ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

NO. 35 SEPTEMBER 1993 ISSN 1012-9987

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COVER / VOORBLAD: *Cycas angulata*, Northern Territory, Australia

Photo: J.F. Tomlinson

CONTENTS / INHOUD

CONTENTS / INHOUD (continued / vervolg)

FROM THE PRESIDENT

It will be appreciated very much if you would study the announcement on page 35 about the possible amendment of the Society's Constitution and if you would vote on the matter in good time.

CYCAD 93 is something of the past. By all accounts it went off well and had a salutary effect on all participants. My sincere thanks go to Roy Osborne, whom from start to finish shouldered a large part of the organizing responsibilities. The generous assistance of the other two members of the Organizing Committee, namely Piet Vorster and Cynthia Giddy, is also gratefully acknowledged. The following persons and organizations have also provided voluntary assistence but for one reason or another their participation have not been acknowledged in the Program: Ita van der Walt who presented us with a magnificent display of indigenous cycads in the name of the Transvaal Regional Branch; Hanneke Grobbelaar who was responsible for the whole program for Accompanying Persons; Marthie Bester, Isabella Claassen, Giel Fourie, Johan Grobbelaar, Jeanne Marshall, Nicole and Marion Meyer who kindly assisted at the Registration table and last but not least, Peaceforce (Pty) Ltd who provided a security guard to watch over especially the cycad display. To all these silent helpers my sincere appreciation for their inputs.

In the June issue of "*Encephalartos*" I referred to a television broadcast about which several members complained to me. The complaints prompted me to write to the Director of Cape Nature Conservation. In his reply, the Director informed me that the cycad stems were freshly planted and that his officers knew that they *could not* have formed new roots by the time the television shots were taken. Consequently what appeared to the viewer as rough handling of the plants by the nature conservation officials were in fact nothing to worry about. Fortunately, the authority concerned realizes that the television material that was broadcast tarnished the image of the nature conservation department and therefore they will try to prevent the broadcasting of similar misleading material in future. It was also reassuring to learn that the Cape Nature Conservation department is intent on giving first priority to the welfare of confiscated plants and animals and regards prosecutions as being of secondary importance. This is how it should be and I want to express my appreciation to the Director for his understanding of my well-intended criticism.

Nat Grobbelaar

VAN DIE PRESIDENT

Ek wil u graag vriendelik vra om die baie belangrike beriggie op bladsy 35 oor die moontlike wysiging van die Vereniging se Grondwet te bestudeer en u stem oor die saak betyds uit te bring.

"CYCAD 93" is nou iets van die verlede. Dit het goed verloop en het 'n besonder verrykende invloed op die deelnemers gehad. My opregte dank gaan aan Roy Osborne wat van die begin tot end 'n reuse bydrae tot die organisering van die konferensie gemaak het. Die ander twee lede van die Reëlingskomitee, te wete Piet Vorster en Cynthia Giddy se onbaatsugtige hulp word ook opreg waardeer. Persone en instansies wat gratis hulp verleen het sonder dat erkenning in die program aan hulle verleen is, is die volgende: Ita van der Walt wat in die naam van die Transvaal Streektak gesorg het vir 'n puik uitstalling van inheemse broodboomsoorte; Hanneke Grobbelaar wat verantwoordelik was vir al die reëlings in verband met die program vir metgeselle van konferensiegangers; Marthie Bester, Isabella Claassen, Giel Fourie, Johan Grobbelaar, Jeanne Marshall, Nicole en Marion Meyer vir hulp by die registrasietoonbank en laastens die firma Peaceforce (Edms) Bpk wat 'n sekuriteitswag beskikbaar gestel het om veral die broodboomuitstalling te bewaak. Aan al hierdie stille hulpverleners my opregte dank vir hul insette.

In die Junie-uitgawe van "*Encephalartos*" het ek verwys na 'n beeldradio uitsending waaroor verskeie lede met my in verbinding was. Die klagtes het my genoop om 'n brief aan die Direkteur van Kaaplandse Natuurbewaring te rig. In sy antwoord het die Direkteur my meegedeel dat die broodboomstompe nuut geplant was en dat die beamptes geweet het dat hulle nog nie kans gehad het om nuwe wortels te vorm nie. Met ander woorde, die oënskynlike rowwe wyse waarop die plante deur die natuurbewaringsbeamptes gekonfiskeer is, was nie werklik ernstig nie. Gelukkig besef die betrokke owerheid egter dat die beelmateriaal wat vertoon is hul optrede in 'n swak lig gestel het en gevolglik sal hulle in die toekoms probeer verhoed dat die media sulke misleidende materiaal uitsaai. Ek is verder bly om te kan meld dat die Direkteur my verseker het dat sy organisasie deurgaans die welsyn van gekonfiskeerde plante en diere eerste stel met vervolging as 'n sekondêre oorweging. Dit is hoe dit hoort en ek wil die Direkteur bedank vir die goeie gesindheid waarin hy op my goed bedoelde kritiek gereageer het.

Nat Grobbelaar

FOCUS ON ... FOKUS OP ...

In each edition of ENCEPHALARTOS, we focus on one southern African species, in the form of an indepth article in layman's language. In this edition the spotlight falls on:

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

ENCEPHALARTOS MUNCHII R.A. Dyer & Verdoorn

Roy Osborne
Department of Chemistry, University of Natal, 4001 Durban

INTRODUCTION

The influence of Rusape farmer, Raymond C. Münch, on the investigations leading to the separation of the *Encephalartos manikensis* "complex" into five separate species was mentioned in the recent article on *E. concinnus* ("*Encephalartos*" 34: 4-11). One of the many wild stands visited by Münch was a uniform colony of cycads with strikingly blue-green foliage, which he found on a huge granite outcrop just south of Chimoio in Mozambique. It was H. Basil Christiaan who suggested to Drs Dyer and Verdoorn that Münch's contribution to our knowledge of the Zimbabwean and Mozambican cycads should be acknowledged by naming one of the "new" species, preferably "the form most distinct from the typical *E. manikensis*", in his honour. Thus it was appropriate that, in 1969, the species represented by the isolated Mozambican colony of blue-green cycads was officially named *Encephalartos munchii* Dyer & Verdoorn.

DISTRIBUTION

The group of plants discovered by Münch remains the only known colony of the species. The plants are located near the summit of a giant granite "whaleback", Mount Zembe, some 12 km south of Chimoio (previously Vila Pery) in the catchment area of the Revue river in western Mozambique (Figures 1, 2). The attractiveness of this unusual form to collectors resulted in the removal of a large number of specimens, mostly through Zimbabwe to South Africa and, even at the time of the description of the species, *E. munchii* was classified as "endangered" in the IUCN Plant Red Data Book. One of the side-effects of the political instability over the last 20-odd years in Mozambique has been that neither cycad scientists nor collectors have been able to

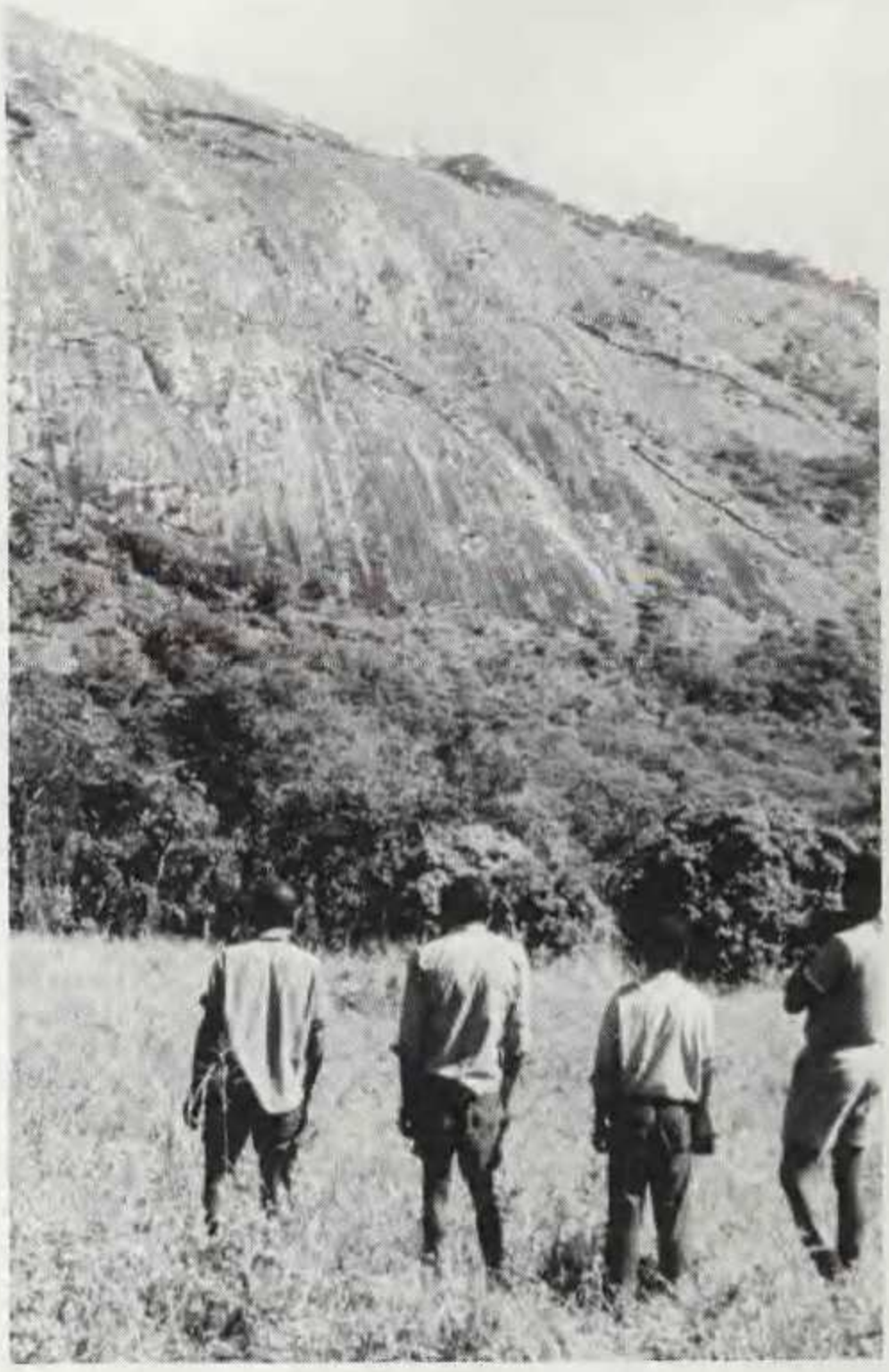


Figure 1 Part of the giant granite whaleback known as Mount Zembe in western Mozambique. The few remaining specimens of *E. munchii* are located near the summit. Photo: Bob Contat.

visit the area and only one somewhat dated estimate of "less than 100 plants" (Ian Turner, *pers. comm.*) for the *wild population could be found.*

Figure 2 One of the specimens of *E. munchii* at the summit of Mount Zembe. Photo: Bob Contat.

Despite its very limited distribution, several botanic gardens have obtained specimens of *E. munchii*. Those gardens known presently to have mature plants (1991-1992 World Cycad Census) are Ewanrigg and Harare Botanic Gardens in Zimbabwe; Durban Botanic Gardens in South Africa; the Royal Botanic Gardens in Sydney, Australia; Fairchild Tropical Garden, Lotusland, Los Angeles Arboretum and San Diego Zoo in continental USA and Foster Gardens in Hawaii (Figures 3, 4). A small number of plants is in private hands (Figure 5), mainly in the gardens of South African collectors.

Figure 3 An attractive group of *E. munchii* in the National Botanic Gardens, Harare, Zimbabwe. Photo: Roy Osborne.

DESCRIPTION

1. STEM

E. munchii plants have short, stout stems, up to 1 m in height and 30 cm in diameter, which are occasionally branched at the base. Older stems may host mosses, lichens and epiphytic plants and sometimes recline with age. There are long, hard, woolly, pointed bracts at the crown and trunks sucker profusely at the base.

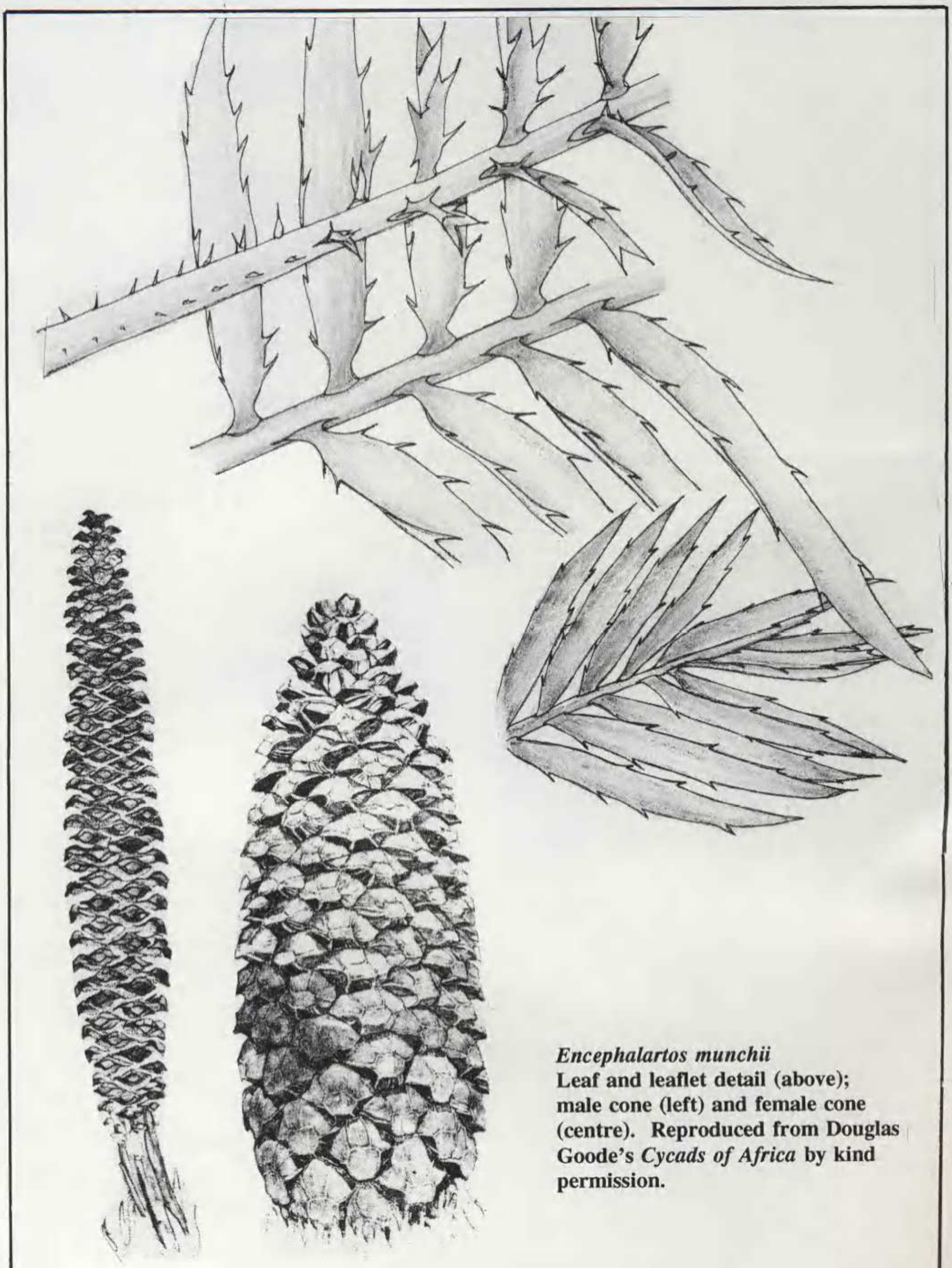
Figure 4 A specimen of *E. munchii* at San Diego Zoo in California. Photo: Gene Richards.

Figure 5 A Mozambican farmer from the Chimoio District proudly demonstrates his garden specimen of *E. munchii*. Photo: Bob Contat.

2. LEAVES AND LEAFLETS

Leaves are about 1 m long, fairly straight and erect but becoming spreading and slightly recurved with age (Figure 6). The predominant foliage colour is a strikingly-attractive bluish-green with a grey powdery bloom (rather like the Eastern Cape "blue" cycads and those in the *E. eugene-maraisii* complex), but there is considerable variation in colour with soil type, local climate and leaf age. Leaflets point upwards to the leaf apex and are held in a V-angle on the rachis. They are quite closely spaced and often overlap, progressively reducing in size to a series of prickles towards a 7-14 cm bare petiole at the leafbase. Median leaflets measure about 15 cm x 2 cm and have 2-6 quite prominent teeth, about 5-6 mm long, spaced regularly along both upper and lower leaflet margins. Dead leafstalks remain attached to form a skirt around the trunk.

