that the authors continue to refer to the Guam cycad as *Cycas circinalis* which it most certeinly is not!]
Authors' address: Department of Botany, University of Texas, Austin, Tx 78713-7640, U.S.A.

Selva, A., Cardini, F.* & Chelli, M. 1994. Identification by tandem mass spectrometry of the very rare ß-carotenone isolated from leaves of two cycads. *Organic Mass Spectrometry* 29: 695-697.
[The authors continue previous work on the leaf pigments from *Ceratozamia kuesteriana* and *C. fuscoviridis*. A minor component has now been conclusively identified as ß-carotenone (5,6,5^1,6^1-di-*seco*-ß,ß-carotene-5,6,5^1,6^1-tetrone), previously known only from the fruits of *Triphasia trifolia*. The usefulness of the technique, known as MIKE (mass-analyzed ion kinetic energy) spectra of the metastable molecular ions, is the main thrust of this publication.]
** Author's address: Dipartimento di Biologia Vegetale, Universita degli Studi di Firenze, Via P.A. Micheli 1, 50121 Firenze, Italy.*

Tadera, K., Gin'ya, H., Sawada, R., Motani, Y., Aikawa, Y., Nozaki, A., Yaki, F. & Minami, Y. 1995. Cycasin formation in tissue culture of Japanese cycad. *Phytochemistry* 38: 1199-1201.
[Embryo, epicotyl and root material from seed and freshly-germinated seedlings of *Cycas revoluta* were cultured on half-strength Murashige and Skoog medium with 1% agar, 3% sucrose, 10 ppm 2,4-D and 0.1% activated charcoal. The cultures were grown in the dark at 30°C for one month, after which the resulting callus material was subcultured onto a similar medium but with 2 ppm 2,4-D together with various concentrations of NAA and kinetin. The greatest mass of callus, about a fourfold increase after one month, was obtained when 1 ppm NAA and 10 ppm kinetin were used. No differentiation was observed in any of the callus material. The callus material was analyzed by HPLC techniques for cycasin and MAM, neither of which was detected. However, when the callus was subcultured on a medium supplemented with MAM, small quantities of cycasin were found in the calluses after one week. In addition, the enzyme glucosyltransferase was detected in the callus material and appears to be implicated in the synthesis of cycasin from the exogenous MAM supply.]
Authors' address: Department of Biochemical Science and Technology, Faculty of Agriculture, Kagoshima University, 21-24 Korimoto 1, Kagoshima 890, Japan.

Wei, F. 1994. A new cycad from Guangxi. *Guihaia* 14: 300.
[This single page publication constitutes the description of *Cycas ferruginea* F.N. Wei, a Chinese cycad from Longzhou county in the south-west of Guangxi. The description comprises the mandatory Latin paragraph and is accompanied by a line drawing (with Chinese annotations) referring to material cultivated in the

Guilin Botanical Garden. There is no elaboration of how the new species is distinguished from other Chinese cycads, there are no ecological or historical notes and there is no indication of its conservation status.]

