

ENCEPHALARTOS

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SOUTH AFRICA

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VAN SUID-AFRIKA

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COVER / VOORBLAD : *Encephalartos friderici-guilielmi*

**A spent and tired male plant producing a new flush of leaves
to replenish its photosynthetic capabilities.**

Photo: Piet Vorster

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PLEASE NOTE

THE NEW POSTAL CODE (2551) OF THE SECRETARY - TREASURER

NEEM ASSEBLIEF KENNIS VAN

DIE NUWE POSKODE (2551) VAN DIE SEKRETARIS - TESOURIER

FROM THE PRESIDENT

Managing the finances of the Cycad Society of South Africa is one of the main tasks of Council. The only income of the Society is from membership fees and donations from members while the main expenditure is the printing and distribution of our quarterly journal, *Encephalartos*. Receiving *Encephalartos* is again one of the main benefits members receive from the Society. The printing and mailing costs for one issue of *Encephalartos*, depending on the number of pages, amounts to about R10 000-00. The income from membership fees is only about R40 000-00 which means that we are only covering the printing and mailing costs for the four issues per year, leaving a deficit for the current year. Escalating printing costs is an unknown factor and it is, therefore, not possible to work out an exact budget. Council is at the moment considering different options to solve the problem, but it will probably end up in an increase in membership fees. If any member can come up with a "magic" solution to prevent another hike in membership fees, we would be very much obliged to be informed accordingly.

I would like to kindly request foreign members to pay **their membership fee by an international money order, in South African currency made out to the Cycad Society of South Africa, and not by a personal cheque.** There are still some of the foreign members who are submitting their membership fee by sending personal cheques without consulting the international section of their bank beforehand to make provision for the extra costs involved. The costs involved to cash these cheques are often more than the equivalent of membership fee, with the result that we are in fact losing the money.

Our editor is struggling to get material for publishing in *Encephalartos*. At the same time some members are complaining that some of the articles are too scientific and that they would prefer reading more general "laymen's" articles. I would like to call on members to support our journal with letters and articles. Start by giving your opinion on the kind of article you would prefer or how we could solve our financial problems. What about a column on questions about growing of cycads? Such questions can then be answered by other members in the next issue or by experts we can contact. Any suggestions to improve the popularity of our journal would be very welcome.

Hannes Robbertse

VAN DIE PRESIDENT

Een van die belangrikste take van die Raad van die Broodboom Vereniging van Suid-Afrika is om die finansies van die Vereniging te beheer. Die enigste inkomste van die Vereniging is die ledegeld en skenkings van lede, terwyl die grootste uitgawe die druk en verspreiding van ons kwartaallikse tydskrif, *Encephalartos*, is. Om die tydskrif te ontvang is weer op sy beurt die belangrikste voordeel wat lede ontvang om aan die Vereniging te behoort. Die druk- en versendingskoste van een uitgawe van *Encephalartos*, afhange van die aantal bladsye, beloop tans ongeveer R10 000-00. Die inkomste verkry uit ledegeld is net ongeveer R40 000-00 en dus word slegs die druk- en versendingskoste gedek en sit ons vanjaar met 'n tekort. Stygings in drukkoste is 'n onbekende faktor en daarom is dit nie moontlik om 'n akkurate begroting op te stel nie. Die Raad is op die oomblik besig om verskillende opsies te oorweeg om die probleem op te los, maar dit sal waarskynlik eindig in 'n verhoging van ledegeld. Indien enige lid met 'n kitsoplossing vorendag kan kom om 'n verdere verhoging in ledegeld te voorkom, sal ons dit baie waardeer om daarvan te hoor.

Ek rig hiermee 'n vriendelike versoek aan alle buitelandse lede om hul ledegeld per internasionale geldwissel, in Suid-Afrikaanse geldkoers uitgemaak aan die Broodboom Vereniging van Suid-Afrika, te betaal en **nie per persoonlike tjek nie.** Daar is nog enkele buitelandse lede wat hul ledegeld per persoonlike tjek aan ons stuur sonder om vooraf met die buitelandse afdeling van hul bank in verbinding te tree om voorsiening te maak vir bykomende kostes. Die koste verbonde om so 'n tjek te verdiskonteer is dikwels meer as die ekwivalent van ledegeld, met die gevolg dat ons in werklikheid die geld verloor.

Ons redaktrise sukkel om voldoende materiaal te bekom om die tydskrif elke keer "vol" te maak. Terselfdertyd word klagtes van lede ontvang dat sommige artikels in die tydskrif te wetenskaplik is en dat hulle meer algemene artikels vir die "leek" sou verkies [asook meer bydraes in Afrikaans - Redaktrise]. Ek wil tog graag 'n beroep op lede doen om die tydskrif met briewe en artikels te ondersteun. Begin byvoorbeeld met u mening oor die soort van artikels wat u sou verkies of gee u mening oor hoe ons die finansiële probleem kan oplos. Wat van 'n rubriek oor vrae oor die kweek van broodbome? Sulke vrae kan dan deur lede in die volgende uitgawe van *Encephalartos* beantwoord word, of deur kenners wat deur ons genader word. Enige voorstelle oor hoe ons die populariteit van die tydskrif kan verhoog, sal baie welkom wees.

Hannes Robbertse

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 kollyg op:

ENCEPHALARTOS APLANATUS Vorster

Piet Vorster

Botany Department, University of Stellenbosch, Private Bag X1, 7602 Matieland, South Africa

INTRODUCTION

Continuing research at the University of Stellenbosch on the classification and biology of cycads, resulted in the description of a new species, *Encephalartos aplanatus*, in the *South African Journal of Botany* 62: 57-60 (1996).

DESCRIPTION

1. STEM

The plants lack aerial stems, the short stem being mostly underground but with the apex of stem usually exposed above ground. The stem is usually solitary (without branches or offshoots).

2. LEAVES

The leaves are few (2-6 or exceptionally 8 per plant). Soon after emergence they are erect and arching, but in very shady situations they sometimes become almost horizontal with age. They can be up to 3.5 m long with a petiole of up to 200 mm long (Figure 1). The petiole and lower rachis is covered with off-white and somewhat shaggy indumentum. The leaflets are directed towards the apex of the leaf at an angle of about 75° with rachis, and opposing leaflets are inserted at an angle of slightly less than 180° to each other. The basal leaflets are progressively reduced in size towards the base of the leaf with the lowermost leaflets reduced to prickles (Figure 2a). The median leaflets are very narrowly ovate and tapering to an acute but not pungent apex, with both margins sparsely dentate (very rarely entire)



Figure 1 *Encephalartos aplanatus*: plant in habitat with almost reclining leaves. Scale bar = 1 m.

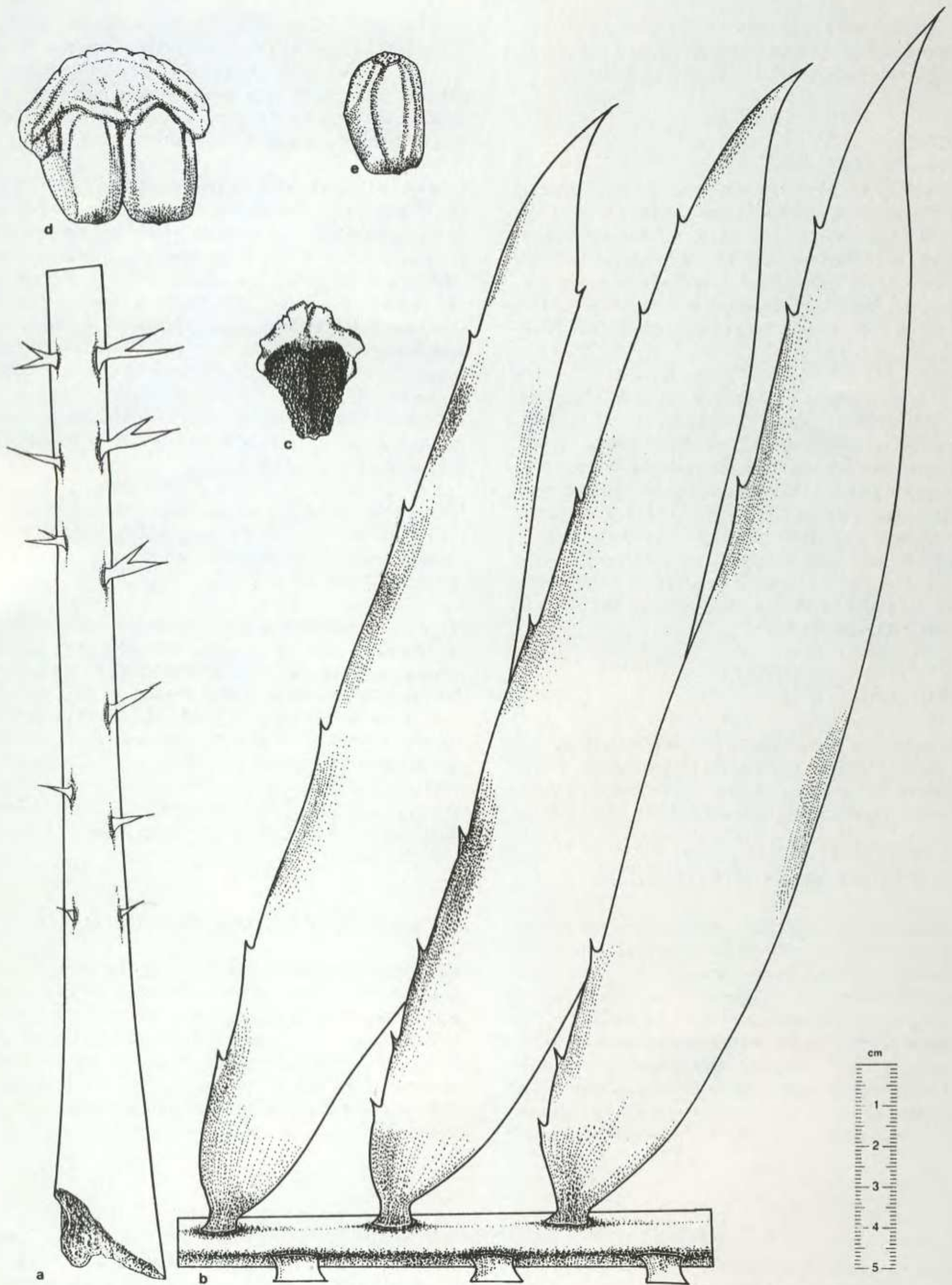


Figure 2 *Encephalartos aplanatus*: (a) petiole with proximal leaflets gradually reduced to prickles, (b) median leaflets, (c) microsporophyll (male cone scale) in abaxial view (lower surface), (d) megasporophyll (female cone scale) and seeds in abaxial view (lower surface), (e) seed with sarcotesta. Delineator: E.C. Vorster.

and somewhat wavy, relatively soft-textured, striate but not corrugated on the lower surfaces, dark glossy green, up to 300 mm long and 40 mm wide (Figure 2b).

3. CONES

The male cones number up to 3 per plant. They are up to 650 mm long and 80-100 mm across, on stalks up to 220 mm long, emerging green but turning pale yellow when maturing (Figures 3a & c). The exposed faces of microsporophylls (male cone scales) are flat, smooth, hairless; the facets are indistinct, with a sharp abaxial ridge which is not or only slightly fringed (Figures 3b & d).

The female cones number up to 2 per plant. They are about 400 mm long and up to 120 mm across, on short stout stalks up to 60 mm long, emerging dark green but turning bright orange-yellow on ripening (Figure 3e). The exposed faces of the megasporophylls (female cone scales) are flat, smooth, and hairless; and their facets are indistinct with a sharp abaxial ridge (Figure 3f) which is not fringed like often in *E. villosus* (Figures 3g & h). The seeds are ellipsoid with almost truncate ends, about 25 mm long and 13-15 mm wide, and the sarcotesta is bright red (Figures 2d & e).

PHENOLOGY

Observations on garden plants in Swaziland, Nelspruit, Pretoria, and Stellenbosch suggest that the cones appear in January, the pollen is shed in April, and the female cones disintegrate in late September to October.

AFFINITIES AND DIAGNOSTIC FEATURES

Encephalartos aplanatus closely resembles *E. villosus* (cf. Dyer, 1965) in its virtually identical cones (Figure 3), its acaulescent habit, and its small number (less than 10) of long and arching leaves (Figure 1) with the proximal leaflets gradually reduced to prickles (Figure 2a); but is distinguished by being altogether larger (leaves up to 3.5 instead of up to 2.5 m long) with leaves often shortly petiolate instead of sessile and leaflets larger (up to 300 x 40 compared to up to 250 x 20 mm) and more dentate with the margins twisted out of plane or somewhat

undulate (Figure 2b) rather than flat, hence the specific epithet. The apex of the stem is often exposed above ground, compared to completely underground in *E. villosus*. All plants seen were solitary, whereas *E. villosus* often suckers to form clumps. It was in fact figured under the name *E. villosus* by Dyer (1947).


Contrary to the author's philosophy (Vorster 1993) that the distinguishing characteristics of a species should lie in the reproductive (i.e. isolating) structures, this species is distinguished solely on vegetative characteristics. Although it resembles *E. villosus* in some respects as detailed above and may possibly be a close relative of that species, it is clearly distinct because of its vegetative morphological and geographical discontinuity with that species (see below). It might be argued that subspecific ranking would be more appropriate, but that would imply a close evolutionary relationship for which there is no proof. At this stage I am not in favour of subspecific ranking in South African cycads.