Readers are referred to the key, accompanying the *E. concinnus* article, which helps to distinguish the taxa of



Encephalartos munchii
Leaf and leaflet detail (above); male cone (left) and female cone (centre). Reproduced from Douglas Goode's *Cycads of Africa* by kind permission.

the *E. manikensis* group, one from another, on the basis of leaf and leaflet morphology.

Figure 6 Leaves of *E. munchii* are straight and erect at first but become spreading and slightly recurved with age. Photo: Leland Miyano.

3. CONES

Up to six jade-green male cones are borne, these are about 65 cm long and 9 cm broad with a 20 cm long peduncle (Figure 7). Both *E. chimanimaniensis* and *E. munchii* have longer and narrower male cones than the other taxa in the *E. manikensis* group. The median scales are about 3.5-4 cm long and are held at right angles to the cone axis, their shape quite different to the distinctly curved cone scales of *E. chimanimaniensis*. Readers are referred to the second key accompanying the *E. concinnus* article, in which the taxa are separated on the basis on male cone morphology.

The barrel-shaped female cones (Figure 8), up to 50 cm long by 20cm in diameter and with a short peduncle, are similar in colour to the male cones. Usually 2-3 are borne per trunk, but up to six have been found on plants in cultivation. The cone scales terminate in a bulla which is about 5 cm broad and 4 cm thick vertically and which has a prominent, slightly concave terminal facet from which quite well-defined ridges radiate. The cone scales are free of hair and relatively smooth in surface appearance. Because of intergrading variations, it is much harder to distinguish female cones of the various species in the *E. manikensis* group than it is with male cones.

Figure 7 Male cones are conical at first appearance but become narrow and cylindrical on maturity. Photo: Roy Osborne.

Seeds typically measure 4.2 x 2.6 cm, with a scarlet outer skin and a fairly smooth inner kernel of dimensions 3.7 x 2.3 cm. An unusual feature in the reproductive behaviour of *E. munchii*, observed recently in a plant growing in Durban, was that the cones remained intact for almost a year after pollination (Figure 9). A consequence of this long "gestation" period was that several seeds had germinated before being shed from the cone. This phenomenon has also been noted for *E. ngoyanus* and *E. transvenosus*. It is not known how widespread or typical this behaviour is; for instance, Nat Grobbelaar recounts that an *E. munchii* in Pretoria, pollinated in autumn 1992, shed seeds in November the same year with germination commencing two months later.

AFFINITIES AND HYBRIDS

Mount Zembe in Mozambique is geographically close to the habitat of several other members of the *E.*

Figure 8 Female plants in cultivation can produce up to six cones. These cones, from a plant growing in a Westville garden, were successfully pollinated in 1992 by Natal Chairman Harry Gerber using pollen obtained from a male plant of another Natal member. Photo: Roy Osborne.

Figure 9 Since the seeds were retained on a female cone from a plant in cultivation in Durban for 12 months after pollination, germination commenced before the seeds were shed. This photo shows a cone scale, freshly removed from an intact female cone, with two seeds, one of which has already germinated. Photo: Roy Osborne.

Figure 10 Established specimens of *E. munchii* sucker profusely at the base. Photo: Roy Osborne.

manikensis group: the Chimanimani mountains lie some 70 km to the south-west, the *E. pterogonus* population at Mount Mruwere is about the same distance to the north but even closer is a series of granite outcrops, each with their own variant on the *E. manikensis* theme (e.g. the Bandula, Vanduzi, Garuso, Chicamba and Chinyayadze populations). Of these, the colony at Mount Chicamba, slightly to the west of Mount Zembe, appears to be closest to *E. munchii*, at least in terms of leaf morphology. Although there are no reported hybrids between named species, the genetics of these various groups is, as yet, unexplored and some element of genetic exchange between the various colonies is plausible if not probable.

CULTIVATION

E. munchii is a vigorous grower, fairly tolerant in its requirements but responding best to ample moisture and warmth in a sunny, well-drained situation. Like other species with similarly-coloured foliage, the attractive "blue" appearance is lost when plants are placed in overly shady sites. Since the plants sucker profusely at the base (Figure 10), separation and rooting of these suckers is an ideal method of propagation. It is hoped that owners of female plants will make contact with

potential pollen suppliers, ensure that their cones are properly pollinated and distribute the resulting seeds to persons who appreciate the privilege of owning this most rewarding species.

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ACKNOWLEDGEMENT

I am grateful to Nat Grobbelaar for his comments on the first draft of this text.

RAYMOND CHARLES MÜNCH

Hazel Münch

P O Box 165, Rusape, Zimbabwe

Raymond Charles Münch (1901-1985) arrived in Zimbabwe (then Rhodesia) in 1910, at the age of nine, when his father commenced farming at "Mona" farm near Rusape. His father passed away while Raymond was at Prince Edward school in Harare (then Salisbury) and hence Raymond took over the responsibilities of the farm, raising cattle, tobacco and other crops, from the age of 21. We were married in 1929, Raymond promising that he would retire at the age of 50 to enjoy his growing interest in plants and gardening. By working hard, he was able to do just that.

The farm "Mona" was built up over the years from 1930 and we became good friends of Basil Christian at "Ewanrigg" (later Ewanrigg Botanical Gardens), remembering a special visit to see his *Aloe* collection in 1943. In 1946 our family made a trip to Beira in Mozambique where Raymond bought a *Cycas thouarsii* plant. This grew well at "Mona" and made two heads. When next Basil Christian visited he said "I want half of it", and so Raymond gave him one head - which is apparently still flourishing at Ewanrigg. That was how the cycad interest started for both of them.

From then on, Raymond travelled extensively in Mozambique, climbing every mountain he saw, sometimes accompanied by myself and our son Desmond. The family also explored the Chimanimani mountains, on one occasion camping up on the mountain for 10 days with all four children. This was in the area where Raymond discovered his *Aloe munchii* and I found my little *Aloe hazeliana*. Raymond also travelled all over South Africa, buying and exchanging cycads. Another trip was to Malawi to obtain *Encephalartos gratus* and onto Pebane on the Mozambican coast to get more *Cycas thouarsii*.

He also exchanged plants with people in America, Australia and Japan and, at the time of leaving the farm, had one of the best cycad collections in the world. Leaving "Mona" and selling his cycads, were decisions taken in view of the war and I believe it broke his heart; his health deteriorated until he passed away on 1 December 1985. Raymond Münch was buried in a little cemetery on the farm he loved so much.

Raymond Charles Münch (March 1973)

Raymond and Hazel Münch, with family and helpers, on a visit to see *Encephalartos manikensis* at the Stapleford Forest (September 1948).

ARTICLES / ARTIKELS

CONING IN *MACROZAMIA COMMUNIS* L. JOHNSON (ZAMIACEAE)

C.E. Chadwick
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Abstract: Data are given of observations on cone production in *Macrozamia communis* in three areas over periods of eleven, eight and five years. No regularity in cone production was detected. Average numbers of cones produced in a single year in these three localities varied from a minimum of 0.250 to 3.818 per plant in male plants and 0.181 to 2.800 for female plants.

There is little information on the time elapsing between germination of the seeds and the production of cones in Australian species of cycads. Chamberlain (1913, p. 142) quotes a female plant of *Macrozamia moorei* in South Africa taking 30 years from seedling to the production of cones. However, the writer has found two reported local cases. G.A. Holloway (*pers. comm.*) noted that a very small plant of *M. communis* took 15 years (1972-1987) to produce two male cones in his garden in Engadine. L.C. Davies (*pers. comm.*) believed that a female garden plant took 28 years to produce cones at Ryde, a Sydney suburb. The age of the plant (and the building up of reserves) would be expected to influence the initiation of coning.

Although Ornduff (1989) studied coning in *Lepidozamia peroffskyana* over a limited period the writer knows of no work extending over a period of years observing plants in die field under natural conditions.

The author studied coning in areas (Figure 1) situated at Noraville and Seven Mile Beach in natural conditions inland from sea beaches, and at Balgowlah, a Sydney seaside suburb where a number of plants were growing

on a grassed footpath on the lower side of a quiet suburban street. A solitary roadside plant, a female, at Wamberal, near Noraville, was also observed for 11 years.

Figure 1 Locality map.

NORAVILLE

At Noraville attention was given to an area of undulating sandhills on the eastern (seaward) side of the road 6.4 km north of the Entrance Bridge. On 3 April 1980 a fire had burned out the whole study area. On 14 May 1980 quite a number of cones, mostly male, had appeared on plants. Numbers of apparent seedlings were seen, but when the sand was moved away from the base it was found that fronds had been burned off in the fire, leaving only caudices, from which new fronds had developed, giving the impression of young seedlings. Heights of fronds varied, possibly influenced by food reserves.

Between May 1980 and the end of that year 24 plants, indicated by wooden pegs, were designated for long term observation on cone production. Each of the plants was selected because it bore at least one cone. Plants were examined several times each year, particularly in the second half of the year when cones become more prominent and mature, and less likely to be overlooked. It was possible to follow 15 of these plants for 11 years (Table 1), but data on the other plants were incomplete.

RESULTS

The average number of cones produced by the seven male plants over 11 years was 12.454 or 1.779 cones per year per plant. The maximum number of cones produced by a male plant in a single year was 12 (Plant 12). The annual production of cones per plant over 11 years varied from 0.363 to 3.818.

In the years 1981 and 1982 only one out of seven male plants produced a cone. In the next three years (1983-1985) 60 cones appeared, average per year 26.66, average per plant 3.8. In the succeeding five years 42 cones were borne, average per year 8.4 cones, average per plant 1.2.

The average number of cones produced by the eight female plants over 11 years was 5.375 or 0.488 per plant. The number of cones produced per year per plant varied from 0.181 to 1.181. Eight plants did not produce a single cone in 1981 or 1982. The next eight years produced 31 cones, an average of 3.876 per year or 0.484 per plant over that period.

Two male plants (Nos. 1 and 7) and one female plant (No. 6) had considerably more cones than other plants (see Table 1). Plant No. 1 was on a ridge in the vicinity of a large *Angophora* tree and sparse low vegetation, largely bracken fern. Plants Nos. 6 and 7 were four metres apart, situated on a slope facing NNW on a sandy ridge with a sparse growth of bracken fern. When examined on 30 June 1991 there were 62 dead fronds around the base of the female plant and 81 around the male plant. Their presence would have given considerable protection to the base of the plants and reduced sand movement.

At the other extreme plant No. 3 was a small plant, not very vigorous, on the summit of the slope containing Nos. 6 and 7, partly shaded by a large *Angophora* tree. It produced only four cones, less than a quarter of the yield by other plants.

SEVEN MILE BEACH

The area under observation was between Gerroa Road and the beach 1.5 km south of the junction with the road to Berry on flat, lightly vegetated area of very high sand content. Although a fire had occurred to the east of the study area, the latter had not been affected.

The plants were selected on 26 February 1983 for long term observations. Of these one (No. 4) was obviously smaller (and presumably immature as it did not produce any cones at all) and another (No. 10) noticeably larger than the others, which ranged in size between the extremes. In July 1983 two more plants (Nos. 11 and 12) were added to the total. On 27 April 1986 five additional plants (Nos. 13-17) were added to those under observation.

Thirteen of the seventeen plants were observed until the end of 1990.

RESULTS

Results were not unexpected (Table 2). Among the

Table 1 Coning data for the period 1980 to 1990 of *Macrozamia communis* plants growing at Noraville, N.S.W., Australia

Plant No.	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total	Yearly Average
					M A L E								
1	2	0	1	3	6	8	4	3	0	0	0	27	2.454
3	1	0	0	0	0	3	0	0	0	0	0	4	0.363
7	2	0	0	4	8	5	3	8	5	3	4	42	3.818
13	3	0	0	3	3	3	0	0	0	3	0	15	1.363
14	1	0	0	2	6	4	0	0	0	0	2	15	1.363
17	2	0	0	4	5	1	0	2	3	0	0	17	1.545
19	3	0	0	3	6	3	0	0	0	0	2	17	1.545
Total	14	0	1	19	34	27	7	13	8	6	8	137	1.779
				F E M A L E									
2	2	0	0	0	0	1	0	0	0	2	0	5	0.454
4	1	0	0	0	1	1	0	1	0	0	0	4	0.363
6	1	0	0	2	2	2	0	2	2	0	2	13	1.181
10	2	0	0	0	0	0	0	0	0	0	2	4	0.363
11	2	0	0	2	2	0	0	0	1	0	0	7	0.636
15	1	0	0	0	1	0	0	0	1	0	0	3	0.272
20	2	0	0	0	0	0	1	0	0	0	2	5	0.454
23	1	0	0	0	0	0	1	0	0	0	0	2	0.181
Total	12	0	0	4	6	4	2	3	4	2	6	43	0.488
WM*	2	0	0	2	2	0	3	2	0	3	2	16	1.454

*Solitary plant at Wamberal.

male plants two were the most prolific (No. 2 with 11 cones, No. 7 with 9 cones). The average number of cones per male plant varied from 0.250 to 1.375. The eight (or five) year number of cones was 32, an average of 1.080 per plant per year.

Among female plants one (No. 11) produced two cones in 1983, but none in the next seven years. Another (No. 8) bore three cones in 1983 and two in 1989, nothing in the intervening five years. No. 5 produced two cones in 1986, none in the other seven years. The average number of cones per plant per year varied from 0.250 to 0.625.

BALGOWLAH

At Balgowlah, a northern seaside suburb of Sydney, a row of specimens of this species had been planted many years ago. They are situated on the lower side of a road and in much better soil than at the other two sites. Five plants (three male, two female) were kept under observation for five years (1986-1990).

RESULTS

Once again there was a wide divergence in numbers of cones produced (Table 3). One male plant produced

Table 2 Coning data for the period 1983 to 1990 of 12 *Macrozamia communis* plants growing at Seven Mile Beach, N.S.W., Australia

Plant No.	1983	1984	1985	1986	1987	1988	1989	1990	Total	Yearly Average
				M A L E						
2	0	2	0	0	3	6	0	0	11	1.375
3	0	0	0	2	0	0	0	0	2	0.250
7	0	3	0	0	3	0	0	3	9	1.125
13				3	0	0	3	0	6	1.200
14				2	0	0	2	0	4	0.800
Total	0	5	0	7	6	6	5	3	32	* 1.080
			F E M A L E							
5	0	0	0	2	0	0	0	0	2	0.250
8	3	0	0	0	0	0	2	0	5	0.625
10	0	0	0	0	3	1	0	0	4	0.500
11	2	0	0	0	0	0	0	0	2	0.250
15				3	0	0	0	0	3	0.600
16				0	2	0	0	0	2	0.400
17				2	0	0	1	0	3	0.600
Total	5	0	0	7	5	1	3	0	21	* 0.457

* Five years taken into consideration

Table 3 Coning data for the period 1986 to 1990 of five *Macrozamia communis* plants growing at Balgowlah, N.S.W., Australia

Plant No.	1986	1987	1988	1989	1990	Total	Yearly Average
		M A L E					
E	0	0	0	3	0	3	0.600
F	0	0	3	0	3	6	1.200
G	4	3	0	3	3	13	2.600
Total	4	3	3	6	6	22	1.466
	F E M A L E						
C	3	2	3	3	3	14	2.800
D	1	0	2	3	2	8	1.600
Total	4	2	5	6	5	22	2.200

three cones, another 13 cones i.e. 4.333 times as many cones as the other i.e. averages per plant per year of 0.600 and 2.600. One female plant had eight cones, another 14, a ratio of 1.750 to one, i.e. an average per plant of 1.600 to 2.800.

An overall evaluation of results is difficult to make. In no case was the age and therefore the sexual maturity of the plant known, so that coning rates need not necessarily be comparable. For this to be possible the plants would need to be the same age and to be grown in identical conditions. The observations quoted would give data on a field population in the cases of the Noraville and Seven Mile Beach specimens, which were growing under natural conditions. The very low coning rate in the former in 1981 and 1982, following a fire, may be significant.

The Balgowlah specimens were not growing in their natural environment. The two female plants produced a much greater number of cones than plants growing under natural conditions, but there were five plants observed over a shorter period.