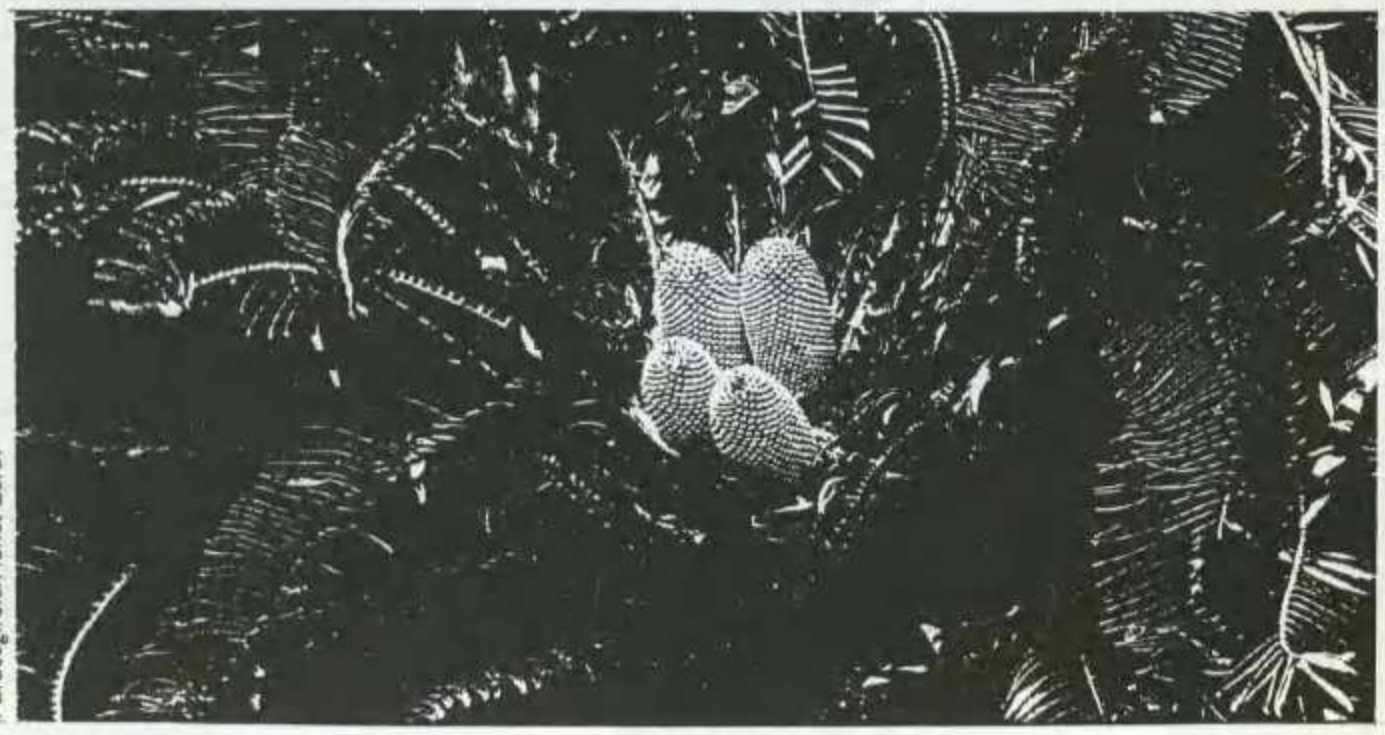
Author's address: Guangxi Institute of Botany, Guilin 541006, Peoples Republic of China.

Compiled by ***Roy Osborne****, Department of Chemistry, University of Natal, Durban, Private Bag X10, 4014 Dalbridge.*

NEWSPAPER CLIPPINGS / KOERANTUITKNIPSELS

Priceless plant foils thieves with hidden bug

NEW SCIENTIST



I. Bracegirdle/Planet Earth

Single male: no female specimen of *E. woodii* is known to exist

THE pilot who was given the job of flying South Africa's exhibits to the Chelsea Flower Show in London last week initially refused to carry the cargo. This was not because it included what some botanists consider to be the world's rarest plant—a cycad, *Encephalartos woodii*—but because he feared that the unique antitheft device buried in the plant might interfere with the aircraft's electronic instruments.

The device is a microchip implant, similar to ones that have been used to protect rare animals from thieves and smugglers. "As far as we know, South Africa is the first and only country to use such a device on a plant," says Jaap Pienaar of the Eastern Cape Department of Nature Conservation. "I was watching a TV programme about bugs being used to protect rare fish, and I thought 'if little fish, why not cycads?'"

Cycads are prime targets for plant smugglers, and the *E. woodii* sent to Chelsea would be a rich prize. The specimen, which is the star of the Kirshtenbosch Botanic Garden's display, was taken from a plant found on a mountain slope in Zululand a century ago. It was a lone male, and no other specimen has been found since. The plant flown to Chelsea and several hundred other clones have been grown from suckers sent out by the parent plant.

The microchip, coated in antibacterial cream, is concealed in a small hole in the plant's stem. "When we first experimented with microchip implants about three years ago we hadn't taken into account the pressure inside a plant as it grows, and the chips tended to work their way out," says Pienaar. The chip in *E. woodii* is encased in a barbed, Rawlplug-like structure designed to resist rejection.