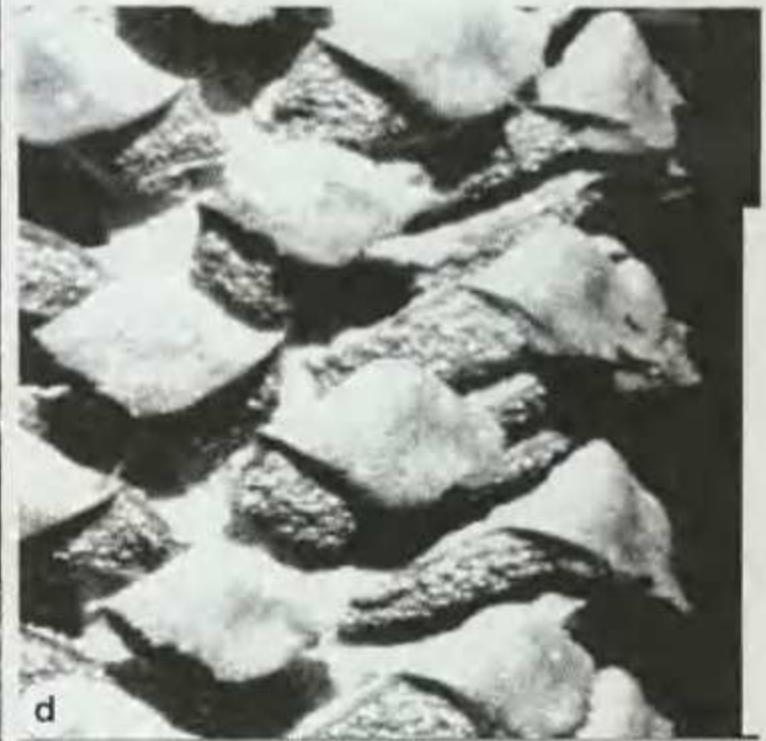
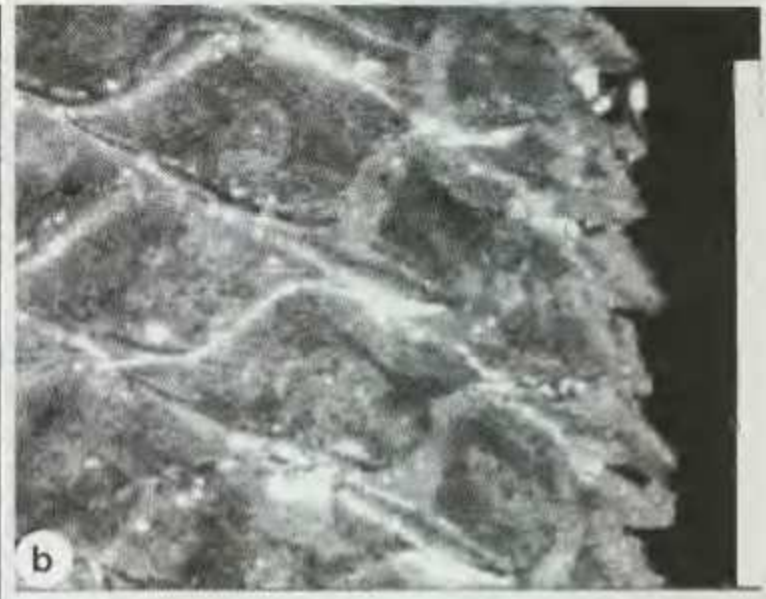
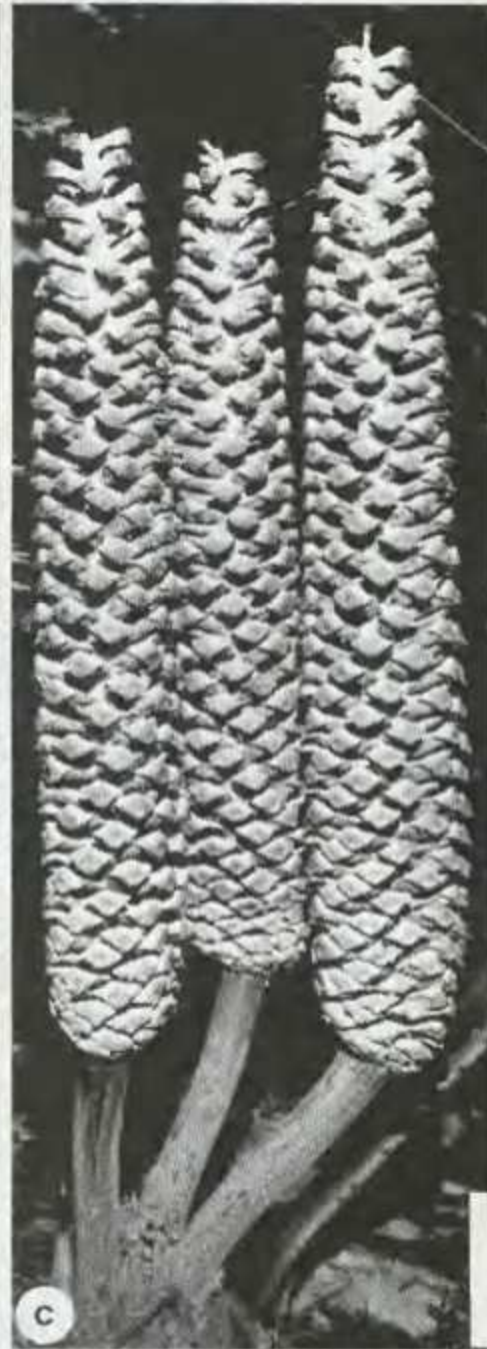
The known localities of *E. aplanatus* are situated approximately 100 km from the closest occurrence of *E. villosus*, and *E. aplanatus* is not considered to be a hybrid involving that species.

Very recent research by Rolf Oberprieler revealed that the cones of each of *Encephalartos aplanatus* and *E. villosus* harbour two related but distinct species of *Porthetes* beetles which are restricted to their specific host cycad species. These beetles, which may well be involved in pollination, provide additional support for the recognition of *Encephalartos aplanatus* (see Oberprieler, 1995). This discovery was the subject of a paper by Vorster & Oberprieler delivered at the Fourth International Conference on Cycad Biology in China, in May this year.

GEOGRAPHICAL DISTRIBUTION AND HABITAT

Encephalartos aplanatus is known only from a small area in the the north-eastern part of Swaziland. I saw it only once in the field, in a steep ravine where it occurred in rather dense shade cast by deciduous and fairly dry ravine forest (Figure 1). It is not known to occur together with either *E. villosus* or *E. umbeluziensis*, and is in fact separated by a about a hundred kilometers from the former.

 Figure 3 *Encephalartos aplanatus*: (a) immature male cones, (b) detail of same, (c) male cones at pollen shedding stage, (d) detail of same, (e) female cone, (f) detail of same showing lack of distinct facets and sharp but fringeless abaxial ridge on exposed faces of megasporophylls (female cone scales), (g) female cone of *E. villosus* from near Port St. Johns showing similarity to that of *E. aplanatus*, (h) detail of same showing sharp and fringed abaxial ridge on exposed faces of megasporophylls - this fringe was not observed in any specimens of *E. aplanatus* but neither is it constant in *E. villosus* so that it is not a distinguishing characteristic. Scale bars: a, c, e, g = 100 mm; b, d, f, h = 50 mm.



CONSERVATION STATUS

Some years ago a fair number of plants of this species appeared in gardens, no doubt the result of illegal collecting. In the course of a field expedition to its known native habitat only a single locality with a few scattered and not very healthy-looking plants was located. I was unable to locate it at localities where it was known to have occurred in the late 1940's, and it is concluded that its numbers which were probably never high, have been reduced by illegal collecting to a point of near extinction. Due to the nature of the land where it occurs, it is unlikely that it can adequately be protected, for which reason the precise geographical information is not made public.

The species is represented in the public collections of the Pretoria National Botanical Garden as well as the Lowveld National Botanical Garden at Nelspruit, but regrettably not in the National Botanic Garden, Kirstenbosch.

ACKNOWLEDGEMENTS

Permission to conduct research in Swaziland was granted

by the Swaziland National Trust Commission. In particular I wish to acknowledge the assistance received from Dr. J.S.M. Matsebula of that organization, as well as the help of Mr. J. Culverwell of the same organization for locating material in the field. For assistance and hospitality during fieldwork, I wish to thank Rev. H. Basson and Mrs. C. Giddy.

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ARTICLES / ARTIKELS

A PRELIMINARY ASSESSMENT OF CYCAD CONSERVATION AND DIVERSITY IN QUEENSLAND, AUSTRALIA

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ABSTRACT

Forty species of cycads in the genera *Bowenia*, *Cycas*, *Lepidozamia* and *Macrozamia* occur in the state of Queensland, Australia. All are protected species under the Queensland Nature Conservation Act (1994), with seven considered as ENDANGERED wildlife, 11 as VULNERABLE wildlife, nine as RARE wildlife and others as COMMON wildlife. Twenty-three species are present in conservation reserves. Major perceived threats to extant populations of all species are poaching (29 species), land clearing (24 species), apparent loss of

genetic variation due to poor recruitment (12 species), and selective clearing or poisoning by land-owners (eight species). Future research priorities are outlined.

1. INTRODUCTION

There are at least 200 species of extant cycads (Osborne 1995b), distributed in both the Old and New Worlds. Major centres of diversity for cycads are Africa (c. 60+ species), central America (c. 71 species) and Australia (c. 72 species). The living cycads are presently being



Figure 1 *Cycas cairnsiana* habitat.

subjected to intensive investigation by various *researchers* throughout the world, with a concurrent increase in knowledge concerning their biology, form, diversity and conservation status (cf. Jones 1993; Osborne 1995b).

Many cycads are under threat for various reasons, especially from habitat destruction, and sometimes from poaching by the hobbyist grower or subsistence landowner. In many regions of the world it is unlikely that adequate conservation of the indigenous cycad flora will be possible due to problems with deforestation, population growth and other changes in land-management (e.g. China: Chen 1994). Even where a system of conservation reserves and nature conservation laws are enacted, there remain widespread problems with enforcement (e.g. Osborne 1995a).

Australia is perhaps fortunate in having vast areas of largely undeveloped land with significant tracts that are yet to be completely altered for farming, housing or other activities. An active program by Australian national and regional Governments to create conservation reserves has also meant that a proportion of the continent's flora and fauna are in areas that are unlikely to be developed from their natural state.

Until the last five years the Australian cycads had remained poorly known, but there has been recent rapid progress with revisions of *Cycas* by K.D. Hill and *Macrozamia* by D.L. Jones reaching completion. Concomitant with this activity has been a major increase in the hobby of cycad collecting, as well as an awareness of the never-ending loss of biological diversity in Australia due to destruction of natural ecosystems for various purposes. All of these factors have contributed to advances in knowledge for Australian cycads on various fronts, yet in many respects they remain poorly known.

In the current paper, the diversity and conservation status of the cycads occurring in the state of Queensland is reviewed. There are at least 40 species of cycad in Queensland (Table 1), and this means that the state has more cycad taxa than any other Australian state (New South Wales has fewer than 20 species and the Northern Territory has fewer than 18 species), with approximately 56% of the Australian cycad flora and 20% of the world cycad flora. Thirty-seven of these species are endemic to Queensland, with one genus *Bowenia* also being endemic. Hence Queensland is undoubtedly very important for cycad diversity on a world scale.

2. DIVERSITY OF QUEENSLAND CYCADS

Four genera distributed in three families of cycads occur in Queensland if the family classification of Stevenson (1992) is followed, namely *Cycas* (Cycadaceae), *Lepidozamia* and *Macrozamia* (Zamiaceae) and *Bowenia* (Stangeriaceae).

2a. CYCAS

The genus *Cycas* occurs in Australia, Melanesia, Micronesia, Malesia, Asia and Madagascar and is estimated to contain 50 species (Hill 1994). The major centre of diversity for *Cycas* is in Australia where there are probably over 25 species. At least 16 species of *Cycas* occur in Queensland with seven described in the last five years (Hill 1992; Forster 1995b) and another six remaining to be described (K.D. Hill, *pers. comm.* 1995).

The Queensland species of *Cycas* are widespread throughout the state but are concentrated in northern and far-northern areas. The different species generally occur in open woodland, woodland or open forest communities that are dominated by species of *Eucalyptus* in the overstorey and with a diverse mixture of mainly grasses and legumes in the understorey (Figure 1). Some species (e.g. *C. silvestris* K.D. Hill and *C. sp.* (P.I. Forster PIF10549A) may occur in closed-forests such as microphyll vineforest and notophyll vineforest, and others (e.g. *C. media* R. Br.) occasionally on notophyll vineforest margins. The different species of Queensland *Cycas* are usually trunked, arborescent small trees up to 10 m in height (Figures 2, 3), although some species rarely attain more than 1 m in height (Figure 4). Basal or side suckers are rare and are usually the result of injury to the growing apex.

2b. BOWENIA

The genus *Bowenia* is endemic to Queensland, Australia and is currently thought to contain three species (Jones 1993). Two species occur in open forest communities on deep sandy to rocky substrates, whereas one species usually occurs in, or on the margins of closed forest communities such as notophyll vineforest. All species of *Bowenia* are small cycads with subterranean caudices and few to many leaves in their crowns.

2c. LEPIDOZAMIA

The genus *Lepidozamia* is endemic to New South Wales and Queensland, Australia and comprises two species that are greatly disjunct from each other. One species (*L. hopei* Regel) occurs in north-east Queensland in closed forests such as complex mesophyll vineforest, whereas the other (*L. peroffskyana* Regel) occurs in open

forest (Figure 5) or the margins of closed forest (rainforest) in south-east Queensland and north-east New South Wales. Both species of *Lepidozamia* are large, arborescent and tree-like, and usually are unbranched unless damaged. Some individuals of *L. hopei* are possibly the tallest living cycads at reputed heights up to 20 m (Forster 1995a).



Figure 2 *Lepidozamia peroffskyana* habitat.