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THE NUCELLUS: ITS POSITION AND FUNCTION IN THE OVULE OF *ENCEPHALARTOS*

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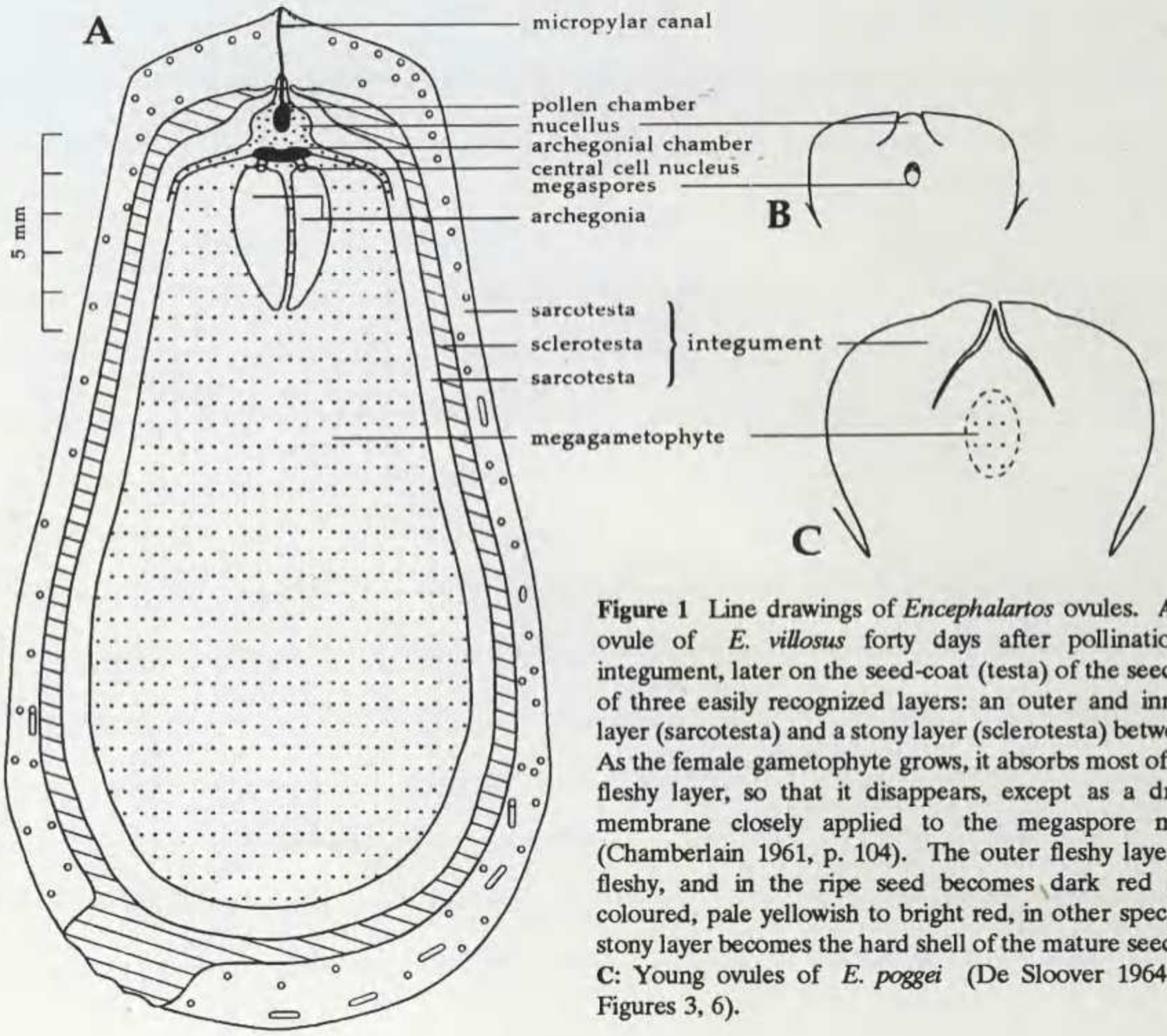


Figure 1 Line drawings of *Encephalartos* ovules. **A**: Mature ovule of *E. villosus* forty days after pollination. The integument, later on the seed-coat (testa) of the seed, consists of three easily recognized layers: an outer and inner fleshy layer (sarcotesta) and a stony layer (sclerotesta) between them. As the female gametophyte grows, it absorbs most of the inner fleshy layer, so that it disappears, except as a dry papery membrane closely applied to the megaspore membrane (Chamberlain 1961, p. 104). The outer fleshy layer remains fleshy, and in the ripe seed becomes dark red (variously coloured, pale yellowish to bright red, in other species). The stony layer becomes the hard shell of the mature seed-coat. **B, C**: Young ovules of *E. poggei* (De Sloover 1964, Plate 1, Figures 3, 6).

Embryologists are botanists that delve into the sex life of plants. Such people collect in great detail information about the reproductive processes that take place during the life cycle of a plant, such as pollination, fertilization, embryo formation and growth and seed and fruit development. In order to understand these events, embryologists have to study the development and internal structure of the organs and tissues that produce male and female gametes, embryos, seeds and fruits. With the aid of dissecting needles, scalpels and intricate sectioning apparatus called microtomes, embryologists cut flowers and cones in all stages of development into minute pieces that, ultimately, are examined under various types of microscopes.

Since Sedgwick (1924) published some details concerning the life history of *Encephalartos*, very little embryological data have appeared in the literature on the southern African species of the genus. The paucity of information in this field is understandable, if seen in the light of the above-mentioned destructive nature of an embryological study, especially when the endangered position of the genus, the irregularity in cone production and the scarcity of female cones on the plants are also taken into account. For it is inside the ovules and therefore within the female cone that not only the megagametophytes, but also the microgametophytes develop to produce female and male gametes.

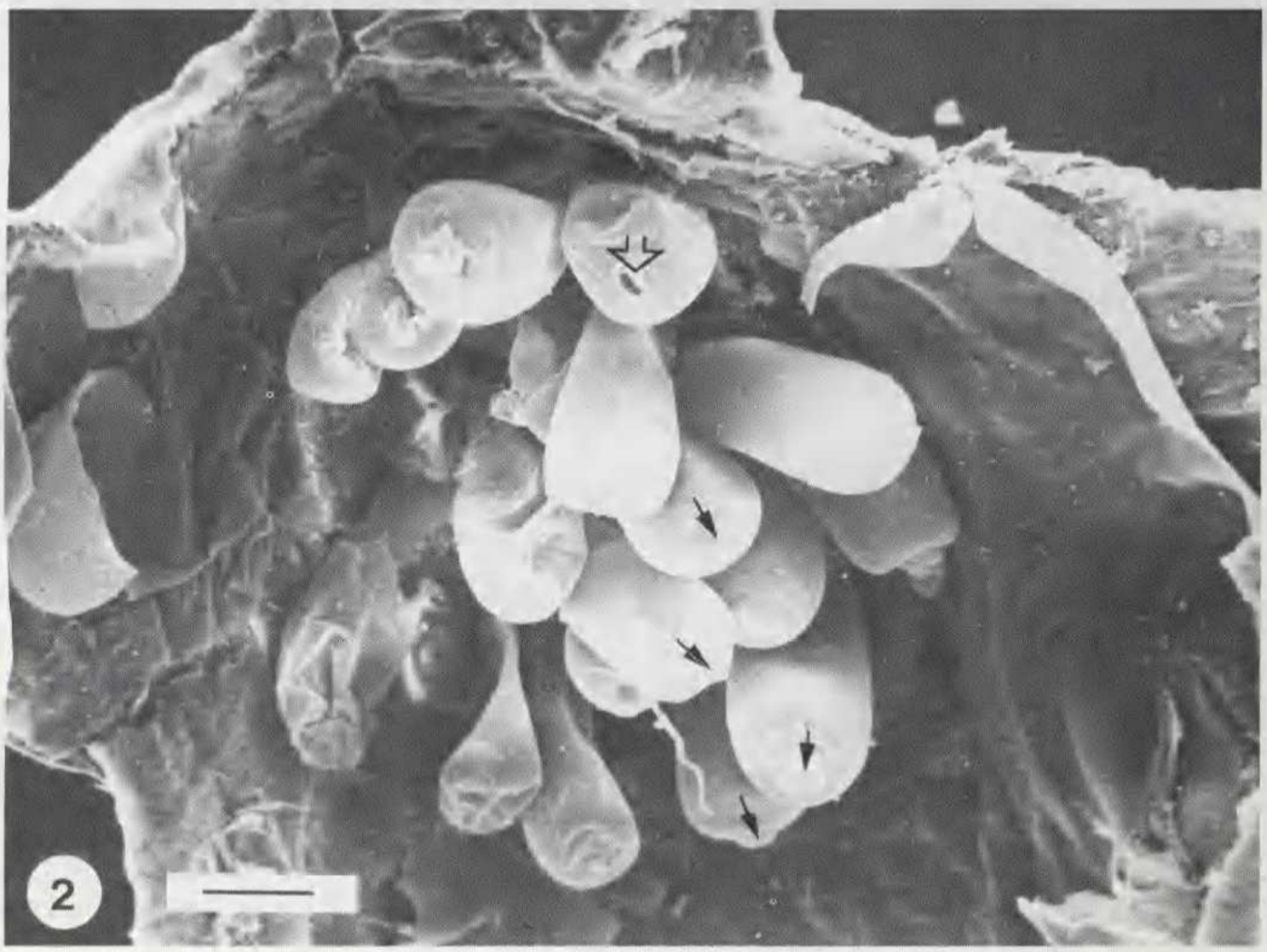


Figure 2 Scanning electron micrograph of the nucellar "roof" of the archegonial chamber, as seen from underneath. Numerous pollen tubes have entered the chamber of this ovule, collected fifty-six days after pollination. Note the desiccated appearance of the nucellar tissue, the swollen intact tubes with the remains of pollen grains (small arrows) at their basal ends and the wrinkled appearance of an open tube (large arrow). Scale bar 250 μm.

The ovular tissue that protects and nourishes both types of gametophytes during their growth is called the nucellus. Each of the two nucellus primordia that are formed on the upper side (adaxial surface) of a megasporophyll, first appears as a small protrusion (Figure 1B), surrounded by the young integument. One of the internal nucellus cells (megaspore mother cell) enlarges and divides meiotically to produce a row of four cells, the megaspores (Figure 1B). During meiosis the number of chromosomes in the nucleus of the diploid

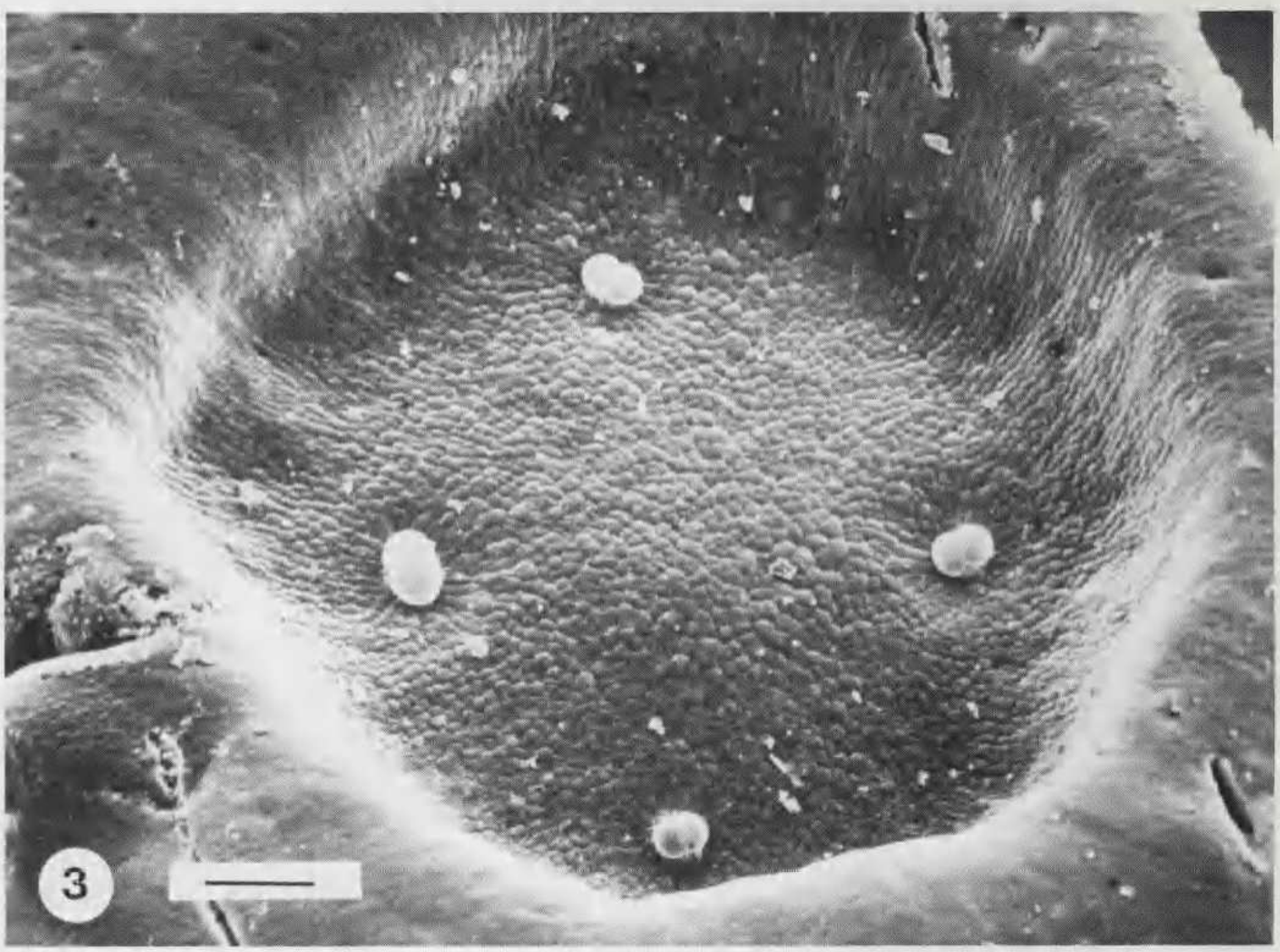


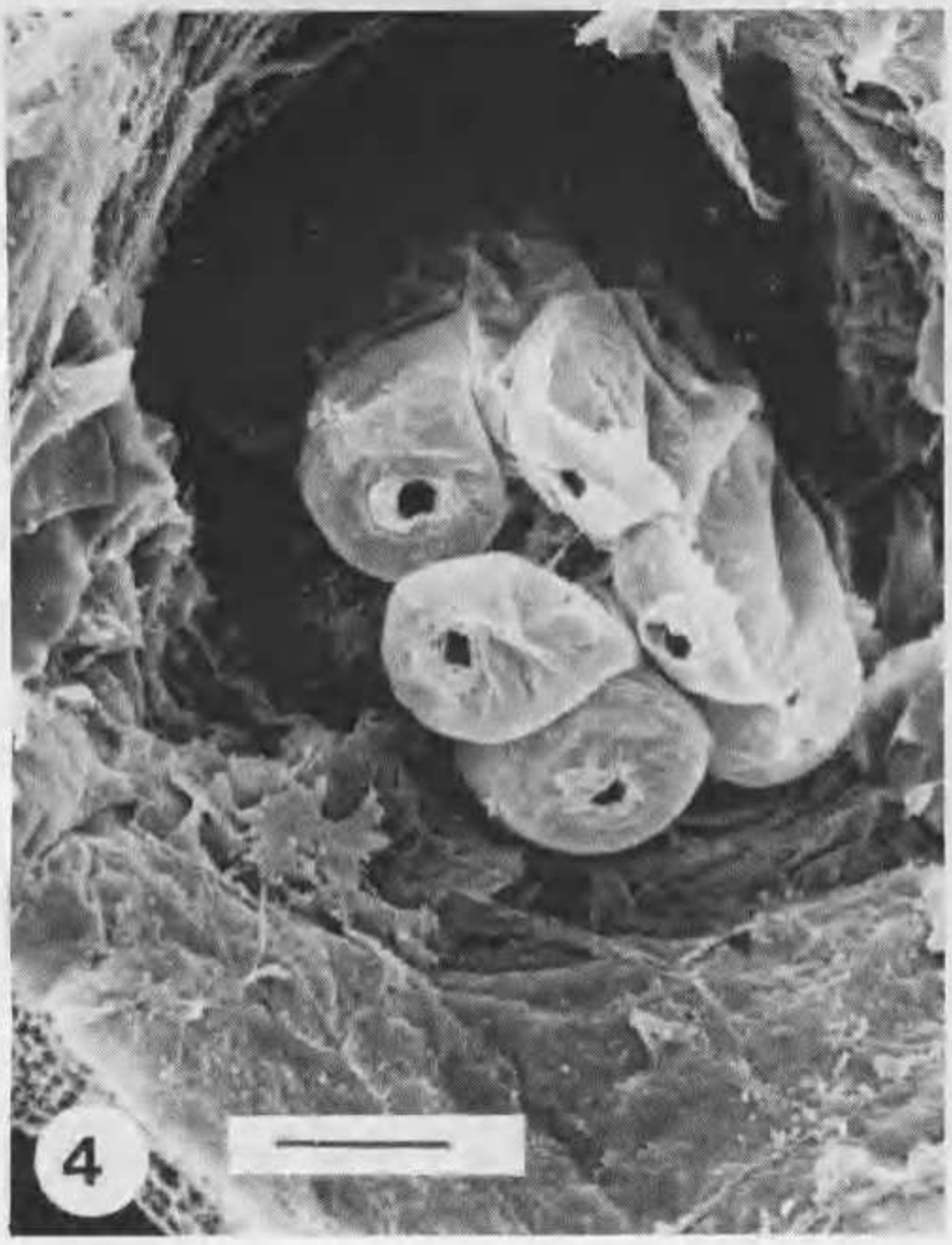
Figure 3 Scanning electron micrograph of the "floor" (megagametophytic tissue) of the same archegonial chamber as in Figure 2, but viewed from above. Note the fleshy appearance of the megagametophytic tissue and the two turgid neck cells of each archegonium as they protrude into the archegonial chamber. Scale bar 250 μm.