But couldn't it be gouged out by a thief? "Not without seriously damaging the plant," says Pienaar. Besides, he says, it is extremely difficult to detect the bug without a special scanner.

Today in South Africa, all cycads transported across provincial borders have to be bugged in this way. Conservation authorities have even started bugging cycads in the wild, and use a satellite tracking system to keep tabs on them. The value of these plants makes it inevitable that smugglers will eventually find a way round the system, says Pienaar. "But at the moment this is the best form of protection we can think of." **Sue Armstrong,** Johannesburg

Lonely Natal cycad joins the jet-set

Very last of the species to be displayed at Chelsea show

The loneliest plant in the world — the only one left of its species — will be winging its way to Britain this week, reports JOANNE SHEPHERD SMITH.

One hundred years ago the lone male cycad, *Encephalartos woodii*, was found in the Ngoye forest in Zululand, northern KwaZulu-Natal, by John Medley Wood while on a botanical expedition.

All cycads are dioecious, having male and female reproductive parts on separate plants. To date, searches by botanists the world over, including the 10 000 hectare forest where the original male was found, have been unsuccessful making this plant extinct in the wild, and arguably the rarest in the world.

And the loneliest.

However, horticulturists have since propagated the only remaining examples from this original plant which is kept in the Durban Botanical Gardens, by taking divisions from the base or crown of the plant.

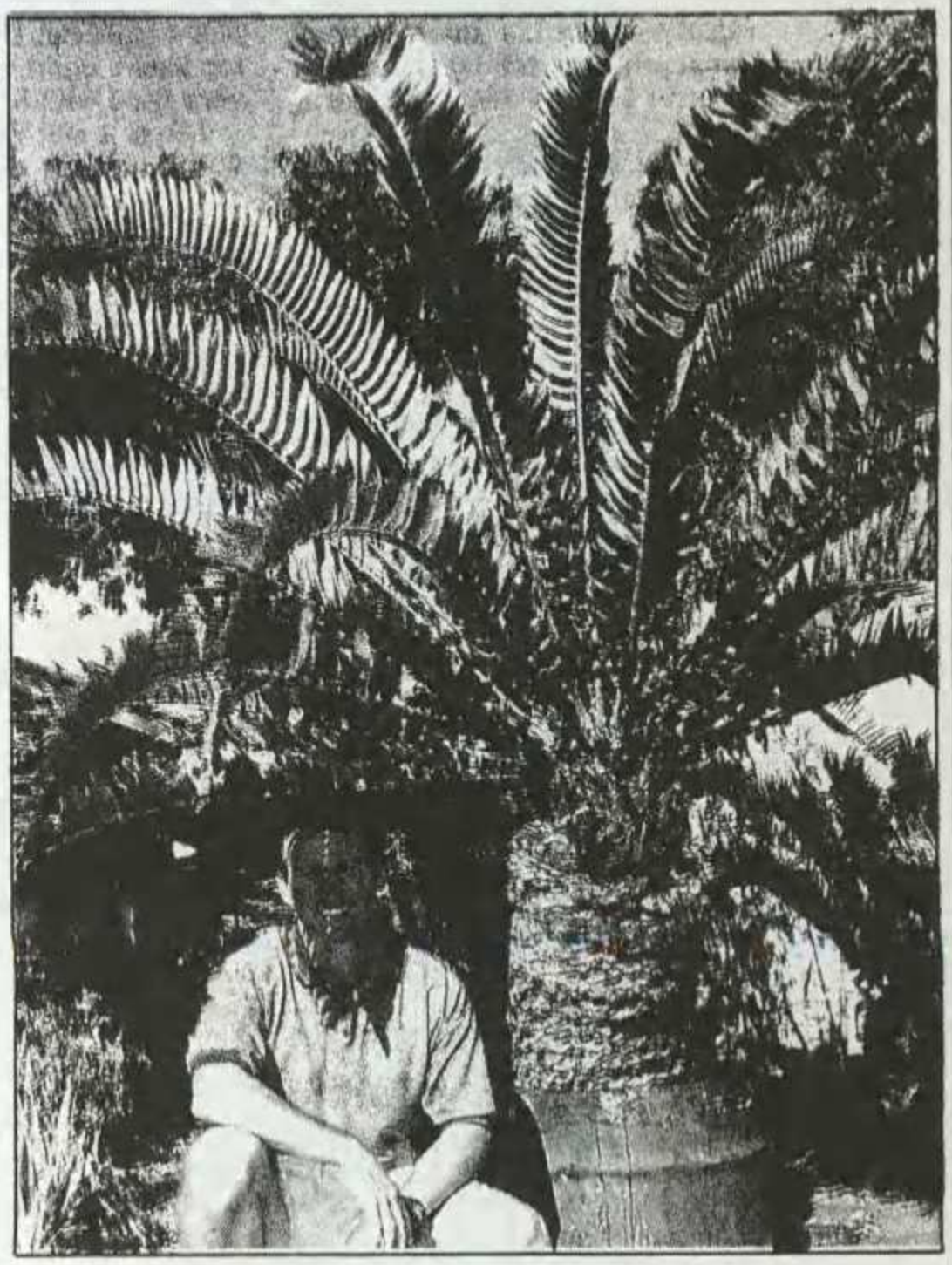
"This is a collector's plant and priceless," said Chris Dalzell, horticulturist in charge of special collections at the botanical gardens.