2d. MACROZAMIA

The genus *Macrozamia* is endemic to Australia and occurs in Western Australia, Northern Territory, New South Wales and Queensland. There are at least 32 recognized species of *Macrozamia* (Jones 1993; Jones & Forster 1994), with about nine still to be described. Nineteen species occur in Queensland, all are endemic (Jones 1993; Jones & Forster 1994), except for *M. lucida* L. Johnson that also just occurs in north-eastern New South Wales (Forster & Jones 1995).

The different species of *Macrozamia* occur in a wide range of plant communities, ranging from woodlands and open forests, to heathland and closed forest margins. Most species are small to medium sized cycads with largely subterranean caudices (Figure 6), although some



Figure 3 *Cycas desolata* habit.



Figure 4 *Cycas media* habit.

are massive and arborescent such as *M. moorei* F. Muell. (Figure 7). Most are single-headed (Figure 8), although the development of multiple growing points on a single caudex is common in some species of *Macrozamia* section *Parazamia* (Jones & Forster 1994) (Figure 9).



Figure 5 *Cycas platyphylla* habit.

3. CONSERVATION CODINGS AND THE QUEENSLAND NATURE CONSERVATION ACT

Conservation Codings for the Queensland flora are allocated using the definitions outlined in the Queensland Nature Conservation Act and associated schedules (Queensland Government 1992, 1994).

X EXTINCT

"Native wildlife may be prescribed as presumed extinct wildlife

76.(1) If the Governor in Council is of the opinion that native wildlife is extinct, the wildlife may be prescribed as presumed extinct wildlife.

(2) Native wildlife is taken to be extinct if it has not been sighted in the wild for a period critical to its life cycle despite thorough searching."

E ENDANGERED

"Native wildlife may be prescribed as endangered wildlife

77.(1) If the Governor in Council is of the opinion that

- (a) native wildlife is in danger of extinction; or
- (b) the survival of native wildlife in the wild is unlikely if threatening processes continue;

the wildlife may be prescribed as endangered wildlife.

(2) Native wildlife is taken to be in danger of extinction if -

- (a) its number has been reduced to a critical level or its habitat has been so drastically reduced that it may be in immediate danger of extinction; or
- (b) it has not been sighted in the wild for a period critical to its life cycle although no thorough search has been made for it."



Figure 6 *Macrozamia lucida* habit.



Figure 7 *Macrozamia moorei* habit.



Figure 8 *Macrozamia cranei* habit.

V VULNERABLE

"Native wildlife may be prescribed as vulnerable wildlife 78.(1) If the Governor in Council is of the opinion that the survival of native wildlife is vulnerable if threatening processes continue, the wildlife may be prescribed as vulnerable wildlife.

- (2) Native wildlife is taken to be vulnerable if -
 (a) its population is decreasing because of

- threatening processes; or
 (b) its population has been seriously depleted and its protection is not secured; or
 (c) its population, while abundant, is at risk because of threatening processes; or
 (d) its population is -
 (i) low or localized; or
 (ii) dependent on limited habitat that is at risk because of threatening processes."



Figure 9 *Macrozamia viridis* habit.

R RARE

"Native wildlife may be prescribed as rare wildlife

79.(1) If the Governor in Council is of the opinion that native wildlife that is not threatened wildlife is rare, the wildlife may be described as rare wildlife.

(2) Rare wildlife may include native wildlife whose population is represented by -

- (a) a relatively large population in a restricted range; or
- (b) smaller populations thinly spread over a wider range."

C COMMON

"Native wildlife may be prescribed as common wildlife

80.(1) If the Governor in Council is of the opinion that -

- (a) native wildlife is common or abundant; and
- (b) the wildlife is likely to survive in the wild;

the wildlife may be prescribed as common wildlife.

(2) Native wildlife may be prescribed as common wildlife even though the wildlife is the subject of a threatening process."

At present for the purposes of the Queensland Nature Conservation Act, allocation of conservation codings to particular species is recommended by staff at the Queensland Herbarium (BRI), where the author is responsible for curation of the cycads. A Herbarium committee makes decisions about individual species based on available data as to various perceived threats using the criteria of Chalson & Keith (1995). A list of recommended changes or additions to Conservation Codings for the Queensland flora is forwarded to the Scientific Committee advising the Minister for the Queensland Department of Environment and Heritage, after which particular species become listed in the Schedule of the Nature Conservation (Wildlife) Regulation.

All species of cycads are considered as PROTECTED wildlife under the Schedule of the Nature Conservation (Wildlife) Regulation (Queensland Government 1994), with 27 listed (or with pending listings) as RARE or THREATENED wildlife under the categories of ENDANGERED wildlife (seven species), VULNERABLE wildlife (11 species) or RARE wildlife (nine species) (Table 1).

This system differs in a number of ways from the newly proposed system of Mace *et al.* (1992) which the IUCN adopted in 1994. The Mace *et al.* system was extensively used by Osborne (1995b) in his analysis of the conservation status of the world's cycads. Unfortunately the majority of population size estimates for Queensland cycads given by Osborne (1995b) are inaccurate, particularly because of the recent changes in taxon delimitation, but mainly due to inadequate survey data. Examples are *Macrozamia fearnsidei* D.L. Jones where it was estimated that only 1900 plants exist in the wild (Osborne 1995b: 5). Recent survey by the author would indicate that there may be as many as 15000 plants. Other species such as *M. miquelii*, *M. douglasii* and *M. mountperriensis* would have considerably more plants than indicated by Osborne (1995b). Obviously accurate surveys are required and Osborne's (1995) allocation of conservation codings for Queensland cycads is premature at this stage.

Under the current Queensland Nature Conservation Act legislation it is an offence to collect material (seeds, plants, foliage) of any cycad that occurs on State owned land (National Parks, State Forests, Vacant Crown Land, Lease-hold Land) without a licence. The taking of material on private freehold land can be approved under certain conditions. The sale of cycad plants on a commercial basis (i.e. more than five plants per month or 20 plants per year), is only possible with a license. Collected plants and plants for sale with a caudex greater than 100 mm diameter require tags that identify their origin. These tags are obtained from the Queensland Department of Environment and Heritage or can be generated by nurseries (under guidelines) where the plants are derived from seed or propagation from cultivated plants.

Cycads in Queensland are now "protected" by laws that if enforced can address some of the conservation issues that affect them. This is in marked contrast to the previous situation where none of the species were protected and cycads were listed under the "Noxious Weeds Act" whereby land-owners were encouraged to destroy them.

Twenty-three species of Queensland cycads occur in conservation reserves (Table 1); however, in some instances the populations are very small and may not adequately conserve the species.

Table 1 Queensland cycads

Taxon	Land tenure ¹	Conservation coding ²	Threats ³
<i>Bowenia</i>			
1. <i>B. serrulata</i> (W. Bull.) Chamb.	+1467	COMMON	C
2. <i>B. spectabilis</i> Hook. ex Hook. f.	+1467	COMMON	A
3. <i>B. sp. nov. A</i> (L.W. Jessup 910)	+47	COMMON	nil
<i>Cycas</i>			
4. <i>C. angulata</i> R. Br.	-7	COMMON	nil
5. <i>C. brunnea</i> K.D. Hill	+1	RARE	C
6. <i>C. cairnsiana</i> F. Muell.	-7	VULNERABLE	C
7. <i>C. couttsiana</i> K.D. Hill	-7	RARE	C
8. <i>C. desolata</i> P.I. Forst.	-7	VULNERABLE*	AC
9. <i>C. media</i> R. Br.	+1467	COMMON	AB
10. <i>C. megacarpa</i> K.D. Hill	+1467	ENDANGERED*	ABCD
11. <i>C. ophiolitica</i> K.D. Hill	-67	ENDANGERED*	ABCD
12. <i>C. platyphylla</i> K.D. Hill	-67	VULNERABLE	AC
13. <i>C. silvestris</i> K.D. Hill	-7	VULNERABLE	C
14. <i>C. sp. nov. A</i> (P.I. Forster PIF10549A)	+1	RARE*	C
15. <i>C. sp. nov. B</i> (P.I. Forster PIF15281)	+167	RARE*	C
16. <i>C. sp. nov. C</i> (B. Gray 2011)	-7	VULNERABLE*	AC
17. <i>C. sp. nov. D</i> (K.D. Hill 4683)	+1	RARE*	C
18. <i>C. sp. nov. E</i> (J.R. Maconochie 2694)	-67	COMMON	C
19. <i>C. sp. nov. F</i> (M. Lawrie AQ8423)	-7	RARE*	A
<i>Lepidozamia</i>			
20. <i>L. hopei</i> Regel	+147	COMMON	ACD
21. <i>L. peroffskyana</i> Regel	+147	COMMON	AC
<i>Macrozamia</i>			
22. <i>M. conferta</i> D.L. Jones & P.I. Forst.	+347	VULNERABLE	ACD
23. <i>M. cranei</i> D.L. Jones & P.I. Forst.	-7	ENDANGERED*	ACD
24. <i>M. crassifolia</i> P.I. Forst. & D.L. Jones	-7	VULNERABLE	CD
25. <i>M. douglasii</i> W. Hill ex F.M. Bailey	+4	COMMON	A
26. <i>M. fearnsidei</i> D.L. Jones	+147	VULNERABLE	ABC
27. <i>M. lomandroides</i> D.L. Jones	+147	ENDANGERED	ACD
28. <i>M. lucida</i> L. Johnson	+147	COMMON	A
29. <i>M. machinii</i> P.I. Forst. & D.L. Jones	+467	VULNERABLE	ACD
30. <i>M. miquelii</i> (F. Muell.) A.D.C.	+12467	COMMON	AB
31. <i>M. moorei</i> F. Muell.	+1267	COMMON	ABC
32. <i>M. mountperriensis</i> F.M. Bailey	+134567	COMMON	AB
33. <i>M. occidua</i> D.L. Jones & P.I. Forst.	+1	VULNERABLE	CD
34. <i>M. parcifolia</i> P.I. Forst. & D.L. Jones	+147	RARE	AC
35. <i>M. pauli-guilielmi</i> W. Hill & F. Muell.	+13467	ENDANGERED	ACD
36. <i>M. platyrachis</i> F.M. Bailey	+14	ENDANGERED	CD
37. <i>M. viridis</i> D.L. Jones & P.I. Forst.	+17	VULNERABLE	C
38. <i>M. sp. nov. A</i> (P. Machin PM16)	+14	RARE*	nil
39. <i>M. sp. nov. B</i> (P.I. Forster PIF12137B)	+467	RARE*	C
40. <i>M. sp. nov. C</i> (P.I. Forster PIF12269A)	-67	ENDANGERED*	ABC

Notes: Voucher details pertain to specimens lodged at the Queensland Herbarium (BRI).

+/- present or absent in a Conservation Reserve

* proposed rating (coding)

¹ Land Tenure categories

- 1 National Park
- 2 Environmental Park
- 3 State Forest Scientific Area
- 4 State Forest Reserve
- 5 Timber Reserve
- 6 Vacant Crown Land (roadsides, stockroutes, water-reserves)
- 7 Private Land (Leasehold or Freehold)

² Conservation Codings as defined in the Queensland Nature Conservation Act

³ Threat categories as defined in Section 4.

4. THREATS TO QUEENSLAND CYCADS

There are no quantitative data available on cycad populations in Queensland. The available data are primarily based on populations that have been recently vouchered in the Queensland Herbarium (BRI). In most cases these vouchers have been made by the author or by associates, enabling a qualitative assessment of population size and threats to the individual populations. Hence, the following assessments of threat are subjective and will undoubtedly be revised if sufficient resources are made available to quantitatively survey the Queensland cycads.

4a. HABITAT DESTRUCTION DUE TO LAND CLEARING

Land clearing continues apace in Queensland using a range of technologies from mechanical clearing with bulldozers, to selective poisoning of trees with herbicides. This clearing is primarily for the purposes of reducing the overstorey canopy thus enabling the understorey of grasses to increase, so as to ensure greater utilization of the land by grazing animals (cattle or sheep). Much of this land clearing has been undertaken or is still being undertaken with no recourse to the original biodiversity of the area or the long-term management implications.

While there is a fair idea of the current distribution of cycads in Queensland, it is most probable that many populations for which we have no records at all, have been completely destroyed in the last 200 years of European settlement. It is estimated that twenty-two species of cycad are directly threatened by current land-clearing practices.

4b. SELECTIVE POISONING DUE TO TOXICITY TO STOCK

Cycad foliage is poisonous when consumed by domestic stock such as cattle, sheep or goats and causes a condition known as "rickets" or "zamia staggers" where a posterior ataxia occurs with the animal's hindquarters becoming paralysed (Seawright *et al.* 1993). Consumption of the untreated seeds causes acute liver damage (Seawright *et al.* 1993). Cycads were previously listed under the "Noxious Weeds Act" of 1930 and land-owners were encouraged by Government authorities to destroy plants. Recognition that these are toxic plants continues today (e.g. Dowling & McKenzie 1993) and many rural land-owners continue to selectively destroy cycads by a variety of methods. In many instances there may be alternatives to destruction such as (a) fencing off the population, (b) selling the plants to collectors or landscapers. Attitudes are however slow to change and undoubtedly many cycads have become locally extinct because of these practises. It is estimated that eight species are currently directly affected by selected poisoning or clearing.

4c. COLLECTOR PRESSURE

Cycad poaching by hobbyist collectors is a world-wide problem (Jones 1993) and perhaps a hobby in itself. No cycad is really safe from this activity as many collectors have little or no respect for conservation laws, reserves or the genetic integrity of populations. There are a number of societies in Australia (and overseas) whose members are interested in collecting Australian (and selected Queensland) cycads. As well there are numerous individuals that may or may not belong to societies that illegally collect plants in small numbers for their own use, or in large numbers for potential resale and profit.