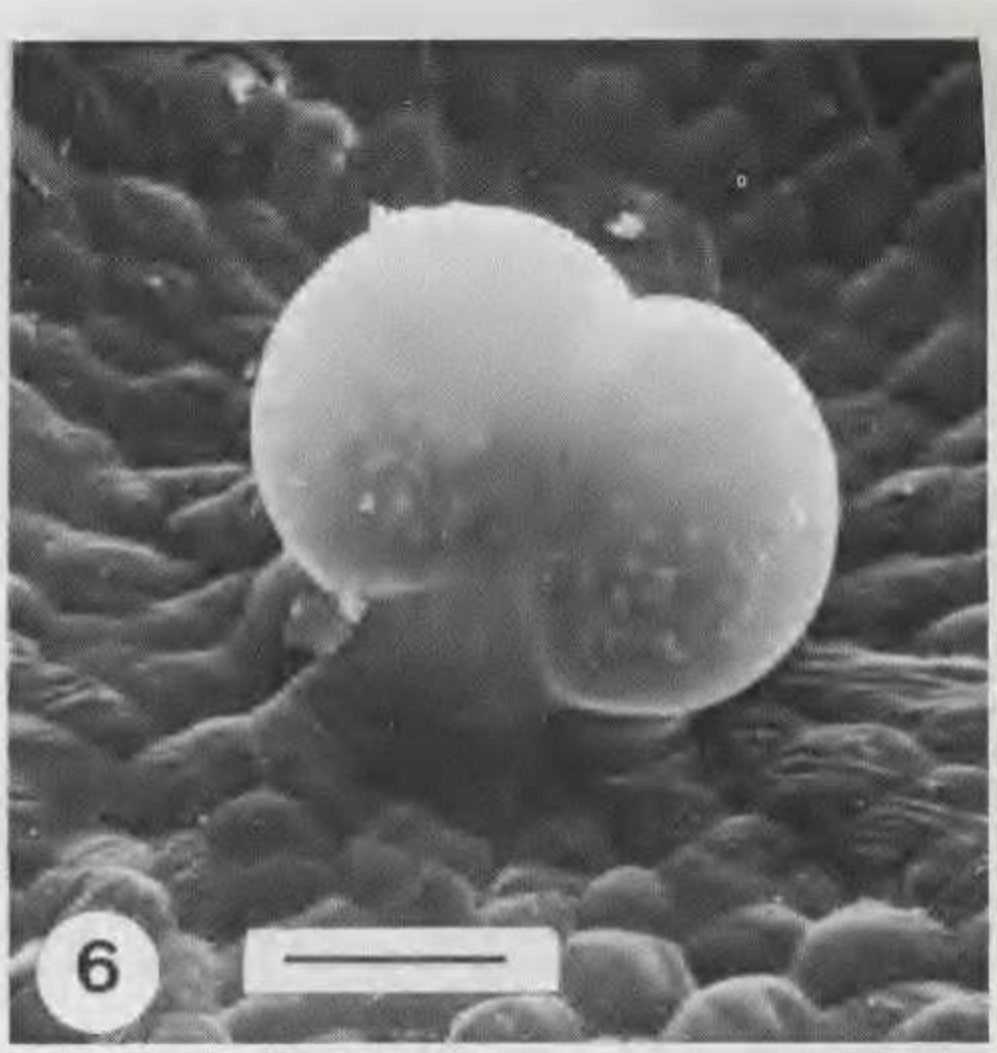
megaspore mother cell are reduced by half, *i. e.* the cells (megaspores) are haploid, and the chromosomes are rearranged. Usually, the lowest one of the four megaspores develops into the megagametophyte. At these early developmental stages the young ovular cone is still completely concealed by the bud scales. In the southern African species the youngest phases in the growth of the nucellus (Figures 1B, 1C) have not been seen, but were found and depicted by De Sloover (1964) during his investigation of the tropical African species, *E. poggei*.

The primary role of the nucellus in the sexual life cycle of *Encephalartos* (and in the life cycle of all gymnosperms and angiosperms) is therefore to form, through the process of meiosis, the first cell of the haploid megagametophyte. During the subsequent growth of the megagametophyte, another function of the nucellus cells becomes apparent: nutrients are supplied to the expanding structure by the surrounding nucellar tissue. Gradually the nucellus is pushed upwards by the expansion of the growing gametophytic tissue and in the mature ovule the nucellus is a small dome-like structure with a prolonged beak that protrudes upwards into the micropyle (Figure 1A). Underneath the nucellus a small depression (Figures 1A, 3), the archegonial chamber, has been established in the apical and central region of the megagametophyte that now contains three to five archegonia.

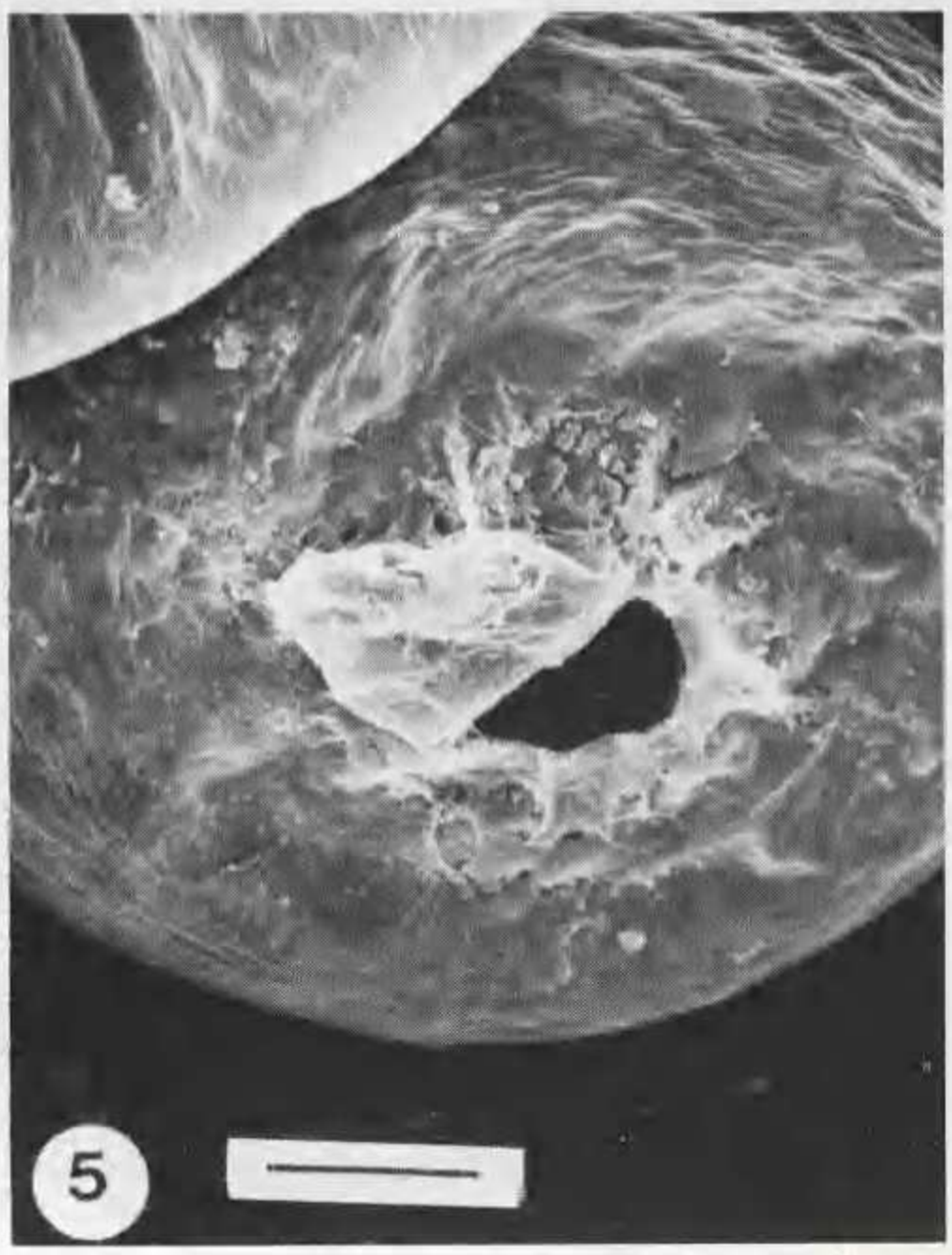
Donaldson and DeWet Bösenberg (1993) have recently very aptly illustrated another function of the nucellus in the pollinated ovule of *E. altensteinii*. Prior to pollination a small cavity, the pollen chamber, is formed in the central nucellar tissue. It is within this enlarging chamber (Figure 1A) that microspores (pollen grains), having passed through the micropyle, develop into microgametophytes (pollen tubes). During their growth the parasitic microgametophytes penetrate the succulent nucellar tissue and are nourished by the disintegrating cells.

During the coning season of 1993 several *E. villosus* plants in the Pretoria Botanical Garden were artificially





Figures 4-6 Scanning electron micrographs of pollen tubes and archegonial neck cells in an archegonial chamber of an ovule collected a week later. **Figure 4** shows that all the pollen tubes have opened. Scale bar 250 μm. **Figure 5** illustrates the open "door" formed by the remains of the pollen grain. Scale bar 50 μm. **Figure 6** depicts the seemingly intact neck cells of an archegonium in the "floor" of the chamber. Scale bar 50 μm.



pollinated by syringing a mixture of distilled water and pollen grains into opening female cones. From these cones, sporophylls were collected at weekly intervals after pollination and the ovules dissected and examined under the dissecting microscope. The central, dome-like region of the nucellus and underlying archegonial chamber were processed according to accepted procedures for viewing under a scanning electron microscope. The first germinating pollen grains were seen in the pollen chamber approximately thirty days after pollination.

As the pollen chamber with the growing pollen tubes extends downwards, the nucellus cells that separate the two chambers (Figure 1A) ultimately disappear and a single compartment is formed. The dome-like, fleshy nucellar tissue has now become a thin, desiccated and tough structure (Figure 2) that has a final role to play: it forms a "roof" over the archegonial chamber and seals it off from the outer air so that the microgametophytes can eject their contents containing the male gametes into an air-tight compartment. Since these gametes (spermatozoids) have to swim to the archegonia and pass through the necks into the egg cells, a hermetically sealed environment is essential for fertilization to be effected.

Between fifty and sixty days after pollination the swollen bases of the microgametophytes could be seen

protruding through the "roof" (Figure 2), while the two turgid neck cells of each archegonium were visible in the "floor" of the archegonial chamber (Figure 3). The pollen tubes did not extend further downwards into the chamber and the spermatozoids apparently entered through a "door", formed by the remains of the pollen grain (Figures 2, 4). In ovules collected a week later, all the pollen tubes had opened and were shrunken (Figure 5), but the neck cells of the archegonia underneath showed no sign of damage (Figure 6). Whether fertilization had occurred in these archegonia, will have to be established by further investigation. Free spermatozoids have not yet been seen.

ACKNOWLEDGEMENTS

We wish to thank the National Botanical Institute at Pretoria for the use of facilities and gratefully acknowledge the assistance of Dr. S. M. Perold during the scanning electron microscopical study. Mr. C. van der Merwe (University of Pretoria) and Mrs. W. Roux are thanked for their help with the illustrations.

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SHORT COMMUNICATIONS / KORT MEDEDELINGS

TIMES OF CONING FOR THE AFRICAN CYCADS

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With the increasing interest in artificial pollination, seed harvest and growing of cycads from seed, it is useful to be able to anticipate when pollen will be available or required, when pollination will be carried out, and when seed crops will be harvestable. I have attempted to keep records from my own work in this respect over the past five years and have compared notes with others (Isabella Claassen, John Donaldson, Cynthia Giddy, Nat Grobbelaar and Johan Hurter). The accompanying table is the result of our various experiences.

The table lists all the African species of *Encephalartos* and *Stangeria eriopus*, with the exception of the very recently-described *Encephalartos delucanus* (from Tanzania) and *E. schaijesii* (from Zaire). The second column given the months when pollen production has been recorded, with superscripts detailing the source of the information and an asterisk being used to designate wild population observations. The third column is in similar format and gives details of months of seed shedding. Finally, the time interval between the two events is shown in the fourth column.

Although there is a fair sprinkling of question marks in the table (species where we have little or no reliable data), in general the table provides much useful information. Most species fall in one of three groups:

Group A is the largest group. Plants in this group shed pollen in autumn (Mar-Apr-May) and drop their seeds 6-8 months later in spring or early summer (Aug-Sep-Oct). This group includes *E. aemulans, E. altensteinii E. arenarius, E. caffer, E. gratus, E. hildebrandtii, E. horridus, E. ferox, E. lebomboensis, E.lehmannii, E. longifolius, E. natalensis, E. ngoyanus, E. paucidentatus, E. princeps, E. trispinosus, E. umbeluziensis, E. villosus* and *E.* "Piet Retiefii". Possibly also included in this set are *E. cerinus, E. chimanimaniensis, E. concinnus, E. manikensis* and *E. woodii*.

Group B seems specific to the species previously within the *E. eugene-maraisii* complex, i.e. *E. cupidus, E. dolomiticus, E. dyerianus, E. eugene-maraisii, E. middelburgensis* and *E.* "venitus". This group produces pollen in late summer (Jan-Feb-Mar) and seeds fall 4-5