One of the divisions will be on display on the South African stand at the forthcoming Chelsea Flower Show. It will be flown in a sealed wooden crate and have a transponder, a safety device, fitted to keep track of its whereabouts and to ensure its safety.

"This is the first time this plant is leaving the country and it is to celebrate the 100 years since its discovery and its rarity," said Chris.

"We will also be taking cones to show people what they look like on the chance that a female will be found."

Cycads are among the most spectacular South African plants threatened with extinction, and in some areas they have become the flagship of plant conservation. There are 34 cycad species in the country, of which at least one is extinct in nature, three are immediately threatened with extinction and a further 12 are highly vulnerable.



SHOW-STOPPER: Horticulturist Chris Dalzell with Encephalartos woodii which will be on the Kirstenbosch Botanical Gardens display at the Chelsea Flower Show.
Picture: SHELLEY KJONSTAD

SUNDAY TIMES, May 28 1995

Cycad soufflé, Ma'am?

By CHERILYN IRETON: London

QUEEN ELIZABETH seemed to take a leaf out of the book of Marie Antoinette — she of "Let them eat cake" fame — this week when she probed the gastronomic merits of South African cycads at the Chelsea Flower Show.

"Are they edible?" she asked David Davidson of the National Botanical Institute at Kirstenbosch during her visit to the annual show.

Sadly, the female cycad cones that caught the Queen's attention are not an untapped source of cheap nourishment — they could even be deadly. There was a suspicion among botanical types at the show that the Encephelartos ferox, if ground down and eaten, would lead to a sickness not unlike encephalitis, which causes inflammation of the brain and sleeping sickness.

Mr Davidson said the cycads that interested the Queen were fairly common but took a long time to reach maturity, providing only one crop of seed cones each year.

The South African exhibit, which won its 19th Chelsea gold medal, also featured one of the rarest plants in the world, Encephalartos wooddii.

Bugged: Encephalartos

NEWSWEEK — 29•MAY •'95

SECURITY

Rare Plant

TO YOUR RUN-OF-THE-MILL black-market botanist, what's the single most valuable status symbol? A South African *Encephalartos woodii:* only 38 of them exist, and they're practically doomed to extinction because they're all male. Which is why keepers of one such South African cycad fitted their specimen with two silicon microchips before shipping it to London for this week's Chelsea Flower Show. The South African government has required border-crossing cycads from certain provinces to be bugged with the plant-tracking, thief-thwarting chips since the technology became available last June. Of course, stationing low-tech bodyguards around the plant doesn't hurt, either.