Until the recent enactment of legislation (Queensland Government 1994), there have been no laws to prevent poaching of cycad plants from the wild. Instead, land-owners were encouraged to eliminate them. In many respects there has been an entrenched culture of digging ("rescuing") plants from the field (cf. Kennedy 1986), and soon after the description of novelties, "study" expeditions have been mounted where the real aim seems to be the extraction of mature individuals (e.g. Anonymous 1992). Some plants (e.g. *Macrozamia platyrachis* F. Muell.) are only present in National Park or State Forests where permits would not be issued for their extraction. Despite this, mature individuals are common in trade, but have all apparently emanated from private land "legitimately from the owners of farms bordering the plateau" (National Park) (Butt 1994). Needless to say these populations on "farms" are not supported by herbarium vouchers or other documentary evidence and their existence remains suspect.

While there are few problems with the identification of mature individuals, the problem of seed of "unknown" origin remains. Preliminary investigations would indicate that each taxon of Queensland cycad tends to have seeds with particular characters. This appears especially so with species of *Cycas*; however, it would be premature at this stage to propose a legislative system of identification for seeds.



Figure 10 *Cycas* sp. (P.I. Forster PIF15281) habit.

As with any group of plants, some Queensland cycad species are more popular than others. A small number of species are used in the landscape trade (e.g. *Macrozamia moorei* F. Muell., various *Cycas* species, *Lepidozamia peroffskyana*), and there is a well established industry to harvest leaves for floral arrangements from *Bowenia serrulata* (Byfield Fern). Hobbyist collectors have tended to concentrate on *Cycas* species, particularly those with "blue" leaves such as *Cycas ophiolitica* K.D. Hill ("Marlborough Blue"), *C. platyphylla* K.D. Hill ("Petford Dwarf"), *C. couttsiana* K.D. Hill ("Glen Idol") (Figure 10) or *C. cairnsiana* F.

Muell. ("Mt Surprise") (Figure 11). In some instances this has resulted in local extinctions due to the extraction of mature plants (e.g. *C. ophiolitica* at Marlborough). To a lesser extent the hobbyist collectors have dug up plants of *Bowenia*, *Lepidozamia* and *Macrozamia*, particularly those miniature species with spiral leaves in *Macrozamia* section *Parazamia*. Large cycads such as *Lepidozamia* species and *Macrozamia moorei* require specialist earth-moving equipment (cf. Walkley 1985) and are expensive in time and transport costs, although they are ultimately a valuable commodity in the landscaping trade (Figure 12).



Figure 11 *Cycas cairnsiana* habit.



Figure 12 Field collected *Macrozamia moorei* for sale at a landscape nursery.

Some localities are well known and species such as *Cycas platyphylla* ("Petford Dwarf"), *C. cairnsiana* ("Mt Surprise"), *C. ophiolitica* ("Marlborough Blue"), *Macrozamia lomandroides* D.L. Jones, *M. platyrachis* and *M. pauli-guilielmi* W. Hill & F. Muell. have been heavily poached. It is estimated that twenty-nine species are poached to varying degrees. In addition to this live plant trade, there is considerable collection of seed from a wide range of species, particularly from *Bowenia*, *Cycas* and *Lepidozamia* species.

4d. GENETIC VARIATION AND REPRODUCTIVE BIOLOGY

Knowledge of genetic variation in the Queensland cycads has been non-existent until recent times. Unpublished electrophoretic work on *Macrozamia* (I. Sharma, D.L. Jones & P.I. Forster, in prep.) will address this to some extent, but further in-depth studies are required of individual populations, as well as work on the other genera. At this stage it can be stated that removal of individuals (even for so-called "legitimate" collections in Botanic Gardens elsewhere) or large quantities of seed, have unknown effects on the genetic integrity of individual populations and species.

Likewise knowledge on the reproductive biology of the Queensland cycads remains minuscule, although it would appear that some general trends of non-specific insect associations can be inferred (Forster *et al.* 1994). It does appear that a diversity of invertebrates are dependent on the Queensland cycads for part or all of their life-cycles (Ornduff 1989, 1991; Forster *et al.* 1994; Forster & Machin 1994) and that the stage at which seed is harvested may directly impinge on some of these animals to an unknown amount.

Some populations of Queensland cycads, particularly some species of *Macrozamia* section *Parazamia* have little evidence of recent recruitment and no sign of insect associates during reproductive events. These facts can perhaps be interpreted as evidence that the cycad populations are "in trouble" from the reproductive biology angle, but casual observations such as these may be found incorrect as more thorough knowledge of their reproductive biology and regeneration cycle develops (cf. Donaldson 1995).

Given all of these variables and unknowns, it is estimated that twelve species are threatened due to an apparent loss of genetic variation because of ineffective reproductive biology.

5. FUTURE RESEARCH PRIORITIES

It is likely that a reasonably accurate classification for the Queensland cycads will be arrived at in the near future. Further work is required in some complex species (e.g. *Macrozamia miquelii*) or species complexes (e.g. *Cycas media* and supposed introgressed integrades with *C. ophiolitica* [Hill 1992]).

Research on the effects of seed removal on genetic integrity of populations is probably one of the main priorities, as without this there is no real way to set "ecologically sustainable" limits for seed harvest as required under the Queensland Nature Conservation Act. Likewise, the effect of leaf harvesting in *Bowenia serrulata* must also be a research priority. The potential

for in-depth studies on pollination biology, recruitment and general population growth and function remains limited only by human interest and resources.

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DOMINICAN REPUBLIC *ZAMIA* AND CITES

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INTRODUCTION

There is one species of cycad native to the island of Hispaniola in the Caribbean (see Figures 1, 2). It has a wide, but patchy distribution on the eastern portion of the island within the country of Dominican Republic (Zanoni 1982). It is abundant at certain localities, particularly in the southern coastal areas on limestone. The taxonomy of this *Zamia* is currently under debate. It has been referred to as a distinct species *Z. debilis* and *Z. latifoliolata* (Stevenson 1987), as a local variant of a single widespread West Indian species *Zamia pumila* (Eckenwalder 1980), and most recently as a population of *Zamia pumila*, which is considered by Stevenson (1987) to occur in central Cuba and southern Puerto Rico, as well as the Dominican Republic.

This species of cycad has been exploited in large numbers in the international trade in recent decades. Wholesale quantities of field-collected plants have been shipped from the Dominican Republic to Miami, Florida since the 1970's. Trade figures collected by the U.S. government indicate that from 1979 (the first year with reliable records) until 1989 an average of over 25 000 plants of this *Zamia* were imported from the Dominican Republic to the United States annually (Figure 3; Tang 1996). These plants were distributed widely and are often found in private collections.

CITES AND ITS ENFORCEMENT

CITES, the Convention on the Trade in Endangered Species of Wild Fauna and Flora, is an international agreement that was ratified and put into effect in the 1970's. The original purpose of CITES was to regulate the international trade in endangered animals and plants, so as to prevent their extinction. Cycads, as a group, have been a focus of CITES from its inception. Below I describe how CITES was enforced to control the trade in the Dominican Republic *Zamia* and evaluate its effectiveness.

Although CITES was ratified by the United States in the mid 1970's, enforcement was slow to take hold. In the United States the enforcement of CITES for plants is carried out by Plant Protection and Quarantine (PPQ), a branch of the U.S. Dept. of Agriculture (USDA). It appears that the trade in this cycad continued unimpeded from the 1970's through the 1980's. The Dominican Republic was not a signatory nation of CITES until 1987 and this may have contributed to lax regulation.

The first serious attempt to enforce CITES regulations on this trade began in 1990. The major importer of this plant into the United States at the time was Costa Nursery, then one of the largest wholesale nurseries in the world. Costa Nursery operates a large propagation nursery in the Dominican Republic and makes



Figure 1 A specimen of the Dominican Republic *Zamia* in cultivation. Photo: M. Perry.

shipments of plants by ship, in refrigerated trailers, to its nursery in Florida through the port of Miami approximately every two weeks. The author observed large numbers of wild-collected Dominican Republic *Zamia* in Costa's Florida Nursery as early as 1986. These were being sold to retail department store chains in Florida as well as other parts of the United States and even Europe. Wild-collected plants of this cycad were frequently seen for sale at the department store chain Home-Depot, in Central Florida (M. Perry *personal communication*).

In 1990 a shipment of 6000 cycad stems being imported by Costa Nursery was detained by PPQ. These were identified by the author as wild-collected stems of *Zamia debilis*. The CITES document accompanying this shipment was issued for 6000 *Cycas revoluta* and was thus invalid. Under U.S. legislation the shipper is given 21 days to produce corrected CITES documentation. If the shipper is unable to produce the proper CITES documents the shipment is forfeit and sent to a rescue centre at the discretion of the U.S. Fish and Wildlife Service (see Tang [1993] for a detailed discussion of CITES regulations concerning cycads). Approximately one week later Costa produced another CITES



Figure 2 Old and immature female cones of the Dominican Republic *Zamia* in cultivation. Photo: M. Perry.

certificate, this time for plants of *Zamia furfuracea*. Again this was the incorrect species, however, the PPQ officer on duty at the time was unfamiliar with cycads and released the shipment.

The CITES authorities in the Dominican Republic were contacted via an intermediary, Thomas Zanoni of the Jardín Botánico Nacional. They indicated that they do not issue CITES permits for wild-collected plants of their native *Zamia*.

After this incident a period of several years followed in which Costa Nursery stopped importing wild-collected stems of the Dominican Republic *Zamia*. It appears that just the threat of enforcement and prosecution was effective in curtailing trade. Costa Nursery imports many types of plants for the foliage industry in the United States, with sales in 1989 exceeding 20 million dollars. Cycads make up only a small fraction of the total. Nurseries like Costa are probably concerned about their overall relationship with customs officials and may opt to avoid risking their entire operation for one small item.

CYCAD IMPORTS FROM HISPANIOLA

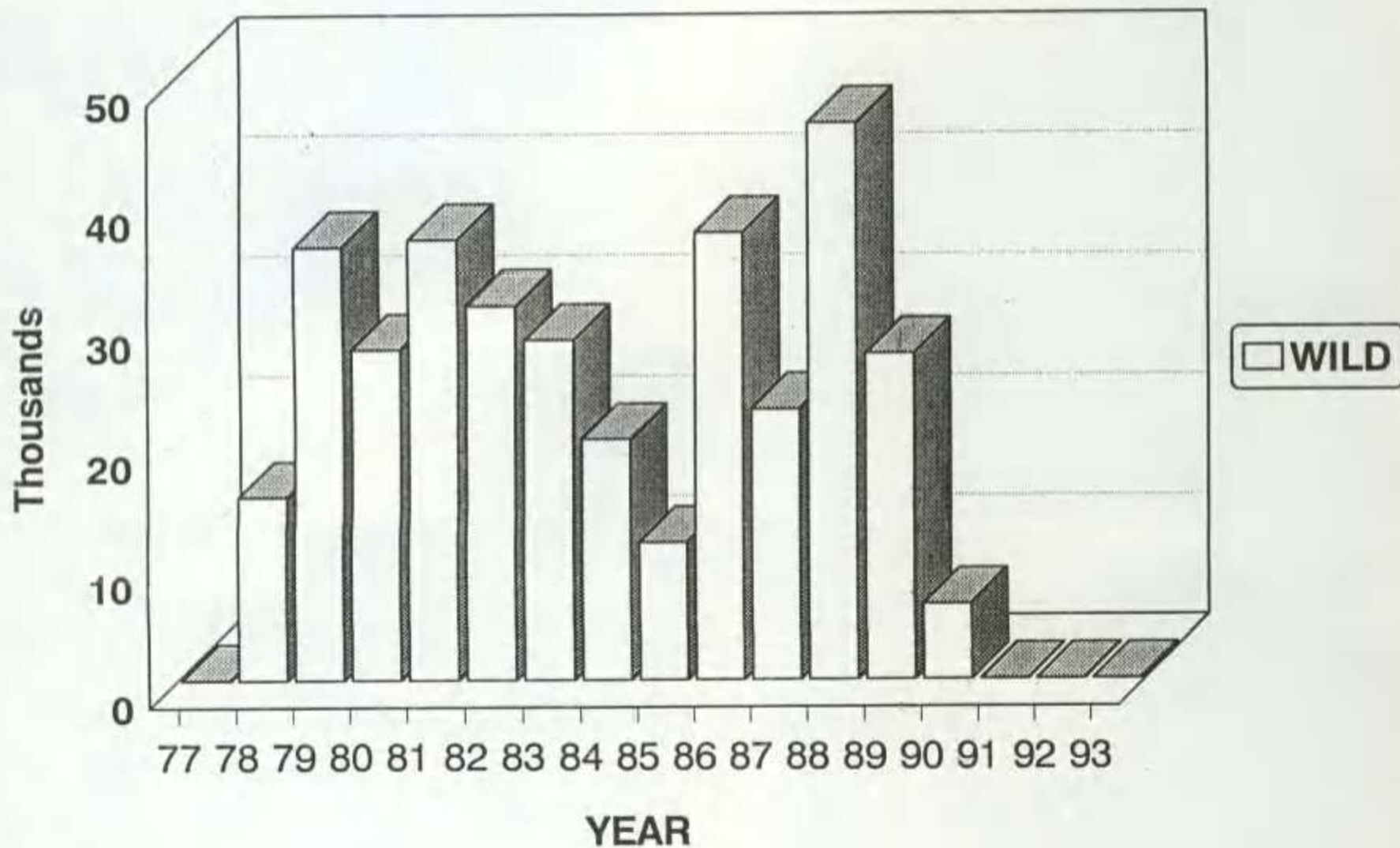


Figure 3 Imports of wild-collected *Zamia* from the Dominican Republic to the United States from 1979 to 1993 based on CITES data.