Table 1 Times for the coning of African cycads

Cycad species	Months for pollen production (1)	Months for seed shedding (2)	Time between (1) and (2)
E. aemulans	▪Mar ◆◆▫▫Apr ▪May	▫▫Sep ◆◆▫Oct ▪Nov	6
E. altensteinii	▫†Mar ▫◆†▫Apr ▫◆#May	▫▫Sep ▫▫Oct ▫▫Nov ▫▫Dec ◆#Jan	8
E. arenarius	▫Mar ▫†▫Apr ▫†▫May ▫Jun	▫Oct ◆#▫▫Nov ▪Dec ▪Jan ▫Feb ▫May	7
E. barteri	?	?	?
E. bubalinus	▫Jan	▫Jan	12
E. caffer	▫Jan ▫†▫Feb ◆#Apr ▫Jun	▫Jul ▪Aug ◆#Oct ◆#Nov ◆#Dec ◆#Jan	7
E. cerinus	?	▫Aug	?
E. chimanimaniensis	▪Dec ▫▫Jan ▪Feb ▫Mar	▫Sep	7
E. concinnus	▫▫Feb ▫Mar	?	?
E. cupidus	▫▫Jan ▫▫Feb ▪Mar	▪May ▪Jun ▫Jul	5
E. cycadifolius	†Aug †▫Sep ◆#▫Oct ◆#▫Nov ◆#Dec ▫Jan	◆#Jan ◆#Feb ◆#Mar	4
E. dolomiticus	▫Sep ▪Dec ▫▫Jan ▪Feb	▪May ▪Jun	5
E. dyerianus	▫Feb ▪Mar ▪Apr	▪Jun ▪Jul	5
E. eugene-maraisii	▫†▫Feb ▫▫Mar	▫▫Jul ▫Aug	5
E. ferox	◆†▫Feb ▫◆†▫Mar †▫Apr ▫▫May ▫▫Jun ▫▫Jul ▪Aug	▪Jun ▫Jul ◆▫▫◆▫Aug ▫▫Sep ◆▫#▫Oct ▪Nov	5
E. friderici-guilielmi	†▫Aug ▫†▫Sep ◆#†▫Oct ◆#Nov	▫▫Dec ◆#Feb ◆#Mar ◆#Apr	5
E. ghellinckii	▫▫Apr ◆#Nov	▪Sep ▪Oct ◆▫Dec ◆#Jan ◆#Feb	4
E. gratus	▫Mar	▫Aug ▫Sep	5
E. heenanii	▪Aug	▪Dec ▪Jan ▪Feb	5
E. hildebrandtii	▫▫Feb ▫▫Mar ▫Apr	▫Sep ▫Oct ▪Nov ▪Dec	7
E. horridus	▫◆▫▫Mar ◆◆#▫▫Apr ▫◆◆#†▫▫May ▫◆▫Jun †▫▫Jul ▫◆▫Aug ▫◆▫▫Sep	▪Oct ◆#▫▫Nov ◆▫▫#▫Dec ◆▫Jan ▫Feb	7
E. humilis	▪Aug ▪Sep	▪Jan ▪Feb ▪Mar	4
E. inopinus	▪Sep ▪Oct †▫Jan ▫◆†▫Feb ▫†▫Mar ▫▫Apr	▫▫Jan ▫▫Feb ▫▫Mar ▫Apr	5
E. ituriensis	▫May	?	?
E. kisambo	◆▫Nov ◆▫Dec ◆▫Jan ▫Feb	◆▫Aug ▪Sep	9
E. laevifolius	◆†▫Sep ◆#†▫▫Oct ▫†Nov	▪Jan ▪Feb ▪Mar	5
E. lanatus	†▫Oct ◆▫†Nov ▫Jan	◆#▫Jan ◆▫▫▫Feb ▪Mar	5
E. latifrons	#▫Jul ▪Aug	#Jan	6
E. laurentianus	?	?	?
E. lebomboensis	▫†▫Mar ▫†▫▫Apr ▫◆▫▫May ▪Jun ▪Jul ▫Aug	▪Aug ◆▫▫Sep ▫▫▫Oct ▫▫▫Nov	6
E. lehmannii	▫†▫▫Mar ◆▫▫#†▫▫Apr ◆▫▫◆#†▫May ▪Jun ▪Jul	◆▫▫#▫Oct ◆▫▫#▫Nov ▫Dec	6
E. longifolius	◆#▫▫Mar ◆#▫▫Apr ◆◆#†▫May ◆▫▫#†▫Jun ▫▫Jul ▫Aug	◆#▫▫Oct ◆#▫▫Nov ◆▫▫#▫▫Dec ▪Jan ▪Feb	6
E. manikensis	▪Jan ▪Feb ▫Apr	▫Jan ▫May ▪Oct	9
E. marunguensis	?	?	?
E. middelburgensis	▫▫▫Mar ▫▫Apr ▫May	▪Jun ▪Jul ▫Sep ▫Oct ▫Dec	8
E. munchii	▪Dec ▫▫Jan ▪Feb	▫Dec	12
E. natalensis	◆▫▫#†▫Apr ▫◆†▫▫May ◆▫▫Jun	▫Oct ◆▫▫#▫Nov ◆▫Dec ◆Jan	7
E. ngoyanus	▫▫Feb ◆▫▫◆▫▫Mar ◆▫▫Apr	▪Aug▪Sep ▫▫Oct	6
E. paucidentatus	▪Feb ▪Mar ▪Apr ▪May ▪Jun †▫▫Jul ▫◆†Aug	▪Oct ▪Nov ▪Dec ◆▫Jan ▫▫▫Feb ▪Mar	7
E. poggei	?	?	?
E. princeps	◆#Apr ▫†▫▫Jun ▫▫Jul ▪Aug ▪Sep	▪Oct ◆#▫▫Nov ▪Dec ▪Jan	6
E. pterogonus	?	?	?
E. schmitzii	?	?	?
E. sclavoi	◆▫Nov ◆▫Dec ◆▫Jan ▫Feb	◆▫▫Aug ◆▫Sep	9
E. septentrionalis	▫Jul	?	?
E. tegulaneus	?	?	?
E. transvenosus	◆▫▫◆†Jun ◆▫†▫▫Jul ◆▫†▫▫Aug ◆▫▫▫Sep ▪Oct	▫Apr ◆▫▫◆Jun ◆▫▫Jul ◆▫▫Aug ◆▫Sep	12
E. trispinosus	▫†▫Mar ◆◆#†▫Apr ◆#May ▪Jun	▫Sep ◆▫▫#▫Oct ◆#▫▫Nov	6
E. turneri	?	?	?
E. umbeluziensis	▪Apr ▫▫May ▫†▫▫Jun ▫▫Jul ▫▫▫Aug ▫†▫▫Sep	▪Aug ◆▫▫Sept ▫▫▫Oct ▫▫▫Nov ▪Dec ▪Jan	5
E. villosus	▫Mar ◆▫▫#†▫▫Apr ◆#†▫▫May ◆#†▫▫Jun ▪Jul ▪Aug	▪Aug ▫▫▫Sep ◆▫▫#▫▫Oct ◆▫▫#▫Nov ◆#Dec	6
E. woodii	n/a	n/a	n/a
E. "Piet Petiefii"	▫†▫May ▫Jun ◆▫Jul ◆Aug	▫Nov	7
E. "venitus"	▫Apr †▫May	▪May ▪Jun ▫Jul	5
Stangeria eriopus	▪Jan ▫▫Feb ▫Apr ▫Jul ◆◆▫Aug ◆◆▫Sep	◆▫Aug ◆#▫Dec ▫Apr	9

* Observations indicated by an asterisk have been made in the field; all other observations are made on plants in garden cultivation in South Africa.
† Isabella Claassen 3/1/1990; # John Donaldson 4/1/1993; ◆ Cynthia Giddy 1/3/1993; ▫ Nat Grobbelaar 3/5/1993 ▪ Johan Hurter 4/11/1992;
▫ Roy Osborne personal observations

months later in winter (May-Jun-Jul).

Group C comprises those species which have densely-woolly cones and are adapted to high-altitude and associated cold winter conditions, i.e. *E. cycadifolius, E. friderici-guilielmi, E. ghellinckii, E. heenanii, E. humilis* and *E. laevifolius* and *E. lanatus*. These species shed pollen in late spring (Sep-Oct-Nov) and seed falls 4-5 months later at the end of summer (Jan-Feb-Mar).

A number of species do not fit comfortably into any of these groups, but seem to have their individual cycle of timing; these are *E. inopinus, E. kisambo, E. latifrons, E. munchii, E. sclavoi* and *E. transvenosus*. In some cases, the female cones retain their seed for much longer periods than the species in groups A, B or C.

Interestingly, some species have narrow time bands for their various developmental processes, while others, e.g. *E. horridus*, seem to extend widely in their coning times. The timing process appears to be more genetically-controlled than environmental, as observations from a large number of garden plants in different parts of the country usually give more-or-less the same data. An exception to this is garden plants in the western Cape, where Piet Vorster comments that his observations are at considerable variance with those reported here. The Mediterranean climate and differences in latitude and longitude may be part of the explanation for this variance.

The data reported here will also be incorporated into a giant matrix of parameters for *Encephalartos* which Roy Osborne, Nat Grobbelaar, Leszek Vincent and Peter Linder will be using for numerical taxonomic and cladistic analyses of the genus.

"FISHTAIL" *ENCEPHALARTOS TRANSVENOSUS*

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A few months ago a young cycad enthusiast informed me of three "modjadji" plants with fused leaf tips growing in private gardens in Pretoria. He accompanied me to a garden in Pretoria North to look at and photograph one of these specimens. I was told that this kind of "modjadji" was initially observed on a farm in the Zoutpansberg mountain range near Louis Trichardt. The farm is at present owned by the Nature Conservation Division of the Transvaal Provincial Administration.

The size of the visible part of the stem of the specimen in Pretoria North is about that of soccer balls. At (and near) the tips of almost all the leaves several leaflets are fused (Figures 1, 2). In the majority of cases the fusion occurs along the entire length of the leaflets, creating a fan-like appearance. This specimen has been in the possession of the owner for just over a year and has produced one whorl of leaves during this period.

The owner referred me to Arnold Prozesky, a well-known cycad enthusiast in Pretoria, to obtain more information concerning the Zoutpansberg locality of the fishtail "modjadji" cycads. Mr. Prozesky told me that, with the aid of binoculars, he could actually discern the fishtail-like leaf tips of some of the cycads growing on top of an overhang occurring along a precipitous cliff.

Finally I was referred to a Louis Trichardt resident, the

Figure 1 A specimen of *E. transvenosus* with fused leaflets at the leaf tips, in a Pretoria North garden.

Figure 2 Detail of the tip of one of the fishtail-like leaves.

previous owner of the farm in question. During a telephone conversation I obtained the following information from him:

These cycads occur about 240 metres downwards from the top of a 400 metre high cliff in an area prone to violent lightning storms. One can only reach the plants by being lowered with ropes from the top of the cliff. The fishtail specimens consist of a large female (mother plant) with some smaller plants around it. He has raised a large number of seedlings from seed of the mother plant, the specimen in Pretoria North being one of them, and one and all produced the fishtail-like leaves. Several years ago the crown of the mother plant was damaged by a rock-fall. As a result of this about 30 to 40 buds developed on the damaged stem and the plant is now multi-headed.

It appears that the fused leaflets at the leaf tips could possibly be a case of mutation. According to Harder *et al.* (1965, p. 341-343) mutations may be due either to a sporadic change in a gene in one chromosome (gene mutation) or to a change in the structure of the chromosome (chromosome mutation), or to change in the number of chromosomes (genome mutation). Certain external agents, especially short-wave irradiation such as ultra-violet light, X-rays and emissions from radium, and also certain chemicals, considerably increase the mutation rate, and a relatively high percentage of *gene* mutations can be artificially created in this way. Such mutations, which are identical with those occurring spontaneously in natural conditions, play an important part in plant breeding. Chromosome mutation results from chromosome fragmentation. This can be induced artificially, particularly by X-rays or chemical treatments. One of the fragments can then either wholly disappear or reattach itself to the same or to a different chromosome fragment. This phenomenon is of great importance in relation to the nature and mode of activity of a gene, since it shows that the activity of a gene is in some way bound up with the structure of the whole chromosome. Finally, it is also possible for irregularities to occur at nuclear division in the distribution of the chromosomes to the daughter nuclei, so that cells arise which deviate from the norm in chromosome number (heteroploidy). Since the genes located in a haploid set of chromosomes are referred to collectively as the genome, such irregularities are spoken of as genome mutations. The presence of several sets of chromosomes is referred to as polyploidy. Polyploidy can be induced artificially by radiation, by subjecting the plant alternately to low and high temperatures (this may well occur in nature and be responsible for some of the polyploids found in the wild), and particularly by chemical means. Artificially produced polyploids are usually characterized by enlarged cells and greater dimensions generally, although growth is usually slower and flowering and fruiting delayed. Most of the mutations well known today, be they gene or chromosome mutations, cause only minor changes in the plant containing them.

Further experimental work is necessary before the cause of the fishtail-like leaves of the "modjadji" cycads can be established and to determine if they could be the result of gene or chromosome mutation. It is therefore a pity that the mother plant was damaged by the rock-fall, causing the coning cycle to be interrupted and postponed.

One can only wonder that in case of the fused leaflets being indeed a result of gene or chromosome mutation, if it could have been induced by the effect of lightning.

It would be interesting to hear from readers of "*Encephalartos*" who own one or more of the offspring of this "modjadji" mother plant, or know someone who does, whether the fishtail-like leaves are produced with each leaf flush or not.

REFERENCE

HARDER, R., SCHUMACHER, W., FIRBAS, F. & VON DENFFER, D. 1965. Strasburger's textbook of botany. New English edition, translated by P. Bell and D. Coombe. Longmans, Green and Co Ltd, London.

ACKNOWLEDGEMENT

I wish to thank Abel Stolz for bringing the existence of the "fishtail" cycads to my notice.

DBG SALES DAY SUCCESS

Roy Osborne
Department of Chemistry, University of Natal, 4001 Durban

In a novel initiative, the Durban Botanic Gardens held a plant fair on Sunday 16 May this year, at which excess stocks of cycads, palms and orchids were offered for sale. There was a large interest from the public and the cycads were sold out within the first hour. A small number of plants were sold by auction fetching prices from R100 to over R1 000. Over R18 000 was raised for the Botanic Gardens Trust Fund on the day and this will be used for further development of the gardens.

It is planned to hold similar plant fairs twice annually in the future.

Right: Durban Parks' Director Errol Scarr (left) calling for bids for a specimen of *Encephalartos eugene-maraisii*, held by Roy Osborne (centre) at the Durban Botanic Gardens plant fair.

Plants for grabs . . . pictured here is Chris Dalzell with an example of one of the orchids, cycads and palms which go on sale at Durban Botanic Gardens on Sunday between 9am and 3pm. Money raised from the sale will go to the garden's trust funds. **Picture by TERRY HAYWOOD**

THE ELEPHANT'S FOOT CYCAD

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

Mr Shri Dhar of Calcutta, India, sent me the photograph reproduced in Figure 1 and asked me whether I could identify the cycad depicted on it for him. From close-up photographs of the leaflets it was obviously a *Cycas* species but that was as far as I could go. Prof. Pant of India, one of our honorary members, then kindly inspected the plant and reported as follows: "I have no doubt that your small tree with the tuberous base belongs to *Cycas siamensis*. I can reason out my identification with you as follows:- (1) The leaves which have leaflets with a single median vein identify the genus as *Cycas*; (2) The tuberous base of the stem is characteristic of *Cycas siamensis* - such tuberous bases are not found in any other species of *Cycas*.

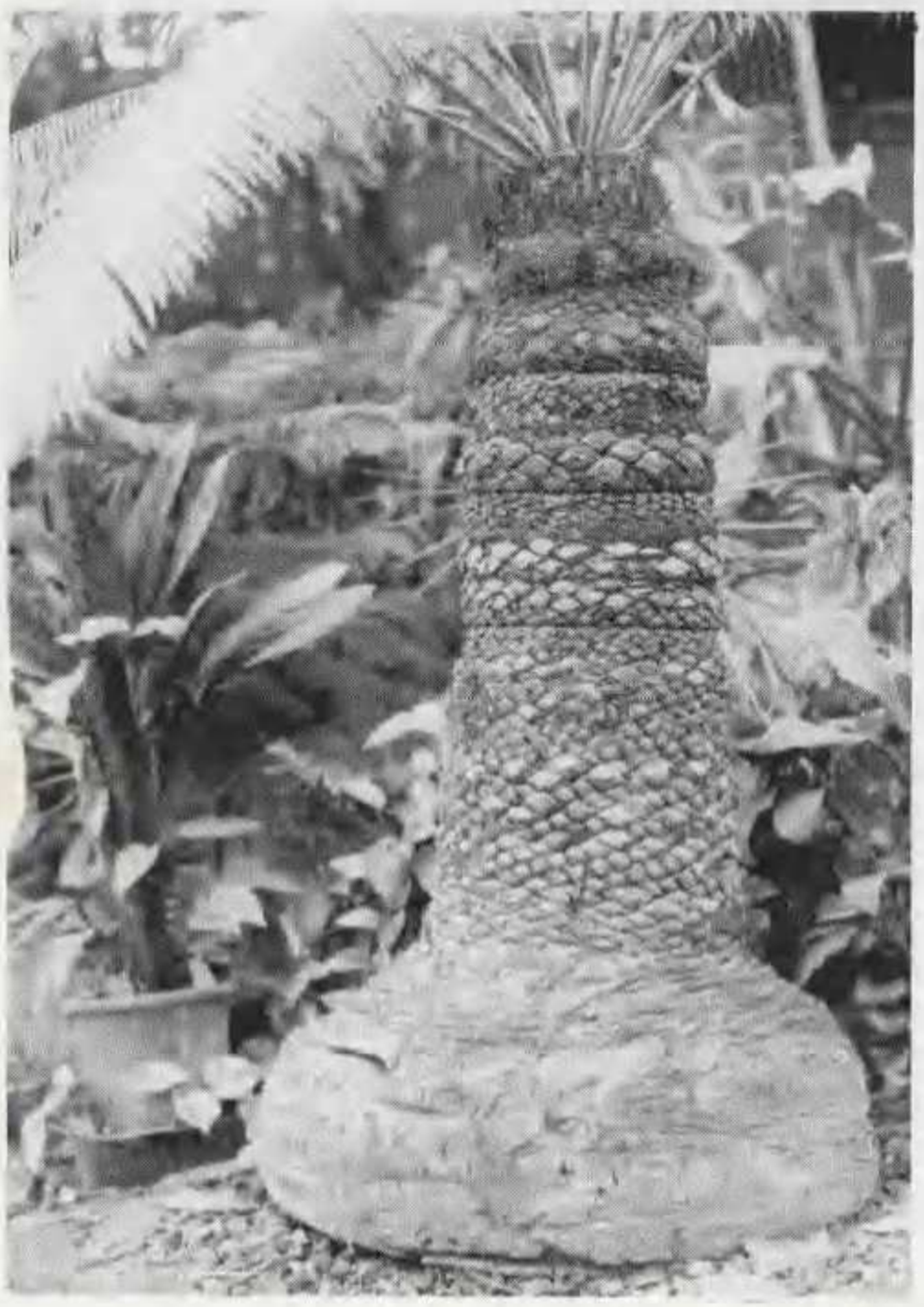

Figure 1 Photograph of an unusual specimen in the lovely garden of Mr Shri Dhar, one of our members living in Calcutta, India.