Landbou-Burger,

17 Februarie 1995

Broodbome skiet goed wortel op Knysna

BROODBOME skiet die afgelope jaar in 'n vinnige pas op by Knysna – nie hul natuurlike tuiste nie – en vorm al 'n stewige kolonie. Die bome gaan nog meer word en digter staan. So kosbaar is hulle dat elkeen genommer is.

Alle bekende besonderhede van elke broodboom hier word in 'n rekenaar geberg. Dit is van groot belang, veral vir navorsers, wat onder meer kan sien hoe oud die plant is, waarvandaan dit kom, van watter soort en geslag dit is en hoeveel keer dit al saad geskiet het.

Moontlik kry almal nog 'n mikroskyfie om hulle per satelliet te help opspoor in geval van onregmatige verwydering. Hierdie Jurassiese park in wording digby Knysna se oeroue woude en staatsplantasies is 'n waardevolle toevoeging tot die kwekerye in die land van die gesogte, skaars en duur plante, waarvan diewe hul hande nie kan afhou nie.

Die laaste paar maande het vier broodbome uit die kwekery verdwyn, al is dit omhein met veiligheidsdraad. 'n Alarmstelsel gaan aangebring word, en wagte sal die terrein met honde patrolleer.

Broodbome, wat 50 miljoen jaar feitlik onveranderd bestaan, veg vir die oorlewing teen sy grootste vyand, die mens, wat ook tot sy redding verskyn het met sy beskerming en kweking. Knysna se onderneming Broodbome vir Afrika is begin as 'n private reservaat, wat terselfdertyd 'n kwekery en botaniese park gaan word.

Dit sal daartoe bydra om die broodbome se posisie te verstewig, want elke soort is bedreig. In die natuur is hulle baie bedreig, dermate dat sommige spesies 'n kritieke oorlewingstadium bereik het. Van owerheidsweë kan hulle nie meer voldoende beskerm word nie omdat dit baie duur is.

Die projek is die geesteskind van mnr. Mark Richter. Sy vennoot, 'n vriend van King William's Town, is die Springbok hengelaar Mike Pantz. Hy is die enigste wêreldkampioen wat Suid-Afrika al in hengel opgelewer het.

Mnr. Richter het die idee van 'n broodboompark twee jaar gelede gekry terwyl hy op King William's Town in die klerebedryf was. Dit het hom nie meer sterk geïnteresseer nie. Toe hy die terrein sien waar die N2 die bopunt van Knysna se strandmeer kruis, het hy onmiddellik geweet dis uitgeknip vir sy doeleindes.

Dit kyk noord en is vanweë die opwaartse helling na agter goed gedreineer. Daarby is die klimaat reg van Knysna, een van Suid-Afrika se gewildste toeristebestemmings. Sy visioen was nie onrealisties nie – alles werk uit soos hy dit gesien het. Die navorsing is gedoen deur prof. Ray Osborne van die Universiteit van Natal (Durban), 'n wêreldkenner van broodbome.

Mnr. Richter het verlede Desember Knysna toe getrek en in Januarie met die ontwikkeling en uitleg begin op die terrein van 6 ha. Die twee vennote doen alles self met die hulp van agtien werkers, wat van Knysna is en werk nodig gehad het. Hulle word in diens opgelei.

Heel eerste moes 'n digte stand van uitheemse indringerplante en bome verwyder word, waaronder baie wattelbome. Dit het mnr. Richter-hulle baie moeite en R40 000 gekos, en hulle ontmoedig om 'n naasliggende 9 ha te koop vir die hervestiging van die inheemse plante.

Dit sal tussen twee en vyf jaar kos om die aangekoopte terrein ook te beplant met bome en struike wat in Suid-Kaapland voorkom. Daar is al 180 ingesit, en hulle sal tot 3 000 aangroei. In hul skadu sal Knysna se beroemde varings aangeplant word.

Grasperke van buffelsgras sal aangelê word. Daarnaas word 'n staproete van sowat 'n kilometer deur die broodbome beoog. "Ons bewaringsprojek sal hopelik vir die plaaslike gemeenskap en toeriste opvoedkundige voordele inhou," sê mnr. Richter, wat lesings hou oor broodbome.