SMUGGLING

In October 1993, during an inspection of Costa Nursery, large numbers of wild-collected Dominican Republic *Zamia* were once again observed (Figure 4). Many thousands of plants at various stages of rerooting and leaf growth were seen. Some rows of plants were without leaves and those in other rows had leaves at various stages of maturity. The rows were labelled "Sto. Domingo" along with a date, apparently indicating their origin in the Dominican Republic and the date they were shipped out of that country. Examination of two years of PPQ records encompassing the dates on the labelled plants indicated that no wild-collected plants of this species had been declared in any imports of live plants into Miami. The obvious conclusion was: Costa Nursery was now smuggling these cycads into the United States.

Examination of Costa Nursery shipments were intensified. PPQ ordered "strip outs" (intensive inspections) of Costa Nursery trailers in an attempt to detect smuggled cycads. These strip outs were done randomly and were also conducted on live plant shipments of other companies so as not to alert Costa of the investigation. A joint undercover investigation

involving both the USDA and the U.S. Fish & Wildlife Service was initiated. Finally in November of 1993 undeclared, wild-collected plants of the Dominican Republic *Zamia* were discovered during a strip out of a Costa Nursery shipment (see Figure 5). The importer was confronted with the evidence and legal proceedings were begun by the USDA with threats of fines and penalties. Under U.S. Fish & Wildlife regulations criminal indictments could have been served as well. In this case they were not. Smuggling appeared to stop.

CONCLUSION

CITES was originally created to protect endangered species by curtailing their international trade. This case study demonstrates the positive use of CITES, as a tool to fight the wholesale removal of cycads from the wild. Like most laws and regulations, however, CITES is not perfect and it has effects that may not have been originally intended. For instance, restrictions on the international trade in cycads: (1) discourages artificial propagation and the trade of seeds and seed-grown cycads (Tang 1992) and (2) inhibits importation of specimens used for scientific research. It is



Figure 4 Wild-collected *Zamia* at Costa Nursery in 1993. The label on the pot reads "Sto. Domingo". Some of these plants were labelled as being sold to "Wal-Mart".



Figure 5 A 40-foot container of live plants belonging to Costa Nursery is stripped out under the supervision of a PPQ officer. In the foreground are sacks of undeclared, wild-collected *Zamia* recovered from deep inside the container. Photo: L. Castaneda.

the author's opinion that the cultivation of cycads and their scientific study are worthwhile endeavours which encourage a better understanding and appreciation of these unusual plants. CITES regulations are often enforced blindly, regardless of the situation involved. In a case cited by Anderson (1993), CITES may ultimately be detrimental to the conservation of a cycad

species by preventing the sale of wild-harvested seeds by locals who would otherwise see no value in preserving these plants.

In the case of Costa Nursery, the prohibition on the trade in wild-collected plants was paralleled by an increase in the production and importation of seed-grown cycads. The latest import figures indicate that the number of seed-grown cycads imported by Costa Nursery into the U.S. currently exceed 100 000 a year, far exceeding previous imports of wild-collected plants (Tang 1996). Discouraging degradation of wild populations and encouraging artificial propagation as a substitute - these, I believe, are the best goals of CITES legislation and the purpose which it should remain focused on.

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William Tang is a member of the IUCN Species Survival Commission, Cycad Specialist Group, a group which makes recommendations on changes in CITES regulations.

AN INTERESTING EXPERIMENT IN CROSS POLLINATION BETWEEN CYCADS

Shri Dhar

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Received 19 February 1996

Although I am an amateur gardening enthusiast, I have a fairly large collection of palms, cycads, etc., in my garden at Calcutta. One of these is a grand old *Cycas siamensis*, almost a hundred years old, with its characteristic elephant's foot-like swollen base of the trunk (Figure 1).



Figure 1 *Cycas siamensis* female plant; early coning stage. Note the characteristic swollen base of the trunk.

One fine morning I noticed that this plant had started to form a crown of sporophylls which, when fully developed, became a beautiful orange coloured crown

(Figure 2). I realized that this was a female plant and that without pollination, and resultant fertilization, it would not produce seeds.

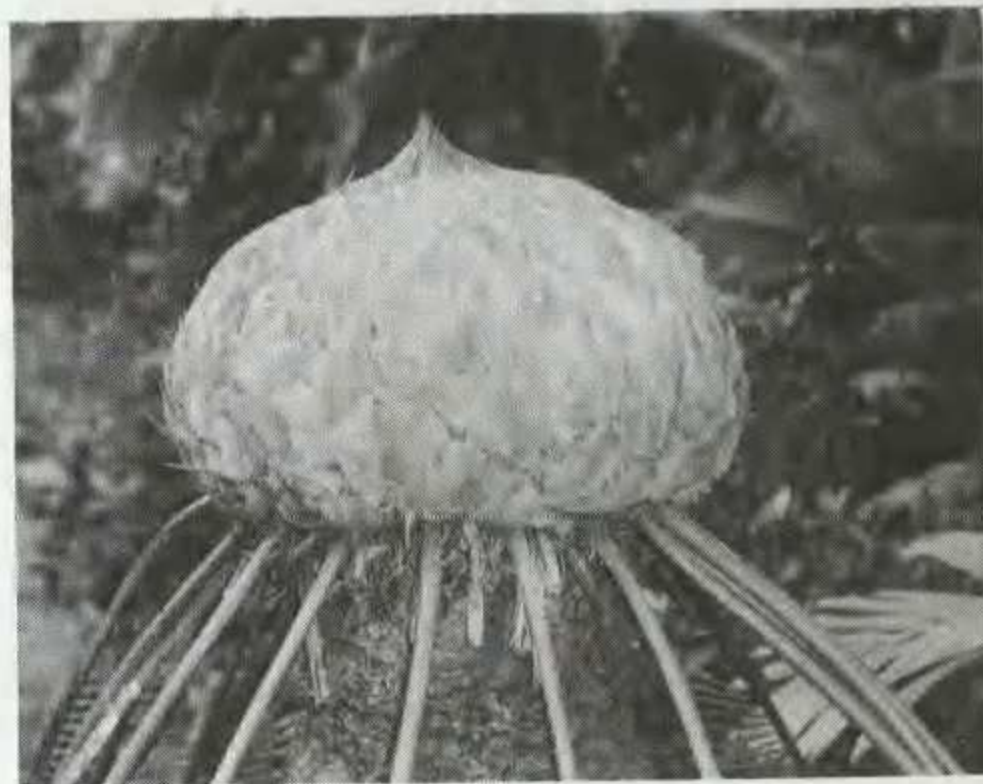


Figure 2 *Cycas siamensis*; female cone at a later stage.



Figure 3 *Cycas siamensis*; female cone showing the megasporophylls and ovules/seeds in detail.

The pollinating agents for *Cycas* species are probably beetles or other insects and not birds. However, at that time I had no *Cycas* male plants in cone in my garden.

By some coincidence, about a year back, I had collected some pollen from my *Cycas rumphii* male plant and had stored it in my refrigerator. I had read that cycad pollen is viable for three years if kept under refrigeration and so I used the *C. rumphii* pollen on my *C. siamensis* by manual dusting of the pollen. After a couple of months my efforts were rewarded and I was excited to catch a glimpse of ovules between the megasporophyll layers. Because the ovules grew larger and became clearly visible (Figure 3) I am optimistic that fertilization had taken place to produce seeds.

Interestingly, before the megasporophyll-head had started to form, the crown of leaves began drooping and by the time the head had formed fully, all the leaves had drooped down (Figure 4). The emergence of leaves, called circinate vernation (coiled inwards from the tip), is typical of all *Cycas* species. So in this *C. siamensis* plant all the leaves emerged at a time, then drooped exposing the megasporophyll-head.



Figure 4 Photograph of the *Cycas siamensis* plant showing the drooping leaves.



Figure 5 Photograph of the *Cycas siamensis* plant showing the old drooping leaves, female cone and new leaf flush.

I was quite surprised to see the *Cycas siamensis* plant producing a new flush of leaves with the megasporophyll-head still intact, leaving the older leaves drooping as before (Figure 5). It is quite an interesting phenomenon.

After the seeds ripen, we will know if they are viable or not. It will take another 10 to 15 years when the seedlings mature before we can actually see whether the hybrids have developed the characteristic form of the mother or the father plant. This whole cycle has been very fascinating and so I thought I would like to share my experience with friends.



NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0039 Lynn-oos

Ontvang 1 April 1996

Lede van die tak het op 20 Januarie 1996 'n uiters interessante voordrag gehoor wat deur dr Elsie Steyn (Figuur 1) van die Nasionale Botaniese Instituut oor haar navorsing gelewer is. Nadat *Encephalartos villosus* vroulike keëls kunsmatig bestuif is het dr Steyn periodiek van die saadknoppe verwyder. Hulle is dan gefikseer en in was ingebed alvorens elke saadknop in honderde dun skyfies gesny word. Elke skyfie is later mikroskopies bestudeer om vas te stel hoe bevrugting en die latere embryo-ontwikkeling presies plaasvind. Sodanige werk is nog nooit voorheen op *Encephalartos* spesies gedoen nie en is uiters tydrowend.



Figure 1 Dr Elsie Steyn van die Nasionale Botaniese Instituut.

Uit die werk wat dr Steyn sover gedoen het wil dit voorkom asof die bevrugtingsproses, soos dit by *E. villosus* plaasvind nie noemenswaardig verskil van die proses wat vroeër vir broodboomsoorte van ander genusse waargeneem is nie. Allerlei ander interessante waarnemings is egter tydens haar studies deur dr Steyn gemaak. Hierdie navorsingsprojek is ongelukkig nou gestaak. Ons wens dr Steyn egter sterkte en voorspoed

toe met haar toekomstige navorsingsprojekte.



Figuur 2 Moedeloos gestoot om die bakkie uit die modder te kry rus party van die mans terwyl ander lyf wegsteek met allerlei slim praatjies.



Figuur 3 Die agterosse stap verslae tussen die ploegvure wat die voorste voertuie in die modder gemaak het deur, want nou is voetslaan die enigste wyse om by die broodbome te kom.

Lede van die Streektak het saam met lede van die Dendrologiese Vereniging op 9 Maart 'n avontuurvolle uitstappie na 'n natuurreservaat naby Mica in die noordoos Transvaal onderneem. Weens die baie reën het ons 4-wielaangedrewe voertuie sommer binne die eerste kilometer vanaf die reservaat se ingang vasgeval (Figuur 2) en ons moes toe die res van die sowat 6 km



Figuur 4 Een van die majestueuse eksimplare van *Encephalartos dyerianus* in die natuurreservaat naby Mica. Vergelyk die grootte van dr Schutte op die rots met die plant se grootte.

(vir my het dit meer na 60 km gevoel!) onder warm vogtige toestande voetslaan (Figuur 3). Al die pyn en sweet was egter die moeite werd toe ons bo-op die rotsbesaaide koppie kom. 'n Pragtige gesig het ons begroet. Reuse eksimplare van *Encephalartos dyerianus* (Figuur 4) het oral vol in keël gestaan en beide manlike en vroulike keëls was oop en gereed vir bestuiwing (Figuur 5). Giel, Karl, Emmerien en ander lede het dan ook 'n handjie bygesit om moeder natuur te help.

Nat Grobbelaar het vertel oor die interessante geskiedenis van die ou *Encephalartos eugene-maraisii*-kompleks en ook allerlei vrae beantwoord.

Ons tak het later by die Natuurbewaring Afdeling van die Noordelike Provinsie aansoek gedoen om die res van die plante in die reservaat kunsmatig te bestuif en verstaan dat dit wel deur sekere van ons lede gedoen is. Ons hoop, om wanneer die saad gereed is, 'n gedeelte daarvan aan ons lede beskikbaar te stel.

Ons hartlike dank nogmaals aan die Dendrologiese Vereniging met wie ons die uitstappie kon meemaak.

Baie dankie ook aan veral Charles de Kock vir sy reëlings met Johan Barnard, Chris Snyman en die verantwoordelike Natuurbewaringsbeampte. Dit was werklik 'n aangename en leersame belewenis.



Figuur 5 Vroulike keëls van *Encephalartos dyerianus* in die reservaat naby Mica gereed om bestuif te word.

----- Toekomstige aktiwiteite:

6 JULIE: Mnr Johan Hurter van die Laeveldse Nasionale Botaniese Tuin by Nelspruit sal 'n lesing en skyfievertoning aanbied oor "Die broodbome van Kenia, Uganda en Tanzanië". Die voordrag sal om 14h00 in die hoofgebou van die Nasionale Botaniese Instituut, Pretoria, aangebied word.

7 SEPT: Uitstappie na "Starvation Creek" naby Kaapsche Hoop in die Oos-Transvaal onder leiding van mnr Ian Davidson van Pretoria, vir die bestudering en besigtiging van *Encephalartos laevifolius* en *E. humilis* in habitat. Belangstellendes vergader om 08h00 by die ingang van die dorpie Kaapsche Hoop. Persone wat van Pretoria of die Witwatersrand reis volg die N4 via Waterval Boven en draai net na die

SAPPI-fabriek af na Kaapsche Hoop.

Die Natuurbewaringsowerheid van Mpumalanga het toestemming vir die uitstappie verleen op voorwaarde dat die getal deelnemers tot 25 beperk word. Dit noodsaak dat ons die uitstappie slegs tot lede wat betyds geantwoord het sal moet beperk. Ons is jammer hieroor want ons wil ons uitstappies graag gesinsgeleenthede hou maar dit sal nie regverdig teenoor lede wees as hulle ten koste van nie-lede uitgesluit word nie. R.S.V.P. aan Hanneke voor 23 Augustus 1996 by telefoon 012-8080995.