Subsequently Dr Ken Hill of Australia sent me a facsimile of an anonymous article published on page 273 of the April 22, 1882, edition of "The Garden". The text reads: "In order to fully realize the beauty of Cycadaceous plants, one needs to see them in such noble proportions as those represented in the accompanying illustration (see Figure 2), which shows a group of the Siamese Cycas in the garden of the Acclimatation Society, in the Bois de Boulogne, Paris, where there are about fifty large specimens, some of which have trunks 6½ ft. in height, and from 6 in. to 10 in. in diameter. This species of *Cycas* is remarkable for the singular manner in which the base of the trunk enlarges into a huge conical mass, gradually acquired from the time of germination - a peculiarity which adds greatly to the quaint aspect of this cycad ..... Its tenderness has been much exaggerated, as plants of it wintered well in the large conservatory in the gardens just named, where the temperature has at times fallen nearly down to zero."

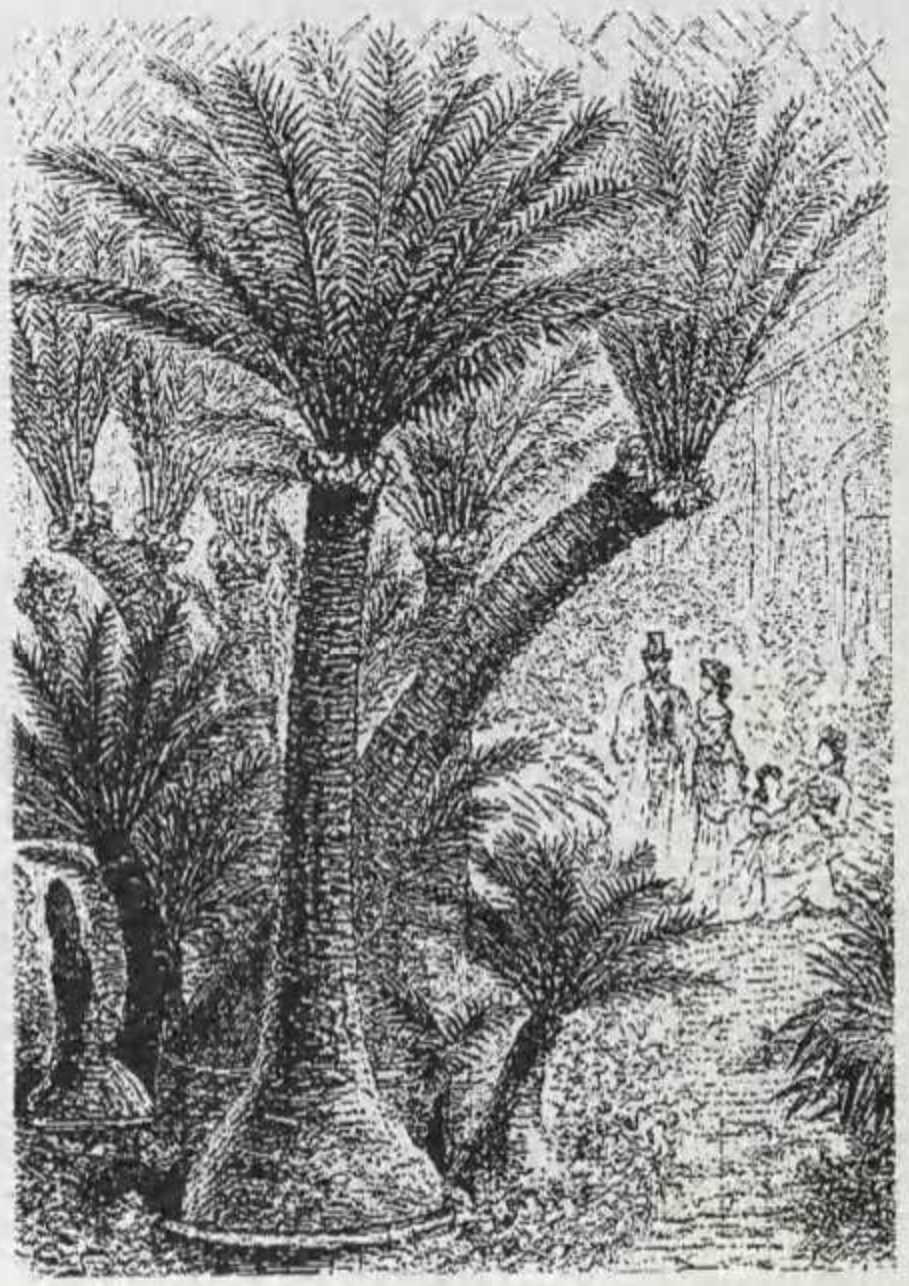

Figure 2 Copy of an illustration that appeared in "The Garden" of April 22, 1882. It shows a group of *Cycas siamensis* plants growing in the Bois Boulogne, Paris.

It would be interesting to know whether the magnificent specimens referred to above are still to be seen in the Bois de Boulogne in Paris.

"BLUE" CYCADS

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

The foliage of some cycad species, such as *Encephalartos dolomiticus*, *E. dyerianus*, *E. eugene-maraisii*, *E. horridus*, *E. middelburgensis*, *E. lehmannii* and *E. trispinosus* usually has a decided "blue" colour. Cycad collectors claim that "blue" forms of species such as *E. longifolius* and *E. arenarius* whose foliage normally are green, also exist and these "blue varieties" are often very much sought after.

Figure 1 Photograph of part of leaf of *Encephalartos lehmannii*. The superficial wax layer has been removed from the central portion of one of the leaflets by rubbing the leaflet between two fingers. This transformed the colour of the treated part of the leaflet to dark green.

Few cycad enthusiasts apparently realize that the "blue" colour is due simply to the presence of a relatively thick layer of wax on the outer surface of the leaves. In Figure 1 part of a young leaf of *E. lehmannii* is shown. Part of one of the leaflets was rubbed between two fingers to remove the wax layer. This transformed the "blue" colour of the treated part of the leaflet into a glossy green. Indeed, the "blue" colour of young leaves usually disappears spontaneously with time and when the plant produces a new flush of leaves, the young leaves are distinctly "bluer" than the old leaves on the same plant.

In a population of 150 *E. longifolius* seedlings that I grew from the seed of green parents, a single distinctly "blue" individual was present. As far as I know one does not find whole populations of "blue" *E. arenarius* or *E. longifolius* under natural conditions. In these and similar cases, the "blue" forms therefore probably are the result of a mutation although it is possible that it could be due to the simultaneous presence of several recessive genes that are necessary for the production of an excess of cuticular wax. The thick wax layer is commonly considered to reduce water loss by transpiration but I do not know of any experimental work about this matter that has been performed on cycads.

WORLD HONOUR FOR CYNTHIA GIDDY

Roy Osborne
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A small but distinguished group met in Durban's Royal Hotel on 13 May 1993 to celebrate the "Honourable Mention" received by Cynthia Giddy in the current series of Rolex Awards for Enterprise. These coveted awards have been made every three years since 1976 and it is the first time a South African has received this distinction.

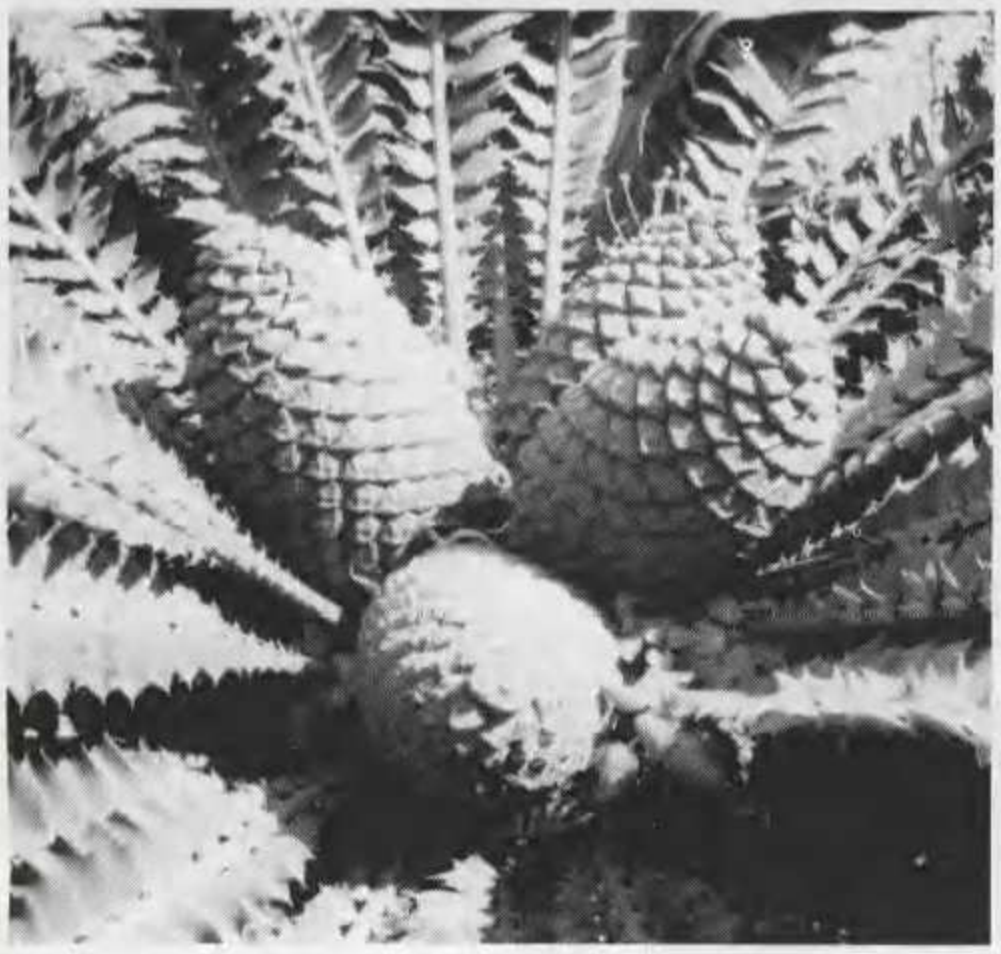
Cynthia's award was in recognition for her project to establish a sanctuary to protect the 300-400 *Encephalartos natalensis* specimens in the Edendale district near Pietermaritzburg (see "*Encephalartos*" 28:17). The project involves not only the protection of the remaining plants but also the initiation of a conservation awareness programme for the local community and the establishment of a nursery on the site.

In presenting a scroll and a gold chronometer to Cynthia, the Rolex representative, Mr H.V. Hefer explained that the five Rolex Laureate awards and the 36 Honourable Mentions are selected on the basis of a spirit of enterprise together with qualities of innovation, originality, inventiveness, interest and impact.
[See Newspaper clipping on page 40.]

THE FOUR-CONED FEMALE *ENCEPHALARTOS FEROX*

Danie Nel
120 Bowker Road, 4093 Escombe

Encephalartos ferox in cone is always eye-catching for the sharp contrast between the scarlet cones and the glossy dark green leaves. *E. ferox* female plants usually bear one or two cones, but a specimen in a private garden in Durban this year produced four cones. [According to "Cycads of South Africa" by Cynthia Giddy and "Cycads of Africa" by Douglas Goode, female plants of *E. ferox* bear up to five cones - Editor.]



REVISION OF PANT'S "CYCAS AND CYCADALES"

Roy Osborne
Department of Chemistry,
University of Natal, 4001 Durban

One of the early and most important books in the cycad literature, Professor D.D. Pant's "Cycas and the Cycadales", published first in 1962 with a second edition in 1973, is being rewritten. Professor Pant informs us that his rewriting is now nearing completion. There will be about 210 figure plates with line drawings and black and white and colour photographs. It will be in three parts and its new title will be "An Introduction to Gymnosperms, *Cycas* and Cycadales". Part I will include three chapters: (1) Introduction (2) Evolution of seed and (3) Classification. Part II will include information on *Cycas*: (4) Distribution and diversity (5) External morphology (6) Vegetative anatomy (7) Reproduction and life cycle (8) Economic importance. Part III will include information on other cycads: (9) Distribution and diversity (10) Vegetative characters and anatomy (11) Reproduction and life cycle (12) Cycad hybrids and economic importance (13) Karyology and cytotaxonomy (14) Fossil history and relationships (15) Chemistry (by Roy Osborne) (16) Ecology (17) Conservation (18) Propagation and cultivation.

SOME OBSERVATIONS ON *ENCEPHALARTOS INOPINUS*

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

On two occasions a friend invited me during early January to pollinate female *E. inopinus* cones in his Pretoria garden. The cones were large and healthy-looking. Despite regular visits to the garden, the cones were never found to be in an "open" condition. When the cones spontaneously disintegrated in May, the sclerotesta (shell) of the seeds were found to be quite soft (unhardened). From recent observations in Pretoria gardens, it turns out that the female cones of *E. inopinus* are receptive for pollination during December and early January when the cones are about half their final size. They open up quite widely when they are ready to be pollinated but they remain open for only a few days. From then on the cones grow considerably for one to two months when they attain their maximum size. From these observations it is clear that in my initial attempts to pollinate the cones, I was informed too late about their existence. According to Dr Claassen (our editor) she also knows of a female cone in a Pretoria garden that was ready to be pollinated during December whilst another case came to her attention that was ready during early February.

This brings me to another peculiarity about this species in Pretoria gardens. The male cones generally appear to shed their pollen considerably later than the time when the female cones open up. The friend who invited me to pollinate his female cones in both seasons had several male plants in the same garden that were coning. He logically assumed that the female cones would be receptive for pollination more or less when the male cones would shed their pollen. In fact, the male cones matured only in February and March. Dr Claassen also informs me that according to her records the male plants in the University of Pretoria's garden during the past six years have shed pollen from early January to early

March but mostly during late January and early February. It is rather surprising that generally speaking the male cones of this species sheds its pollen considerably later than the time when the female cones are receptive for pollination.

In my latest attempt to pollinate a female *E. inopinus* cone, I had only one chance (in January) to pollinate the cone before it closed. When this cone disintegrated spontaneously in May, some of the "seeds" were relatively small and greenish whilst about half were large and most of them had a brownish colour. It turned out that all the greenish "seeds" had soft sclerotestas whilst the brownish seeds had the normal hard kernels. The "soft seeds" were all found to be unfertilized whilst all the "hard" seeds that were sectioned (10) were fertilized. It would therefore appear that unlike most *Encephalartos* species, the ovules of *E. inopinus* have not attained the size of the mature seed at the time of pollination and that unless the ovules are fertilized, the seeds do not develop further. This is of course common for *Cycas*, *Dioon* and *Ceratozamia* species but I don't know what the position is with regard to species of the other cycad genera.

Three of the hard-shelled seeds referred to above floated in water. On sectioning them, they were each found to contain several immature *Antliarhinus zamiae* individuals. It is not known whether this insect has previously been found to parasitize the seeds of this cycad species whose natural habitat is quite far from the areas in which the insect is commonly reported to occur naturally.

Figure 1 Photograph showing one of the laughing-doves on the nest.

BIRD'S NEST CYCAD?

Isabella Claassen
P.O. Box 11322, 0011 Brooklyn

Bird's nest cycad? Yes, but not as in bird's nest fern (*Asplenium nidus*).

Last year a pair of laughing-doves (*Stigmatopelia senegalensis aequatorialis*) built their nest on one of the leaves of my male *Encephalartos transvenosus* plant (Figure 1). Unfortunately the eggs (Figure 2) were never hatched, because one morning I found the nest empty, and not even an egg-shell was nearby in sight.

Figure 2 Photograph showing the two eggs in the nest.

CYCADS RECOVERING WELL AT FAIRCHILD TROPICAL GARDEN

Knut Norstog and Priscilla Fawcett
5925 J. Road, Waterloo, IL 62298, U.S.A.

Figure 1 This specimen of *Cycas circinalis* was decapitated by hurricane Andrew. Six months later, adventitious shoots have developed along the trunk. The arrow indicates a bud near the apex.

We spent a week in March at Fairchild Tropical Garden and are pleased to report that the cycads are recovering well from the damage caused by hurricane Andrew (see "*Encephalartos*" 33: 26-28). The accompanying photographs show recovery of two specimens of *Cycas circinalis*, six months after the damage.

Figure 2 This specimen was not decapitated but lost all the leaves on its windward side. A new flush of foliage has restored the plant to its former appearance.

A REPORT ON THE THIRD INTERNATIONAL CONFERENCE ON CYCAD BIOLOGY PRETORIA, JULY 1993

Roy Osborne
Department of Chemistry, University of Natal, 4001 Durban

Hosted by the Cycad Society of South Africa and held under the auspices of the IUCN's Cycad Specialist group, CYCAD 93 was, simply stated, a huge success. That was the consensus opinion of the 121 participants from Australia, the USA, England, France, the Peoples Republic of China and, closer home, South Africa, Transkei, Swaziland and Zimbabwe. Several of the participants were "old faithfuls" from CYCAD 87 (Nice, France) and CYCAD 90 (Townsville, Australia) and others were new friends, but all agreed the CYCAD 93 Conference and associated activities were the best international "cycad" event ever.