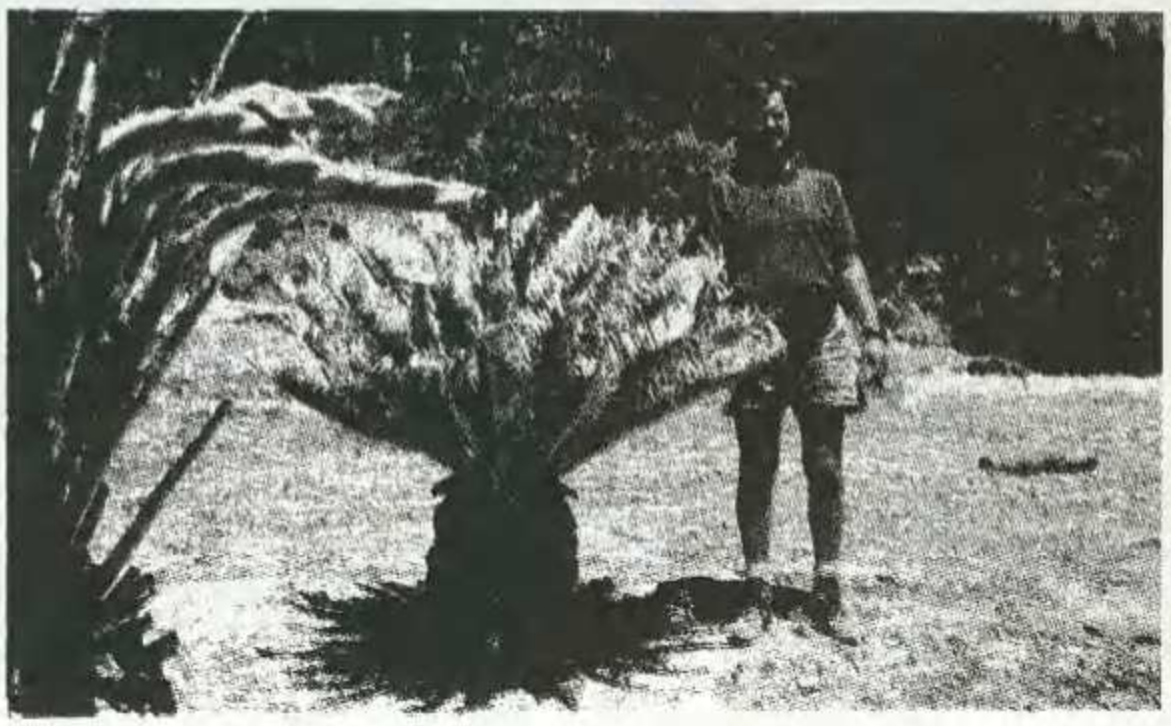
Geld vir die broodboompark sal gemaak word met 'n teekamer en die verkoop van broodbome teen R25 tot R500. Ook inheemse bome sal aangebied word en aandenkings soos hoede en T-hemde in drie of vier ontwerpe.

Die belangstelling uit die buiteland is 'n riem onder die hart van die bewaringsbewustes. Dit kom veral uit Australië, wat ook broodbome het, en Amerika, danksy die kennisse wat mnr. Richter gemaak het op die derde internasionale konferensie oor broodbome, wat verlede jaar in Pretoria gehou is.

Sedert die broodboom-gogga mnr. Richter in 1990 gebyt het, het hy 5 000 broodbome gekweek. Hy het begin belang stel omdat hy van tuine hou en broodbome hom betower, veral sedert hy agtergekom het hoe skaars hulle is en dat hulle op die gevaarlys is.

Hy het reeds sowat veertig soorte by Knysna gevestig en wil graag alle Afrika-soorte in sy versameling hê.

Broodbome vir Afrika se telefoonnommer is (0445) 87-1441, en die posadres is Bus 209, Knysna, 6570. Mnr. Richter is bereikbaar by ☎(0445) 87-1391.



Mnr. Mark Richter van Knysna in sy broodboomtuin.