2 NOV: Skyfievertoning en praatjie deur dr Piet Vorster van die Universiteit van Stellenbosch oor "Onlangse nuwe broodboomontdekkings in suider Afrika". Die voordrag sal om 16h00 in die hoofgebou van die Nasionale Botaniese Instituut,

Pretoria, aangebied word. Die praatjie sal deur 'n bring-en-braai by Hollandhuis, in die tuin van die Nasionale Botaniese Instituut, Pretoria, aan die noordelike kant van die rant gevolg word. Die bestuur van die Streektak sal pap en vleis gratis voorsien maar verder moet elke deelnemer sy/haar eie eet- en drinkgoed sowel as eetgereedskap voorsien. Bring gerus ook jou eie veldstoel en musiekinstrument saam as jy kans sien om die verrigtinge met 'n bietjie musiek op te vrolik. Lede wie se vanne op A - M begin moet asseblief vrugteslaai bring terwyl diegene wie se vanne op N - Z begin asseblief mengelslaai moet bring. R.S.V.P. aan Hanneke by 012-8080995 voor 25 Oktober 1996.

As u plante of sade het om uit te stal of te verkwansel, kan u dit gerus na die byeenkomste op 6 Julie of 2 November bring. T-hemde en dasse met die Streektak se embleem daarop sal by al die byeenkomste te koop aangebied word.

PACSOA ANNUAL SHOW AND PLANT SALE

Roy Osborne

281 Buckley Road, Burpengary, Queensland 4505, Australia

Received 4 April 1996

For the 12th year in succession, the Palm and Cycad Societies of Australia Ltd (PACSOA) held its annual plant show and sale at the Mt Coot-tha Botanic Gardens, on the outskirts of Brisbane, over the weekend of 2-3 March 1996. This is the group's most public event and its main source of funds outside of membership fees. Up to 2000 visitors attend the show (Figure 1) and an enthusiastic crowd always gathers before opening time on the first day in order to secure their "special" palm or cycad on the plant sale (Figure 2).

About 50 members of the Society, generally from the southern Queensland section of PACSOA, help to prepare and staff the event, which comprises a major exhibition of palm and cycad plants, a seedbank sales operation, a bookstore and, of course, the plant sales function. As a first-time participant in the show, I was much impressed by the quality, diversity and reasonable prices of the many palms and cycads on sale, and also how willingly members of the Society "pitched in" to get the whole show prepared and to assist throughout the weekend. About 30 members offer plants for sale and 20% of the revenue accrues to PACSOA; this "commission" usually translating to about \$5000. [Wild-collected material is not permissible for these sales;

indeed, the Nature Conservation legislation in Queensland dictates that a special licence is required to sell any native cycads with a caudex diameter greater than 10 cms.]

Stan Walkley, President of PACSOA, said that he was pleased to see a number of rare species becoming available for distribution, e.g. *Encephalartos whitelockii*, *Zamia neurophyllidia* and *Z. splendens* amongst the cycads, and *Basselinia eriostachys*, *B. gracilis* and *Cyphophoenix elegans* in the palms. He was also enthusiastic about the quality of the plant display, which had been planned by local architect David Tanswell. He wished to express thanks to all those who gave their time to assist in this important event and especially all the ladies who excelled in the catering section.

Each year the exhibition has a special focus; this year the feature was a display of rattan palms together with some interesting articles made from these palms. In previous years the special features have included such items as Madagascan palms, cold-tolerant palms, *Chamaedorea* and *Rhapis* palms. Cycads have not yet been much of a feature but their increasing popularity may change this in future.



Figure 1 Visitors enjoying the palm and cycad exhibition at the PACSOA 1996 Annual Show. Photo: Lou Randall.



Figure 2 Part of the large variety of palms and cycads offered for sale at the PACSOA 1996 Annual Show. Photo: Lou Randall.

It seemed obvious that this type of display and sales activity could be a key function for any of the

palm and/or cycad groups, not the least those in South Africa, the U.S.A. and other parts of Australia where there are large numbers of hobbyist-growers.

NEW REGULATIONS CONCERNING CYCADS IN THE PROVINCE OF GAUTENG

Nat Grobbelaar

P.O. Box 15357, 0039 Lynn East, South Africa

Received 1 April 1996

Cycad enthusiasts will be pleased to hear that:

- (a) it no longer is necessary to request the Nature Conservation authorities to issue you with an ownership permit when any of your Transvaal cycads attains a stem diameter of 150 mm - as used to be the case. Other cycads were always exempted from this regulation.
- (b) for the transfer of ownership of a cycad of any size, the new owner must merely obtain a letter of donation from the previous owner - this applies only to South African species - for other species no documentation is required.

The following regulations have not changed:

- (a) Permits must be obtained to sell South African cycad species - both seedlings and bigger plants. Permits are not required for the sale of other species.
- (b) For the export/import of cycads of any size to/from another Province or country an export

permit must first be obtained from Gauteng or the other Province or country. This permit must be sent to the importing Province or country from whom an import permit must be obtained. It will depend on the Importing Province or country whether this will apply to all or only certain cycad species or plants of certain sizes.

Please note that the permits mentioned above and letters of donation will normally also serve as transport permits.

[In die Noordelike Provinsie is die opstel van nuwe regulasies nog nie afgehandel nie en is die Ordonnansie op Natuurbewaring (Ordonnansie No 12 van 1983 en die regulasies ingevolge daarvan opgestel aangaande spesiaal beskermde plante) van die ou Transvaalse Provinsiale Administrasie nog van toepassing (Deon von Wielligh, Natuurbewaring Nylstroom, *persoonlike mededeling*, 2 April 1996).

Ook in Noordwes Provinsie is die regulasies van die ou Transvaalse Provinsiale Administrasie nog van toepassing (Giel Fourie, *persoonlike mededeling*, 10 April 1996).
- Redaktrise.]

Excerpts from a letter to Piet Vorster:

ARTIFICIAL HYBRIDS INVOLVING CYCAS REVOLUTA

In your letter in *Encephalartos* 42: 27 you asked if anyone had crossed *Cycas revoluta* with other species.

I know of four different people who have crossed *C. revoluta* with *C. taitungensis*. The cross ends up being a tight-growing plant, twice as fast as *C. revoluta*. But that cross is most likely because they are closely linked. A cross you would be interested in would be *C. revoluta* x *C. siamensis*. These produced seedlings and the same person has a second seed set this year.

MULTIPLE CONES IN CERATUZAMIA

I would like to make a comment on your description of the *Ceratozamia mexicana* in *Encephalartos* 42: 1 (cover photo). I have small colonies (10-100) of five species of *Ceratozamia*s, and each year there are plants that produce multiple male cones of every species. One year a *C. hildae* plant put out three male cones. Afterwards the heads did not split or do anything unusual. I understand that in South Africa people do not have as many different plants to look at as far as *Ceratozamia*s go. I see in the journal they always say that only good *Ceratozamia* seeds expand but normally only 10-20% of *C. norstogii* seeds end up being good. I hope this helps you a bit.

Tom Broome, 9128 Golden Gate Boulevard, Polk City, Florida 33868, U.S.A.

Received 29 January 1996

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Dear Editor

ENCEPHALARTOS APLANATUS

Cycad enthusiasts should be thankful to the taxonomists that are taking the trouble to study our cycads more intensively. Where such studies suggest that a given species should be subdivided into two or more taxa, careful consideration should, however, be given to whether the new taxa merit specific or subspecific status.

As mentioned elsewhere in this issue of the journal, plants from the vicinity of Siteki (formerly Stegi) in

Swaziland has been given the name of *Encephalartos aplanatus* (see "Focus on ..." article). The author states that the plant closely resembles *E. villosus* Lem. and can be distinguished from the latter species only by some vegetative quantitative characters such as its larger leaves which are often shortly petiolate, more dentate and with margins that are twisted out of the plane of the remainder of the leaf or being undulate. To separate out such a plant as a new species, to me appears to be rather unfortunate. *Encephalartos villosus sensu lato* comprises a large variety of morphological forms both as far as the cone and leaf morphologies are concerned. Because of their overriding similarities, the various forms that occur all the way from about East London in the south to Swaziland in the north must obviously be phylogenetically closely related and be considered to be a cline until good scientific evidence can prove otherwise.

To my surprise the author uses a rather illogical argument for not ascribing a subspecific rank to the new taxon. He writes: "It might be argued that subspecific ranking would be more appropriate, but that would imply a close evolutionary relationship for which there is no proof." But in the absence of compelling evidence to the contrary, one always considers plants that are morphologically very similar, especially as far as their reproductive organs are concerned, such as in the present case, to share a close evolutionary relationship.

In a paper published in the "Proceedings of the Third International Conference on Cycad Biology", on p. 253, the same author uses the very same argument as that mentioned above, for proposing to subdivide *E. lebomboensis sensu lato* plants into two species. Because there are quite big differences between the morphology of especially the female cones in the case of the *E. lebomboensis* plants, a division of *E. lebomboensis sensu lato* into two species is more acceptable than in the case of *E. villosus sensu lato*. However, I can't see how it can be said that no grounds exist to acknowledge a close phylogenetic relationship between the plants from the different localities and therefore refuse to allocate subspecific rank to them. Indeed it will be interesting to see whether the botanical community at large will recognize *E. aplanatus* Vorster and the proposed subdivision of *E. lebomboensis sensu lato* into two species.

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

Received 4 April 1996

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Dear Editor

LEN BUTT - CREDIBILITY GAP

Len Butt, who is held out in certain quarters in Australia (and elsewhere) to be an expert on Australian cycads, was criticized in Issue Nos 43 and 44 of "*Encephalartos*" by two prominent and highly respected Australian botanists, David Jones and Paul Forster.

Butt is the author of "An Introduction to the Zamiaceae in Australia" which was published in booklet form in Issue No 31 of "*Palms & Cycads*" and which attracted scathing criticism from Craig Thompson in Issue No 33 of "*Palms & Cycads*".

Amongst other matters, Thompson noted distinct similarities between Butt's articles and articles on cycads in Selwyn L. Everist's book "*Poisonous Plants of Australia*".

In a response to Thompson, in Issue No 34 of "*Palms & Cycads*", Butt denied plagiarizing Everist's work but conceded that he had used Everist's book as a reference source for the sole purpose of researching the poisonous capability of cycads and formally apologized for not acknowledging Everist's work.

I was also highly critical of certain aspects of Butt's booklet, in a letter printed in Issue No 55 of "*Principes minor*".

In response to my letter, Butt wrote to me personally and conceded that *Macrozamia communis* was the only New South Wales *Macrozamia* that he had seen in habitat. (A copy of Butt's letter has been supplied to the Editor for authentication).

In view of the recent criticism of Butt by David Jones and Paul Forster, I have taken the opportunity to re-examine Butt's articles on New South Wales *Macrozamia*s in "An introduction to the Zamiaceae in Australia" and have concluded that Craig Thompson was quite correct in his comment (in respect of New South Wales *Macrozamia*s) that Butt's articles were basically "reworked copy" of Everist's articles.

A comparison of key comments by Everist and, also, by Butt in respect of several of the different New South Wales *Macrozamia* species indisputably confirms this latter comment; for example:

● *Macrozamia fawcettii*:

Everist: "A species closely related to *M. pauli-guilielmi* but with very broad, toothed pinnae. It is known only from the far north coast of New South Wales from the Richmond River to Coffs Harbour."

Butt: "... is from the far north coast of New South Wales and is closely related to *M. pauli-guilielmi*. However, the pinnae are much broader and pronouncely (sic) toothed near the apex. It is an isolated species."

Comment: Butt has virtually duplicated the scant information provided by Everist about this species.

● *Macrozamia secunda*:

Everist: "A rare species somewhat similar to *M. spiralis* but with concave leafstalks and stiff, narrow pinnae which are crowded along one side of the rhachis. It is known only from a few specimens collected in the Mudgee and Dubbo districts in Central New South Wales."

Butt: "... is another small species found growing around Mudgee and Gilgandra and in many areas where *M. spiralis* grows. This has led to it being mistaken for the latter species on many occasions. It is very similar, having a close relationship with it. Noted differences include the concave petiole and the narrow crowned pinnae of *M. secunda*."

Comment: Apart from the confusing reference to the "narrow crowned pinnae", Butt is wrong when he commented that *M. secunda* has been "mistaken for (*M. spiralis*) on many occasions". L.A.S. Johnson (1961) simply stated that "occasional individuals (of *M. spiralis*) may be hard to distinguish from *M. secunda*".

● *Macrozamia diplomera*:

Everist: "Similar in appearance to *M. communis* but the tips of leaf-segments (pinnae) are divided into two almost parallel lobes. the rhachis of the leaf is straight and angular."

Butt: "Although there are many distinct differences, *Macrozamia diplomera* has often been confused with the larger species *M. communis*. As with that species, the pinnae are divided at the apex into two lobes. The rachis is straight and more angular than in other species in its habitat. I have not seen the female cones so cannot comment on them."

Comment:

Butt's statement that "as with that species (*M. communis*), the pinnae are divided at the apex into two lobes" is wrong on two counts -

- first : the pinnae on *M. diplomera* divide at the base not at the apex, and
- second: *M. communis* has entire pinnae.

Note the common usage of the unusual term "lobes".

Butt's comment that he had not seen female cones of this species is somewhat incongruous in view of his admission to me that *M. communis* was the only New South Wales *Macrozamia* species that he has seen in habitat.

● *Macrozamia spiralis*:

Everist: "The name has been misapplied to many other species by most authors. True *M. spiralis* has been called *M. corallipes* by many authors. Small plant with no visible trunk and a few leaves (2-12) in a crown at ground level; leaves on mature plants generally 60-90 cm long with a bare base forming a stalk 15-40 cm long; rachis either straight or twisted in a moderate spiral; female cones egg-shaped, 12-20 cm long seeds 2.5-3 cm long, orange to scarlet when ripe."