The deputy Mayor of Pretoria (centre) meets Cynthia Giddy, Nat Grobbelaar, Kobus Eloff and Roy Osborne just prior to the Cycad 93 opening ceremony.

Part of Ita van der Walt's attractive display in the foyer of the Cycad 93 Conference Centre.

The Conference 5-9 July

The conference was held over 4 academic day sessions at the University of Pretoria. An official welcome was given by Councillor Uys, Deputy Mayor of Pretoria and Professor Kobus Eloff, Editor of the South African Journal of Botany, delivered the opening address. A total of 32 papers and 19 posters was presented, these representing diverse interests in the sessions of (1) conservation and cultivation, (2) physiology, biochemistry and toxicity, (3) systematics and ecology and (4) reproductive biology. All were of high standard and generated useful discussion. An interesting comment from Cynthia Giddy was "if CYCAD 87 was the coralloid roots conference and CYCAD 90 was the neurotoxicity meeting, the CYCAD 93 was the beetle conference", this remark in allusion to the number of presentations on cycad-insect relationship (John Donaldson, Rolf Oberprieler and Knut Norstog starring in this respect). One particularly well-received paper was the report on the Montgomery Foundation/Fairchild Tropical Garden research expedition to China in 1992 (Terrence Walters).

The academic week was broken by a day off to visit the recently-extended cycad plantings and nursery at the National Botanic Gardens at Brummeria and to see the impressively large scale operations at Koos Oosthuyzen's Patryshoek Nursery near Pretoria North.

Cycad 93 participants relaxing over a picnic luncheon in the National Botanical Gardens, Pretoria.

Visitors were much impressed by the scale of operations at Koos Oosthuyzen's Patryshoek Nursery near Pretoria North.

One cannot report on the Conference without mentioning the front-of-house arrangements. Ita van der Walt excelled herself in arranging a spectacular plant display; the exhibitors (Cycad Centre and Caversham Press) offered a wide range of goods and the poster displays were informative and attractive.

Social events during the week included a lavish reception at Munitoria by the Mayor of Pretoria, a night out as guests of the Transvaal Section of the Cycad Society, with a slide show under rather unusual conditions by Loran Whitelock, and a magnificent Banquet in the aquarium of the Pretoria Zoo.

An interesting programme for the accompanying persons was organized by Hanneke Grobbelaar. All those participating enjoyed the various day trips and, we suspect, the chance to get away from the "cycad freaks".

Right: A bemused Willie Tang amongst *Encephalartos transvenosus* in the Modjadji Nature Reserve at the start of the pre-Conference tour.

Doris Francis and Louis Erhard pose next to the giant *E. middelburgensis* on the Middelburg Cycad Trail.

Johan Kluge informing the visitors about the seed-orchard project at the Lowveld National Botanic Garden.

Pre-Conference tour participants view the recent seed-orchard plantings of *E. cerinus* at Nelspruit.

The CYCAD 93 post-Conference tour group at Durban's Old Fort Garden.

The Pre- and Post Conference Trips

The pre-Conference tour (1-4 July) saw 39 visitors, mainly international set off around the northern and eastern Transvaal. Highlights included the visit to the *Encephalartos transvenosus* Modjadji Forest, a tour through the Kruger Park, the Lowveld Botanic Gardens and seeing *E. laevifolius*, *E. humilis*, *E. middelburgensis* and *E. lanatus* in the wild.

The post-Conference tour (10-16 July), with 26 participants, started with a flight to Durban when the party saw Giddy's Nursery, the Old Fort Gardens, the Durban Botanic Gardens (with a launch of Roy Osborne's new booklet and a champagne-assisted *Cycas* planting ceremony) and site visits to *Encephalartos villosus* and *Stangeria* populations. The Port Elizabeth visit included a Mayoral Reception, tour of St George's Park and an inspiring field day viewing *Encephalartos horridus*, *E. lehmannii* and *E. longifolius* in the wild. A tour of the Cape Peninsula with a magnificent crayfish luncheon at the Black Marlin Restaurant, was followed by a cable-car ride to the top of Table Mountain, oddly-enough in the company of His Grace the Duke of Atholl, visiting Cape Town at the same time.

Right: Roy Osborne starts the ball rolling with a ceremonial planting of a *Cycas rumphii* specimen at Durban Botanic Gardens.

Cycad 93 visitors viewing the new cycad plantings at Durban Botanic Gardens.

Durban Park's Director Errol Scarr at the launch of Roy Osborne's new cycad booklet at Durban Botanic Gardens.

The day in Kirstenbosch Botanical Garden allowed visitors to see the *Encephalartos woodii* specimen with its anti-theft "sucker cage".

CYCAD 96

Professor Chia-jui Chen of the Peoples Republic of China presented plans for the Fourth International Cycad Conference to be held in Panzhihua City, Sichuan Province, in 1996. Professor Chen's proposal was accepted by an overwhelming majority and Terrence Walters (USA), Cynthia Giddy (Africa) and Ken Hill (Australia) have been appointed as overseas assistants to the Organizing Committee. Further details will appear in subsequent issues of "*Encephalartos*".

THE CYCAD SPECIALIST GROUP MEETING

The CYCAD 93 Conference was used as an opportunity to hold an open meeting of the cycad specialist group representatives. Views were aired on the sensitive matter of cycad seed importing and exporting. Cynthia Giddy was proposed as the next Chairman for the Cycad Specialist Group and Knut Norstog was delegated to report back to the Species Survival Commission on the meeting.

CYCAD 93 post-Conference tour participants pose at the Cape of Good Hope, the south-westernmost point in Africa.

CYCAD 93 COMMITTEE AND SPONSORS

The success of CYCAD 93 was due to a combination of good planning and management by the organizing committee: Nat Grobbelaar (Chairman), Roy Osborne (Finance), Cynthia Giddy (Tours) and Piet Vorster (Programme) with generous support from the following sponsors: The Foreign Affairs Dept. of the Government of South Africa, the University of Pretoria, the Endangered Wildlife Trust, the Wildlife Society of Southern Africa, the National Botanical Institute, the Cycad Society of South Africa, the Cycad Centre, Caversham Press, Babcock Identification Systems, Pick 'n Pay Stores, SAMCOR, SANLAM, Peaceforce Security, Johnson & Johnson, the Industrial Development Corporation and Toyota S.A. Marketing.

PROCEEDINGS OF CYCAD CONFERENCES

In view of the importance of the various contributions at the three Conferences so far, the Proceedings have been published as special volumes.

The CYCAD '87 Proceedings were published as *Memoirs of the New York Botanical Garden* Volume 57. The CYCAD '90 Proceedings are a special volume published by the Palm and Cycad Societies of Australia. The CYCAD '93 Proceedings will be published by the Cycad Society of South Africa.

Acknowledgements

Photographs used in this report were provided by Gerry Camp, Harry Gerber, Cynthia Giddy, Roy Osborne and staff of Springbok-Atlas Safaris.

AMENDMENT OF THE CONSTITUTION OF THE CYCAD SOCIETY OF SOUTH AFRICA

1993-07-27

The present Constitution compels Council to supply all members that have paid their membership fees for the preceding year, with a copy of the March issue of "*Encephalartos*" irrespective of whether they have paid their dues for the current year or not. As a consequence, members in good standing annually subsidize the distribution of about 200 copies of the March issue of "*Encephalartos*" to members that have not renewed their subscription. By accepting the proposed amendment of the Constitution, this procedure will be terminated and only members in good standing will receive the magazine.

It is proposed that Clause 4.2.1 be amended as indicated below. The underlined wording is to be added and the wording in brackets is to be deleted:

Clause 4.2.1. SUBSCRIBING MEMBERS, paying an annual subscription of an amount determined by COUNCIL (see clause 5.1) on the basis of the running costs of the Society. The membership shall extend over the one-year period from 1st January to 31st December. Membership fees shall be payable in advance at the end (beginning) of each year, but not later than the 31st December (March of that year) after which membership of subscription payment defaulters will be terminated.

Please mail your ballot to:

The Ballot Officer
Box 15357
0039 Lynn East
South Africa

to reach him **before** 20th October 1993.

Please use the ballot-paper on the first page of the coloured sheet in the front of this issue of the journal.

WYSIGING VAN DIE GRONDWET VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

1993-07-27

Onder die huidige Grondwet, is die Raad verplig om die Maart uitgawe van "*Encephalartos*" aan alle lede te stuur wat die vorige jaar se ledegeld betaal het ongeag daarvan of hulle hul ledegeld vir die nuwe jaar betaal het of nie. Dit kom dus daarop neer dat opbetaalde lede jaarliks die gratis beskikbaarstelling van sowat 200 eksemplare van die Maart-uitgawe van "*Encephalartos*" aan lede subsidieer wat nie hul ledegeld betaal het nie. Deur die voorgestelde wysiging van die Grondwet hieronder te steun sal hierdie praktyk gestaak word en sal slegs opbetaalde lede die tydskrif ontvang.

Daar word voorgestel dat Klousule 4.2.1 soos hieronder aangedui gewysig word. Die onderstreepte bewoording moet bygevoeg word en die bewoording in hakies moet weggelaat word:

4.2.1 BYDRAENDE LEDE, wat 'n jaarlikse ledegeld betaal, die bedrag waarvan deur die RAAD (kyk klousule 5.1) vasgestel word op grond van lopende uitgawes van die Vereniging. Die ledegeld sal 'n eenjaar periode van 1 Januarie tot 31 Desember dek. Ledegeld sal aan die einde (begin) van elke jaar vooruit betaalbaar wees en 'n lid wat na 31 Desember (Maart) agterstallig is met sy ledegeld (vir daardie jaar) se lidmaatskap sal beëindig word.

Pos asseblief u stembrief aan:

Die Stemopnemer
Bus 15357
Lynn-Oos
0039

om hom voor 20 Oktober 1993 te bereik.

Gebruik asseblief die stembrief op die agterkant van die gekleurde blad voorin hierdie uitgawe van die tydskrif.

CYCADS OF THE WORLD - ANCIENT PLANTS IN TODAY'S LANDSCAPE

David L. Jones

Published by Reed, a division of William Heinemann Australia (9th Floor, North Tower, 1-5 Railway Street, Chatswood Plaza, Chatswood, NSW 2067 Australia) and printed in Singapore by Imago Productions (F.E.) Pty Ltd.
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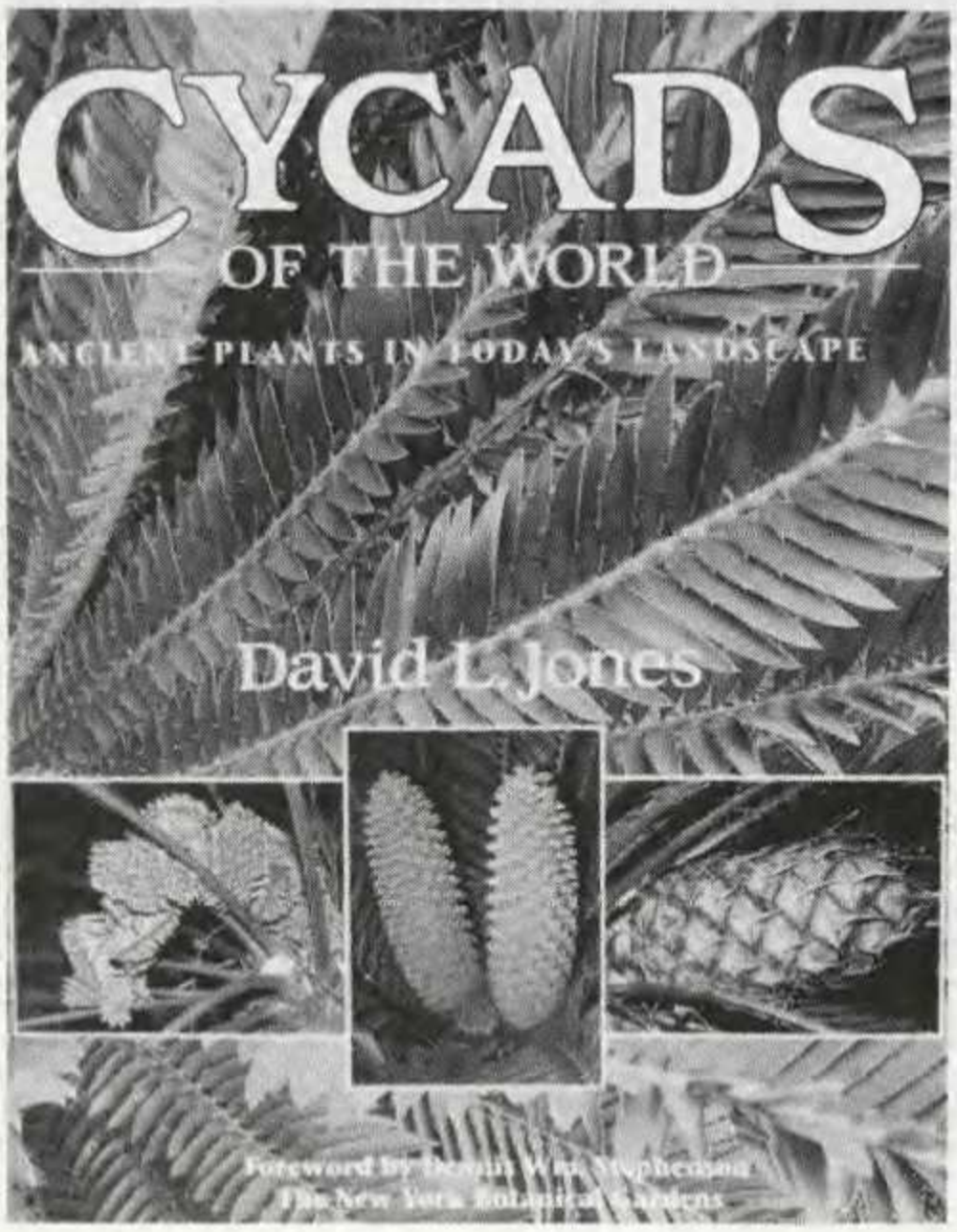

I can't say I enjoyed David Jones' new book "Cycads of the World - Ancient Plants in Today's Landscape". I can say that I am going to enjoy it and will keep on enjoying it - this book is an absolute winner and there's no past tense about it. Smack up-to-date with all the recent taxonomic changes, Jones has packed in information all about cycads and about all cycads in 312 pages of an excellent production, well-illustrated with 250 colour plates (many of which are habitat photographs and many of which illustrate recently-described species), distribution maps, line drawings, identification keys and 16 reproductions of some fascinating prints from early botanical works.

A professional horticulturist and botanist now resident in Canberra, Australia, Jones is an experienced writer, already having published authoritative texts on *orchids*, climbing plants, ferns and palms; this experience comes through abundantly in the author's rare ability to present scientifically-accurate content in a style which is both interesting and easy to read.

Part 1 of the text, "Structure, Biology and Conservation", introduces the reader to the 3 families and 11 genera of the Cycadales and then goes on to a chapter on cycad history and pre-history, including descriptions of 20 genera and 39 long-extinct species (I had no idea that there had been major advances in cycad fossil studies, e.g. the finding in 1987 of 79 specimens of *Dioonopsis nipponica*, a fossil rather like *Dioon spinulosum* but from Palaeocene deposits in north-eastern Japan!). This is followed by a pragmatic chapter on conservation, botanical information on the structure of cycads, notes on their economic uses (an interesting snippet - four thousand ornamental carvings in cycad trunks were exported from Japan in 1985!), a chapter on reproductive biology, notes on cultivation, pests and diseases, propagation and growing cycads in containers.

Although it is the Australian species with which Jones is most familiar, the book's coverage of genera in Part 2, "The Living Cycads", is broad and well-proportioned; e.g. there are 48 pages and 62 colour plates in the chapter on *Encephalartos* compared to 32 pages and 48 colour plates for *Macrozamia*. For each of 185 named and authored species, Jones gives a description, details of distribution, habitat, botanical notes and information on cultivation and propagation. The book ends with a comprehensive bibliography, a useful glossary of botanical terms and an index to species covered in the text.

Roy Osborne
Department of Chemistry, University of Natal, 4001 Durban

[Copies of David Jones' book will be available in South Africa from the Cycad Centre, P.O. Box 4726, Durban 4000, and is distributed in South Africa by The Struik Publishing Group, Graph Avenue, Montague Gardens, Milnerton 7441.]

THE CYCAD COLLECTION OF THE DURBAN BOTANIC GARDENS

Published by the Durban Botanic Gardens, Parks Department, City of Durban, 1993.
Soft cover, iii + 29 pages.
Price R16,00.

This booklet, actually written by our honorary life member **Roy Osborne**, constitutes a guide to the cycad collection at the Durban Botanic Garden.