Butt: "This is a small species formerly known as *Macrozamia corallipes*. It has a subterranean caudex, no visible trunk and fronds up to twelve in number. Leaves to 90 cm have been noted. The petiole is bare of spines and the rachis 40 cm long. Pronounced spiralling of the rachis is evident. The seed cones measure approximately 20 cm long and the seed orange red rather than orange. With this species, the pinnae have toothed edges even on mature plants."

Comment: Butt is wrong on two counts in his description of this species;

- first: the rachis is either straight or moderately spirally twisted, and
- second: mature pinnae do not have toothed edges.

L.A.S. Johnson (1961) stated that the rachis "is straight to moderately spirally twisted" and that the pinnae (on mature plants) are "entire" but "often 2-3 toothed at the tips in immature plants".

● *Macrozamia communis*:

Everist: "Palm like plant, usually without any trunk above ground except in shallow soils where the trunk may be 1-2 m high and up to 60 cm in diameter. Distribution and Habitat: New South Wales, mainly in coastal areas from the Macleay River to Bega and westward as far as Goulburn."

Butt: "Most commonly, this plant forms subterranean caudices in hard rocky areas, but in shallow soils can form a trunk to two metres tall with a diameter to 60 cm. It is found in coastal regions equal to those of *Macrozamia miquelii* from just north of Bega, New

South Wales, to two thirds up the northern New South Wales coast, and as far west as Goulburn. It grows with other species such as *M. diplomera*."

Comment:

Butt has repeated another error made by Everist who stated that the distribution range of *M. communis* extends "westward as far as Goulburn.". Goulburn is a city located to the south of Sydney, while the distribution range of *M. communis*, according to L.A.S. Johnson (1959), extends "westward to the head of the Goulburn River" in inland New South Wales.

Butt's comment that *M. communis* "grows with other species such as *M. diplomera*" is also incorrect. L.A.S. Johnson (1961) stated that "*M. communis* is not known to come into contact, in the wild, with the closely related species *M. diplomera*."

Butt's confused and confusing comment that "this plant forms subterranean caudices in hard rocky areas, but in shallow soils can form a trunk to two metres tall" is also obviously incorrect.

Notwithstanding the patently obvious similarities between Butt's articles and those by Everist, Butt made a major error in his article on *M. stenomera* when he states that "*M. stenomera* C. Moore has similarities to both *M. communis* and *M. diplomera*." (Note: *M. heteromera* was described by C. Moore whereas *M. stenomera* was described by L. Johnson.)

While *M. diplomera* has a close affinity with *M. communis*, any suggestion that *M. stenomera* is similar to *M. communis* borders on the ridiculous, as *M. stenomera* is a small cycad often with less than 10 leaves (which rarely exceed 0.8 m in length) while *M. communis* is a large cycad with up to 100+ leaves (which can stand up to 2.4 m above ground level).

Making any sense at all about Butt's article on *M. stenomera* was a daunting task, until I realized that Butt's articles on *M. heteromera* and *M. stenomera* had (inadvertly!) been amalgamated under the single heading of *M. stenomera* in the "Palms & Cycads" booklet. Confirmation of this fact is available by comparison with Butt's previously published articles on these two species - in Issue Nos 12 and 13 of "Encephalartos" and, also, in Issue No 101 of "Australian Plants".

Reference to these latter articles highlights another error made by Butt when he stated that *M. heteromera* (which is closely related to *M. stenomera*) has "a similarity to both *M. communis* and *M. diplomera*" - a comment which strangely enough coincides with an identical incorrect statement by Everist that *M. heteromera* is "similar in appearance to *M. communis* and *M. diplomera*."

In other words, in previous articles on *M. heteromera*, Butt repeated the blatantly incorrect comment by Everist that *M. heteromera* is similar in appearance to *M. communis*, but in his "*Palms & Cycads*" booklet (which did not include an article on *M. heteromera*) he made the equally absurd comment that *M. stenomera* "has similarities to *M. communis*."

The mix-up of his *M. stenomera* and *M. heteromera* articles also explain why Butt decided, in Issue No 34 of "*Palms & Cycads*", that *M. heteromera* ("the plains plant") and not *M. stenomera* ("the hills plant") was responsible for the poisoning of approximately 2,300 sheep near Coonabarabran in 1929. Despite two attempts, however, Butt could still not correctly identify the species involved in this famous poisoning episode. If he cared to examine the June 1930 "*Agricultural Gazette of N.S.W.*" he would find conclusive photographic evidence that the species involved was actually *M. diplomera*!

I defy any intelligent person to read and compare Everist's articles, about New South Wales Macrozamia, with the almost "carbon copy" details which are found in Butts articles and come to any conclusion other than that Butt plagiarized Everist's work, bearing in mind, as previously mentioned, that Butt did not acknowledge the use of Everist's work in "An Introduction to the Zamiaceae in Australia".

For those who do not agree with the conclusion that Butt plagiarized Everist's work (to make up for his own lack of knowledge about New South Wales Macrozamia), I believe that a comparison of some glaring errors made by Everist and repeated by Butt should convince them otherwise. Errors such as:

- the incorrect statement by Everist that the tips of the pinnae on *M. diplomera* are divided into two lobes,
- the incorrect statement by Everist that *M. heteromera* is similar in appearance to *M. communis*, and
- the incorrect statement by Everist that the distribution range of *M. communis* extends westward as far as Goulburn.

Notwithstanding the obvious and, I believe, irrefutable evidence that Butt's articles on New South Wales Macrozamia are a rehash of the scant and often incorrect information contained in Selwyn Everist's book, Butt devoted an entire section of his booklet to the "Parazamia thickets of New South Wales". These so called "Parazamia thickets" are simply a figment of Butt's imagination as they do not, in fact, exist.

The reason for this monumental error, which would be apparent to anyone with even a rudimentary knowledge of New South Wales cycads, is that Butt obviously misconstrued a comment made by Charles Chamberlain

in his 1919 book "*The Living Cycads*" to the effect that "*Macrozamia spiralis* sometimes grows in such profusion that it forms dense thickets." Chamberlain, however, was describing the species which, since L.A.S. Johnson's 1959 revision of the nomenclature of Australian Zamiaceae, has been known as *M. communis*.

To clarify the situation: L.A.S. Johnson (1961) commented that "*M. spiralis* is usually found as scattered, often depauperate plants The plants do not occur in large, dense stands like those of *M. communis*."

Moreover, like *M. spiralis*, all of the New South Wales Section *Parazamia* species are small in stature (they normally have a crown of less than 10 leaves, which seldom exceed 1 m in length) and generally grow in a pattern of scattered individual plants. Butt was even cognisant of the latter, in his article about the so-called "Parazamia thickets", when he stated that "their low stature render them insignificant in the habitat" - and just how he considered that such plants could grow in "dense thickets" (or stands) is inconceivable and beyond comprehension.

This fabrication by Butt of the so called and non-existent "Parazamia thickets" is a further example of his lack of knowledge about New South Wales cycads and simply drives another nail into the coffin of his already dubious credibility.

Butt is also consistent in his inconsistency insofar as he mentions hybrids at least five (5) times in his booklet when referring to New South Wales cycads, but then in his letter of response to Craig Thompson (Issue No 34 of "*Palms & Cycads*") states that "to my knowledge, no fully proven hybrid has really been discovered"?

Butt's credibility recently suffered another serious blow when it was pointed out by Paul Forster ("*Encephalartos*", Issue No 44) that Butt had incorrectly included *Cycas silvestris*, a newly described *Cycas* species with "glossy mid-green" pinnae, in a grouping of "blue-foliaged" cycads.

When I examined Butt's article on these "blue-foliaged" cycads, I was struck by the uncanny resemblance of most of the detailed plant information provided by Butt to the information contained in Dr Ken Hill's 1992 review of the nomenclature of Queensland *Cycas* species - "A preliminary account of *Cycas* (Cycadaceae) in Queensland", "*Telopea*" Volume 5(1) - in which Dr Hill described six (6) new *Cycas* species.

And while Butt mentioned Dr Hill's name in several of his articles on the various species involved, there was certainly no general acknowledgement of the obvious reliance placed by Butt on Dr Hill's work.

In fact, it is interesting to observe just how Butt tries to camouflage his reliance on the information contained in Dr Hill's detailed accounts of the different Queensland *Cycas* species. For example, when Butt described *Cycas brunnea* he mentioned "the formal descriptions by Ken Hill" but then used the terminology "observers report" before giving plant details undoubtedly extracted from Dr Hill's description of this species. In addition, in his article on *Cycas angulata*, Butt made no mention about Dr Hill, but then, after using the phrase "latest descriptions of this interesting taxon", gives plant detail that is almost identical with the information contained in Dr Hill's description of this species.

I concur with Paul Fortser's comment that "it seems that misinformation on Australian cycads continues to proliferate" and I am convinced that a critical review of the totality of Butt's articles on Australian cycads is justified on the basis that his articles:

- are not always based on his own field observations,
- are not always accurate, and/or
- often bear an uncanny similarity to the writings of other authors.

REFERENCES

- JOHNSON, L.A.S. 1959. The families of cycads and the Zamiaceae of Australia. *Proceedings of the Linnean Society of New South Wales* 84: 64-117.
- JOHNSON, L.A.S. 1961. Zamiaceae. *Contributions from the New South Wales National Herbarium, Flora Series* 1: 21-41.

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BOOK REVIEWS / BOEKBESPREKINGS

PROCEEDINGS OF THE THIRD INTERNATIONAL CONFERENCE ON CYCAD BIOLOGY

P. Vorster (Editor)

Published by the Cycad Society of South Africa at Stellenbosch, South Africa (ISBN 0-620-19228-3), this long awaited documentation of the proceedings of CYCAD 93 which was held in Pretoria during July 1993 appeared during March 1996 although the official printed date is given as 1995. It is a soft-covered book of 449 pages containing the professionally reviewed texts of the 44 contributions that were offered at the conference. Apart from the opening speech, the contributions are grouped under six headings:

Conservation (13 contributions) dealing with:

Cycad conservation in the past and the need for improvements in the future; cycad trade in the Americas and its regulation by CITES; a third world perspective of cycad conservation; *ex situ* cycad conservation in the Lowveld Botanical Garden; the distribution and conservation status of the genus *Encephalartos* in the Transvaal, South Africa; the translocation and re-establishment of priority *Encephalartos* species in the Transvaal, South Africa; cycad monitoring in the Transvaal, South Africa (abstract only); cycad conservation in Natal; cycad conservation and cultivation in KaNgwane (abstract

only); and evaluation of possible causes and consequences for cycad conservation of local extinctions of insects associated with cycad strobili (abstract only); estimates of cycad population viability using a stage structured simulation model (abstract only); a world list of cycads; and the results of the 1991-1992 world cycad census and a proposed revision of the I.U.C.N. threatened species status for cycads.

Cultivation (3 contributions) dealing with:

The vegetative propagation of *Encephalartos* species using excised leaves; somatic embryogenesis and organogenesis from leaf and embryo explants of *Ceratozamia* and *Zamia* (abstract only); the cycad collection at Ganna Walska Lotusland, California, U.S.A.

Physiology, biochemistry and toxicology (7 contributions) on:

Macrozamin in the life history of the leopard magpie moth, *Zerenopsis leopardina* (abstract only); the occurrence and possible health significance of toxins in cycad pollen; the effect of growth regulator

concentration on *in vivo* callogenesis on primary root explants of *Macrozamia riedlei* (abstract only); suspected intoxication in dogs by *Cycas revoluta*; the use of radiocarbon for determining the growth rate of arborescent cycads; the ritual and medicinal usage of *Stangeria eriopus* in South Africa; circadian and oscillatory heat production in cycad cones (abstract only).

Systematics (10 contributions) dealing with:

Molecular systematics of cycads; infrageneric relationships, phylogeny, and biogeography of the genus *Cycas* (Cycadaceae); observations from a 1992 expedition on the cycads of China; *Cycas* in China, with notes on its conservation status; taxonomic changes in the Australian cycads; vicariant *Macrozamia* species in southern Australia; morphometric analysis of vegetative characters of *Encephalartos woodii*, *E. natalensis* and an apparent intermediate; the identity of *Encephalartos lebomboensis*; morphological and genetic comparison of forest and grassland *Stangeria eriopus*; and anatomical studies on the leaflets of glaucous-leaved *Encephalartos* species in South Africa.

Ecology (4 contributions) dealing with:

Evolutionary and ecological considerations concerning the pollination of cycads by insects; the role of insects and fire in the ecology of *Encephalartos laevifolius* and their management implications; the classification, relationships and biology of the weevils (Coleoptera: Curculionoidea) associated with cycads; and the host specificity of the weevils (Coleoptera: Curculionoidea) associated with cycads and its implications for cycad taxonomy.

Reproductive biology (6 contributions) dealing with:

Pollination mechanisms and the association of *Amorhocerus* (Curculionidae) with *Encephalartos*; an annotated review of known information concerning aspects of the reproduction of cycads; vegetative and reproductive cycles of some *Encephalartos* species in Pretoria gardens; duration of developmental stages of the male gametophyte in the interval between pollination and release of spermatozoids in *Encephalartos altensteinii*; the role of insects in the pollination of *Encephalartos cycadifolius*; and demographic studies on *Encephalartos ghellinckii*.

Separate indices of contributing authors and of cycad names mentioned in the text are also provided in the book. Dr Piet Vorster, the editor is to be complimented on the production of a splendid product which must have taken up a considerable amount of his time. The attractive illustration of a germinating cycad seed on the front cover is by Piet's talented wife Elsa.

The publication date of the book had to be postponed several times due to the printers not being able to meet

the agreed deadlines. As a consequence the publication date of 1 August 1995, as given on the reverse side of the front cover in connection with new taxonomic combinations published in the book is probably not valid.

The book can be ordered from Mr Giel Fourie, 9 Hobson Street, Stilfontein, 2551, South Africa at a price of R90-00 or US \$90-00 per copy, all inclusive of packaging and surface mail dispatch. Orders from countries other than South Africa must be accompanied by an international money order and **not by a personal cheque** and should be made out to the Cycad Society of South Africa.

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CYCADS; THEIR CULTIVATION AND PROPAGATION

Guy Wrinkle

This attractively produced booklet of 24 pages of text should prove to be a useful addition to the library of all cycad enthusiasts because it deals with many aspects of the cultivation of cycads that are rather neglected in the other books on cycads currently available. Guy is well known to many cycad lovers in South Africa because of his occasional visits to this country. Indeed the booklet is dedicated to the memories of Bruce Bursey and Embden Pienaar.

The contents of the booklet is divided into sections dealing with General Principles; Growing Medium; Water; pH; Fertilizers; Witches Brews and Other Concoctions; Temperature; Humidity; Air Movement; Growth Rate; Pests and Diseases; Propagation; and Conclusions.

The text is written in a flowing and conversational style and purposely avoids the use of complex scientific jargon and techniques. The author often points to the paucity of reliable data concerning some aspects of cycad cultivation. Throughout the booklet he freely shares the results that he obtained from personal experiences in the cultivation of cycads, with the reader.

The booklet can be ordered from Mr Guy Wrinkle of 11610 Addison Street, North Hollywood, California 91601, U.S.A. at a price of US \$5-00 per copy plus postage.

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NEW SCIENTIFIC REPORTS

Ahern, C.P.* & Staff, I.A. 1994. Symbiosis in cycads: The origin and development of coralloid roots in *Macrozamia communis* (Cycadaceae). *American J. Bot.* 81(12): 1559-1570.

[The process begins with initiation of young apogeotropic, papillose roots called "precoralloids" and involves phases of maturation, cyanobacterial invasion, coralloid formation, senescence, and regeneration.]

*First author's address: Botany Dep., La Trobe Univ., Melbourne, VIC 3083, Australia.

Barone, G.*, Corsaro, M.M., De Castro, C., Lanzetta, R., Mangoni, L. & Parrilli, M. 1994. Structural investigation of *Ceratozamia spinosa* mucilage. *Carbohydrate Research* 260(2): 259-270.

[The polysaccharide appears to be made up mainly by a chemically homogeneous material but with a wide range of molecular weights. The primary structure of the polysaccharide has also been elucidated.]

*First author's address: Dip. Chim. Org. Biol., Univ. Napoli Federico II, Via Mezzocannone 16, 80134 Napoli, Italy.

Canini, A.*, Brandizzi, F. & Caiola, M.G. 1994. Localization of calcium in the cyanobiont and gonidial zone of *Cycas revoluta* Thunb. by microelectrodes, chlortetracycline, electron spectroscopic imaging and electron energy loss spectroscopy. *Protoplasma* 179(3-4): 151-157.

[By means of these techniques, bound calcium was detected inside the mucilage of apical and median segments whereas, in the basal segments, it was completely absent. In the heterocysts of apical segments of coralloid, calcium was localized on the envelope, cell walls, thylakoids and cyanophycin granules. In the gonidial zone of the basal segments, dead or degenerating heterocysts completely lacked calcium.]

*First author's address: Dipartimento di Biol., Università di Roma, Tor Vergata, Via della Ricerca Scientifica, I-00133 Rome, Italy.

Chavez, V.M.*, Litz, R.E. & Marquez, J. 1995. Histology of somatic embryogenesis of the cycad *Ceratozamia mexicana* var. *robusta* (Miq.) Dyer. *Plant Science (Limerick)* 108(2): 191-200.

[None of the early stage somatic embryos that formed from the primary cultures developed to maturity. Approximately 12-15 months after the first appearance of precotyledonary somatic embryos they became hard and opaquely white. Somatic embryos were dicotyledonary. Root initials developed distal to the root cap. The bipolar morphology of the somatic

embryos was confirmed.]

*First author's address: Univ. Florida, Tropical Res. Educ. Cent., 18905 SW 280 St., Homestead, FL 33031, U.S.A.

Crosiers, C.* & Malaisse, F.P. 1995. *Ex situ* pollination and multiplication of *Encephalartos laurentianus* De Wild (Zamiaceae, Cycadales). *Biodiversity and Conservation* 4(7): 767-775.

[This paper reports the first case of *ex situ* pollination and multiplication of this rare and giant Central African cycad at the National Botanical Gardens of Meise, Belgium. A brief description of the discovery, distribution and morphology of the species is given. About 160 seeds were produced by each of the two female cones. While most seeds were stored for exchange purposes, six of the ten seeds planted germinated.]

*First author's address: Lab. d'Ecol., Fac. des Sci. Agronomiques, 2 Passage des Deportes, B 5030 Gembloux, Belgium.

Donaldson, J.S. & Bösenberg, J.D. 1995. Life history and host range of the leopard magpie moth, *Zerenopsis leopardina* Felder (Lepidoptera: Geometridae). *African Entomology* 3(2): 103-110.

[The insect has been recorded from host plant species in two families of Cycadales and three families of Angiospermae. The host range is unusual in its composition and range for an aposematic insect that appears to sequester methylazoxymethanol (MAM) or its glycosides from cycad tissues. It is apparent that *Z. leopardina* is specific to cycads in its early larval instars but that both cycads and angiosperms may be used by late instar larvae.]

Authors' address: Natl. Bot. Inst., Private Bag X7, Claremont, 7735, South Africa.

Endrödy-Younga, S. 1991. Boganiidae (Coleoptera: Cucujoidea) associated with cycads in South Africa: Two new species and a new synonym. *Annals of the Transvaal Museum* 35: 285-293.

[The author describes two new beetles, *Metacucjys transvenosi* from *Encephalartos transvenosus* and *M. goodei* from *E. natalensis*. Neither of the species were ever found on or in the female cones of their hosts and the author concludes that: "Apparently these beetles, which are the most numerous insects present in male cones, play no role in the pollination of these plants. (In the case of *E. transvenosus* this conclusion is in full agreement with the observations of the compiler of this report.) The author also reports that *AfroboGANium capense* Endrödy-Younga, 1986, is a junior synonym of

Micrambe propria Grouvelle, 1899, resulting in the new combination *Afroboganium proprium* (Grouvelle, 1899).]
Author's address: Department of Coleoptera, Transvaal Museum, P.O. Box 413, Pretoria, 0001, South Africa.

Forster, P.I. 1995. *Cycas desolata* (Cycadaceae), a new species from north Queensland. *Austrobaileya* 4(3): 345-352.

[The new species is described and illustrated. Its affinities are discussed and notes are provided on its distribution, habitat and conservation status.]

Author's address: Queensland Herbarium, Meiers Road, Indooroopilly, Queensland 4068, Australia.

Gigliano, G.S.*, Nazzaro, R. & Muoio, R. 1994. A chemotaxonomic study of mucilages in American Zamiaceae. *Giornale Botanico Italiano* 128(5): 851-860.

[Methylrhamnose, fucose, rhamnose, mannose, arabinose, galactose and glucuronolactone are the monosaccharides identified in hydrolysed mucilages collected from 37 species belonging to the five American cycad genera, *Ceratozamia*, *Chiqua*, *Dioon*, *Microcycas* and *Zamia*. Differences and similarities among patterns at both intergeneric and intrageneric levels are discussed for their systematic implications.]

*First author's address: Dipartimento Biol. Vegetale, Fac. Sci., Univ. Napoli Federico II, Via Foria 223, 80139 Napoli, Italy.

Gobe, D.C. 1994. Apoptosis in brain and gut tissue of mice fed a seed preparation of the cycad *Lepidozamia peroffskyana*. *Biochem. and Biophys. Res. Comm.* 205(1): 327-333.

[Apoptosis (programmed cell death) was identified in histological sections of brain and gut tissue of adult mice. From the present study, presence of apoptosis in brain tissue after cycad toxicity may provide a link between cycad ingestion and development of neurodegenerative disorders.]

Author's address: Dep. Pathol., Univ. Queensland Med. Sch., Herston Road, Herston, Brisbane 4006, Australia.

Hurter, P.J.H.* & Glen, H.F. 1996. *Encephalartos hirsutus* (Zamiaceae): a newly described species from South Africa. *S. Afr. J. Bot.* 62(1): 46-48.

[This new species from the northern Transvaal was previously unofficially referred to as *Encephalartos "decurrens"*. At present the species is said to be known only from three widely separated localities in the Northern Province. The exact localities of the plants are not disclosed neither is mention made of the conservation status of the plants. The species is said to resemble *E. eugene-maraisii*, *E. dolomiticus*, *E. dyerianus*, *E. lehmannii*, *E. princeps* and *E. middelburgensis* in its pungent, stiff, glaucous leaves.

It does however differ from all the mentioned species in its decurrent pinnae and glabrous sporophylls with a waxy covering.]

*First author's address: Lowveld National Botanical Garden, P.O. Box 1024, Nelspruit, 1200, South Africa.

Kokubugata, G.* & Kondo, K. 1994. Quantitative variability in karyotype of *Cycas revoluta*. *Kromosomo (Tokyo)* 2(75-76): 2613-2618.

[The arm ratios of twelve terminal-centromeric chromosomes showed wider standard deviations than those of the other chromosomes. The lengths of all the chromosomes in the root-tips studied were always larger than those in the leaflets studied.]

*First author's address: Lab. of Plant Chromosome and Gene Stock, Fac. of Sci., Hiroshima Univ., 1-4-3 Kagamiyama, Higashi-Hiroshima City 739, Japan.

Kondo, K.*, Kokubugata, G., Hizume, M., Tanaka, R. & Satake, T. 1995. A karyomorphological study of five species and one variety of *Cycas*. *Cytologia (Tokyo)* 60(2): 141-147.

[All the taxa had the common chromosome number of $2n = 22$ and very similar karyotypes. It is the first time that the chromosome number of *C. media* var. *basaltica* and *C. siamensis* was determined.]

*First author's address: Lab. Plant Chromosome Gene Stock, Fac. Sci., Hiroshima Univ., Higashi-Hiroshima 739, Japan.

Kowalska, M.T.*, Itzhak, Y & Puett, D. 1995. Presence of aromatase inhibitors in cycads. *Journal of Ethnopharmacology* 47(3): 113-116.

[In their quest to identify tropical plants that contain inhibitors of aromatase and thus may be efficacious in treating estrogen-dependent tumours, the authors screened five cycad species (*Cycas cairnsiana*, *C. revoluta*, *C. rumphii*, *Dioon spinulosum* and *Encephalartos ferox*). All extracts yielded positive results.]

*First author's address: Dept. Biochem. Mol. Biol., Life Sci. Build., Univ. of Georgia, Athens, GA 30602, U.S.A.

Litz, R.E.*, Moon, P.A. & Chavez, V.M. 1995. Somatic embryogenesis of leaf callus derived from mature trees of the cycad *Ceratozamia hildae* (Gymnospermae). *Plant Cell Tissue and Organ Culture* 40(1): 25-31.

[Callus was initiated from leaves in new vegetative flushes. Somatic proembryos developed from the callus approximately three months later. The somatic embryos that eventually developed were primarily dicotyledonous, and less frequently monocotyledonous. Germination occurred *in vitro* whereby the coleorhiza elongated and a tap root emerged; however, plantlet recovery has not

been demonstrated because the shoot axis failed to elongate.]

*First author's address: Tropical Res. Education Centre, Univ. Florida, 18905 S.W. 280 St., Homestead, FL 33031, U.S.A.

Vorster, P. 1995. *Encephalartos successibus* (Zamiaceae): a new species from Uganda. *S. Afr. J. Bot.* 61(6): 347-351.

[This species is the same as the one that has recently been described by P.J.H. Hurter under the name *E. whitelockii* in *Phytologia* 78: 409-416 (1995) and consequently the latter name takes precedence over *E. successibus*.]

Author's address: Department of Botany, University of Stellenbosch, Private Bag X1, Matieland, 7602, South Africa.

Vorster, P. 1996. *Encephalartos aplanatus* (Zamiaceae): a new species from Swaziland. *S. Afr. J. Bot.* 62(1): 57-60.

[The species is described as new from north-eastern Swaziland. It is said to resemble *E. villosus* in its acaulescent habit, small number of long and arched leaves, proximal leaflets gradually reduced to prickles, and virtually identical cones, but differs in being altogether larger with longer leaves which are often shortly petiolate instead of sessile, with leaflets larger, more dentate, and with their margins out of plane or somewhat undulate rather than flat.]

Author's address: Department of Botany, University of

Stellenbosch, Private Bag X1, Matieland, 7602, South Africa.

Vorster, P. *Encephalartos brevifoliolatus* (Zamiaceae): a new species from the Northern Province. *S. Afr. J. Bot.* 62(1): 61-64.

[The species is said to resemble *E. laevifolius* in having practically identical male cones, slender but rigid and spineless petioles with a whitish felt-like indumentum when young, and relatively narrow and entire leaflets which are abaxially finely ribbed. It differs from *E. laevifolius* and related species in its conspicuously wider and shorter leaflets with revolute margins.]

Author's address: Department of Botany, University of Stellenbosch, Private Bag X1, Matieland, 7602, South Africa.

Vovides, A.P.* & Inglesias, C.G. 1994. An integrated conservation strategy for the cycad *Dioon edule* Lindl. *Biodiversity and Conservation* 3(2): 137-141.

[The paper reviews an attempt to establish wild populations of the cycad as a locally valued economic resource. The cycads are being grown as a village based industry to provide revenue to supplement traditional agriculture.]

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