It consists of a historical introduction, a short introduction to the cycads, a concise but excellent guide to cultivation and propagation, a bibliography which is perhaps more extensive than called for by the subject, and a species by species treatment of the indigenous as well as foreign cycads in the gardens. These are arranged firstly by geographical area of origin, and then alphabetically within each region. There is no index, so that the novice may have difficulty in finding the treatment of any particular species. Each species treatment consists of a short description of the diagnostic features, something on its cultivation, and at least one colour photograph of a diagnostic feature, be it a cone, a leaf, or general habit of the plant. On the whole the photographs are of excellent quality.

For its size the booklet is expensive. Yet it contains a wealth of information and, due to the extensive nature of the Durban Botanic Gardens collection, will be a handy source of reference elsewhere. The connoisseur will not learn much from this booklet, but I can unhesitatingly recommend it to anyone requiring an excellent and compact guide to the cycads without paying too much.

Piet Vorster
Botany Department, University of Stellenbosch.

[Copies of this booklet may be obtained from The Director, Parks Department, P.O. Box 3740, 4000 Durban; and also from The Cycad Centre, P.O. Box 4726, 4000 Durban.]

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

ENCEPHALARTOS TRISPINOSUS

Maans Kemp's article on *Encephalartos trispinosus* in "*Encephalartos*" 33: 4-12 touches upon a number of interesting facets, on which I would like to comment.

In the Botanic Garden in Pretoria there used to grow a plant which vegetatively was clearly *E. trispinosus*, but it bore male cones with a russet brown indumentum exactly as in *E. horridus*. I discussed the matter with the late Dr. Dyer, who said to me that he distinguished this species on a population basis, but that single individual specimens can often not be placed satisfactorily. For me this neatly sums up the problem of circumscribing this species. Personally I would not be surprised if the observed variation is a manifestation of past hybridizing with several species, never mind that at this moment it may not necessarily occur together with species such as *E. arenarius*, *E. horridus*, or *E. lehmannii*.

In my collection I have a field-collected plant with unusually wide leaflets, but the typical female cone of *E. trispinosus*. The suspicion that this may indicate past hybridization with *E. arenarius* is re-enforced by one of two plants grown from seed distributed years ago by Kirstenbosch under the name of *E. arenarius*. One of these plants looks much like *E. trispinosus*, but the other has wide leaflets very similar to the female plant described above, but with a male cone practically identical to that of *E. arenarius*.

I once saw plants, but no cones, from an area about 50 km north of Uitenhage. These looked like very large *E. trispinosus*; but, taking into account present-day distribution, probably represent past hybridization between *E. horridus* and *E. lehmannii*.

The Bushman's River Mouth has long been noted as a place where *E. trispinosus* hybridized with gay abandon with *E. altensteinii*. Regrettably this wonderful open air laboratory has been destroyed almost completely by looters. In my collection I have two plants which I have every reason to believe originally came from this locality. The one, a female, looks like *E. altensteinii*, but careful scrutiny makes one wonder whether it hasn't got some *E. trispinosus* in its lineage, though a few generations back. The other is a typical *E. trispinosus*, a rather small male, with a most intense silver foliage in spite of what Maans wrote about the colour of *E. trispinosus* at this locality.

In Kirstenbosch there are several plants which are clearly hybrids between *E. altensteinii* and *E. trispinosus*. They are big plants with green fronds, the leaflets are more

lax and surprisingly larger than in *E. altensteinii*, and their descent from *E. trispinosus* is visible in the form of typical *E. trispinosus*-like spines here and there. The cones can be either green or yellow. These plants are broadly similar to hybrids produced by editor Isabella Claassen, using *E. trispinosus* as female parent. Now, there is a belief in some quarters that green-leafed individuals of *E. trispinosus* occur. I do not believe in these, and I am sure that the green-leafed plants are hybrids with *E. altensteinii*. In my collection I have an artificially produced hybrid between these two species, which looks exactly like a very typical *E. trispinosus*, but with green foliage. The male cones of the two parent species are not dissimilar, and those of this hybrid are intermediate in colour and morphology.

Finally, I do not think that the plant shown in Maans' Figure 12, showing a female cone with entirely smooth cone scales, is *E. trispinosus*, but rather *E. lehmannii*. On two occasions I have come across such plants which were clearly *E. lehmannii*, but with startling green cones. I do not think that these plants are hybrids, but that it is simply a case that lacks the characteristic russet brown hair coat. Simply brush off the indumentum from a normal cone, and the result is identical. What I would like to know, however, is whether these *E. lehmannii* plants with green cones occur as scattered individuals amongst normal plants, or as populations of green coned plants; and I would be glad to hear from readers who may know more. The strange rumours about a "blue" form of *E. arenarius* of which the leaves look like those of *E. horridus*, may likewise refer to *E. horridus* without the normal indumentum.

On page 10 Maans repeats Dyer & Verdoorn's ideas about evolution of *E. horridus* and *E. lehmannii* from *E. trispinosus*. This has never been more than rather fanciful speculation, and there is no scientific evidence for such an evolutionary line.

Piet Vorster, Botany Department, University of Stellenbosch, Private Bag X5018, 7599 Stellenbosch.

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Geagte Redaktrise

ENCEPHALARTOS VILLOSUS: AANTAL VROULIKE KEËLS

Ek verwys na u artikel "*Encephalartos* plants in cultivation: unusual cone number" in "*Encephalartos*" 34: 31. Volgens "Cycads of Africa" deur Douglas Goode kan vroulike plante van *E. villosus* 1-4 keëls produseer maar meestal kom net 1-2 keëls per plant voor. Die afgelope twee jaar het drie van my vroulike *E. villosus*-plante elk drie keëls voortgebring. Die keëls was net so mooi groot as dié van die susterplante wat elk net een gedra het. Twee van die plante staan in betreklike koelte en is tussen 15 en 20 jaar oud; die ander een is tussen 40 en 50 jaar oud en staan in vol son. Alhoewel die getal keëls per plant nie buitengewoon is nie, vind ek dit wetenswaardig dat die plante in twee agtereenvolgende jare elk drie keëls geproduseer het.

Ek geniet ons tydskrif baie en besit gelukkig die volledige reeks.

***Prof. T.J.R. Botha**, Clairlaan 80, Manor Gardens, 4001 Durban.*

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Dear Editor

YELLOW LEAVES IN CYCAD SEEDLINGS

As an avid cycad enthusiast, I would please like to ask advice on the soil pH aspect of cycad cultivation. I have a collection consisting only of garden cultivated seedlings less than five years of age. I have always known that plants tolerate a fair range of soil pH, so I never added any lime to the potting mixture. Although receiving regular fertilization, adequate sunlight, no frost and good drainage, numerous seedlings of *Encephalartos lebomboensis*, *E. natalensis*, *E. longifolius* and especially *E. friderici-guilielmi* have started producing homogenous, margarine yellow leaves and leaf stalks that do not become green on maturation. Is it possible that the pH is too low/acid and that minerals and nutrients are physiologically unavailable, i.e., they do not dissolve, dissociate or ionize and thus cannot be taken up by roots?

Is it advisable to add dolomite to potting mixtures in reasonable quantities to most species including *E. eugene-maraisii* and allies, *E. inopinus*, *E. lanatus* and the E. Cape species? Is it true that *E. longifolius* prefers a more acid soil? In the new book "Cycads of the World" by David L. Jones, it is mentioned that most cycads prefer a more acid soil medium, which is confusing.

Dr R. Schutte, P.O. Box 783694, 2146 Sandton.

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The Editor, "*Encephalartos*"

THANK YOU CYCAD 93 ORGANIZING COMMITTEE

Through the medium of your magazine, we would like to express our sincere appreciation and thanks to the CYCAD 93 Organizing Committee for all the many, many long hours and pre-planning arrangements and the

many thoughtful kindnesses that made Louis and my trip to South Africa so very successful indeed! It was a grand time and a really wonderful experience! The group, too, was terrific - and a lot of us will be visiting back and forth. But best of all, for me, was seeing the cycads in habitat - visiting *Encephalartos horridus*, *E. longifolius* and *E. lehmannii* was truly a very special day. But, we also loved our delicious meals especially in Port Elizabeth and Cape Town.

So, many, many thanks for all the careful and thoughtful planning and for the gracious, generous hospitality. We both certainly appreciate it.

***Doris Francis & Louis Erhard**, Royal Botanic Gardens, Kew, England.*

NEW SCIENTIFIC REPORTS

Donaldson, J.S. 1993. The dead hand on discovery: permits for the study of protected plants. *South African Journal of Science* 89: 120-122. [The author describes the difficulties and frustrations facing botanical researchers in South Africa in respect of the unwieldy "permit system" and the large number of authorities involved in its administration. Properly-motivated challenges to such restrictive legislation may result in a more effective system.]
Author's address: Conservation Biology Research Unit, National Botanical Institute, Private Bag X7, Claremont 7735, South Africa.

Hill, K. 1993. *Cycas arenicola* (Cycadaceae), a new species from the Northern Territory of Australia. *Telopea* 5: 419-422. [The author describes a new species from the sandy soils in the catchment areas of the East Alligator and Liverpool Rivers to the south and south-east of Darwin. The species has *C. calcicola* as its nearest relative. This paper forms part of the basis for the treatment of *Cycas* which will appear in volume 48 of the *Flora of Australia*.]
Author's address: Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia.

McVaugh, R. 1992. Flora Novo-Galiciana, a descriptive account of the vascular plants of western Mexico. Volume 17, gymnosperms and pteridophytes. University of Michigan Herbarium, Ann Arbor, USA. [The author describes the Mexican cycad genera *Dioon* and *Zamia*, with detailed notes on the species in western Mexico. Curiously, McVaugh includes *D. holmgrenii* and the two previously-recognized varieties of *D. tomasellii* within *D. edule*. In addition, he sinks *Zamia paucijuga* into *Z. loddigesii*. It is noted that McVaugh is a specialist in the family Myrtaceae; his gymnosperm treatments in Flora Novo-Galiciana are viewed with circumspection by conifer and cycad specialists.]
Author's address: c/o The University of Michigan Herbarium, Ann Arbour, USA.

Muthuchelian, K. 1991. The phytotoxic effect of heavy metals on nitrate reductase (Ec 1.6.6.1) activity in leaves of *Cycas circinalis* Linn. *Journal of Current Bioscience* 8: 124-128. [Dilute solutions of tin, lead, copper, cadmium, zinc, mercury and aluminium salts inhibited the activity of the enzyme nitrate reductase in *Cycas circinalis*.]
Author's address: School of Energy, Environmental and Natural Resources, Madurai Kamaraj University, Madurai, 625021 India.

Norstog, K.J.*, Fawcett, P.K.S. & Vovides, A.P. 1992. Beetle pollination of two species of *Zamia*: evolutionary and ecological considerations. *Palaeobotanist* 41: 149-158. [*Zamia pumila* is pollinated by *Rhopalotria slossoni* and by *R. mollis*. The plants are dependent on the insects for reproduction while the insects need the plants for brood places, food and shelter. Both the plants and the insects need to be considered in conservation strategies.]
**Author's address: c/o Fairchild Tropical Garden, Miami, Florida, 33156 U.S.A.*

Sharma, A.*, Mishra, D.P. & Kumar, A. 1992. Characterization of a symbiotic, heterocystous, nitrogen-fixing cyanobacterium from *Cycas* coralloid roots. *World Journal of Microbiology and Biotechnology* 8: 529-531. [The authors report on the morphology and physiology of an *Anabaena* sp. isolated from coralloid roots of *Cycas revoluta*.]
**Author's address: College of Basic Sciences and Humanities, G.B. Pant University of Agricultural Technology, Uttar Pradesh, 263-145 India.*

Skubatz, H.*, Tang, W. & Meeuse, J.D. 1993. Oscillatory heat-production in the male cone of cycads. *Journal of Experimental Botany* 44: 489-492. [Using the technique of microcalorimetry, the authors have shown that single scales from the male cones of *Ceratozamia miqueliana* and *Zamia furfuracea* showed short-term oscillations in heat production at the time of pollen shedding. Such oscillations were not detected in *Cycas*

rumphii, despite the cone scales of that species being weakly thermogenic. The authors provide evidence for the oscillatory behaviour being a consequence of the glycolysis pathway and its enzymes.]
**Author's address: Department of Botany, K13-15, University of Washington, Seattle, WA 98195, USA.*

Stevenson, D.W. 1993. The Zamiaceae in Panama with comments on phytogeography and species relationships. *Brittonia* 45: 1-16. [11 species of *Zamia* occur in Panama, including 4 new species described in this paper. The taxa dealt with are the Central American species *Zamia acuminata, Z. fairchildiana* and *Z. skinneri*; the northern South American species *Z. chigua, Z. manicata* and *Z. obliqua*; and the endemic Panamanian species *Z. cunaria* (sp.nov.), *Z. dressleri* (sp.nov.), *Z. ipetiensis* (sp.nov.), *Z. neurophyllidia* (sp.nov.) and *Z. pseudoparasitica*.]
Author's address: The New York Botanical Garden, Bronx, New York 10458-5126, USA.

Sugimoto, Y.*, Yamashita, Y., Katou, A. & Fuwa, H. 1992. Some properties of Sotetsu (*Cycas revoluta* Thunb.) trunk starch. *Denpun Kagaku* 39: 147-154 (in Japanese). [The particle size, susceptibility to enzymic digestion, gelatinization temperature, associated enthalpy change and amylose contents of starch from *Cycas revoluta* trunks was investigated.]
**Author's address: Faculty of Home Economics, Mukogawa Womens' University, Nishinomiya, Japan 663.*

Vogt, D.C. and Stephen, A.M.* 1993. The gum exudate of *Encephalartos longifolius* Lehm. (female): further hydrolytic studies. *Carbohydrate Research* 238: 249-260. [The authors use a technique of sequential acid hydrolysis to determine the structure of the complex polysaccharide in the gummy exudate, following on from the work described in ENCEPHALARTOS 13: 22-24.]
**Author's address: Department of Chemistry, University of Cape Town, Rondebosch, 7700 South Africa.*

Vogt, D.C. and Stephen, A.M.* 1993. The gum exudate of *Encephalartos friderici-guilielmi*. *Carbohydrate Research* 241: 217-226. [Comment and author's address as above.]

Vovides, A.P.*, Norstog, K.J., Fawcett, P.K.S., Duncan, M.W., Nash, R.J. & Molsen, D.V. 1993. Histological changes during maturation in male and female cones of the cycad *Zamia furfuracea* and their significance in relation to pollination biology. *Botanical Journal of the Linnean Society* 111: 241-252. [Certain cells in the parenchyma of male and female sporophyll tissue, called idioblasts, contain both the BMAA and macrozamin toxins. Idioblasts in female cones of *Zamia furfuracea* show marked changes in morphology and content at the time of pollen receptivity and the author's speculate that these changes are associated with defence against predators and mobilization of toxins.]
**Author's address: Instituto de Ecologia, A.C., Apdo Postal 63, Xalapa, Veracruz, 91000 Mexico.*

Compiled by **Roy Osborne**, *Department of Chemistry, University of Natal, 4001 Durban.*

NEWSPAPER CLIPPING / KOERANTUITKNIPSEL

THE BARKLY EAST REPORTER 28 May 1993

World recognition for cycad proposal

HORTICULTURALIST Cynthia Giddy formerly of Barkly East and now of Thornville has been awarded an Honourable Mention in the international Rolex Awards for Enterprise – the first time a *South African has won this award.*

To qualify for an award, entrants are required to propose project ideas which are both original and feasible. These are perused by a distinguished panel of judges from around the world and five laureates are chosen. Honourable Mentions are given to other projects which are considered to have outstanding qualities.

Out of the thousands of entrants, Cynthia Giddy's proposal for the establishment of a wildlife sanctuary for endangered cycad plants in Edendale was given an award. She was presented with a gold Rolex chronometer and scroll at a ceremony in Durban.

Cynthia told *The Natal Witness* that her idea grew when she learned that large, adult cycad plants – some of them up to 500 years old – were being sold in Edendale to commercial collectors and gathered for medicinal use. She has come across some being sold for as little as R5, indicating the sellers have *no idea of their true* value. On the black market a similar cycad would fetch around R2 000.

"My proposal is for a community project in Edendale in which the cycads could be nurtured and sold as a sustainable resource," Cynthia said. "At present, the money obtained in the short term from these cycads does not compare with the income and employment which could be gained by nurturing the adult plants and selling seedlings.

"I am willing to provide the expertise to teach people how to establish the sanctuary and to persuade them that to preserve these plants will be of more benefit to them and others." Although Cynthia is looking for funding for *the project, she says it need not necessarily* cost a great deal to get the sanctuary started.

At present cycads are specially protected plants and it is illegal to sell them without a permit. Ultimately, then, the project will have to be overseen by the relevant conservation authority.

Cynthia and her husband Ted (brother of Neville) are well known in Barkly as they formerly farmed on Kelvingrove. They now run a nursery at Umlaas Road. Congratulations on this great achievement.

Horticulturalist Cynthia Giddy has received world recognition for her proposal for a cycad sanctuary in Edenvale.