ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

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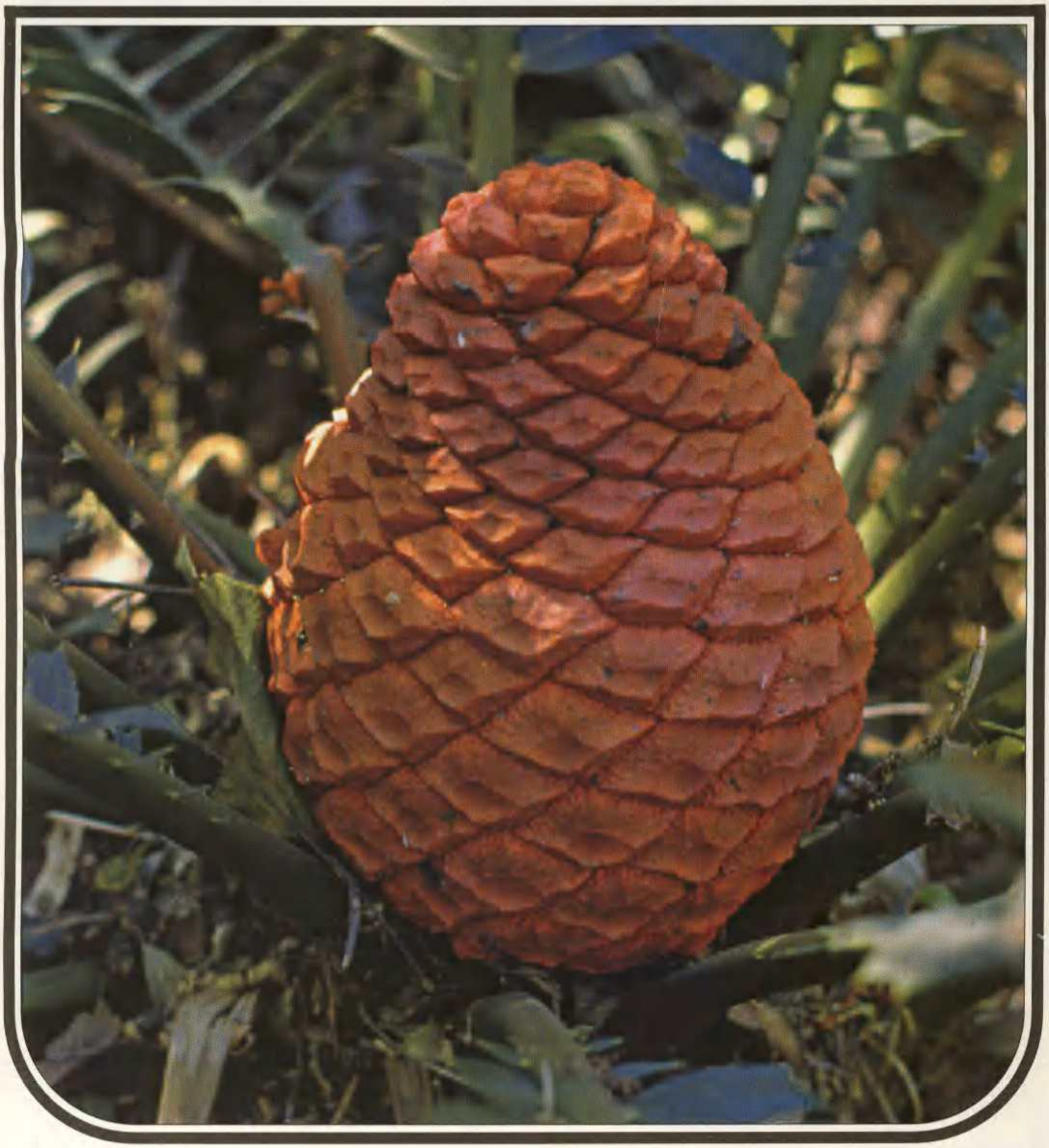

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COVER / VOORBLAD : Female cone of *Encephalartos ferox*; in the Pretoria National Botanical Garden (1989).

Photo: Isabella Claassen

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FROM THE PRESIDENT

All subscribers to "*Encephalartos*" are surely impressed with the beautiful fifty-eigth edition of our magazine. The colour photo of the unusual *Encephalartos ngoyanus* on the cover is just as artful as it is impressive. The photos of the westernmost located *Encephalartos middelburgensis* are similarly full of colour and character. Unfortunately this masterpiece, just like the cycads described in it, may become a collector's item if the Society can not generate funds from other sources. This is due to the printing and distribution costs of edition no. 58 that amounted to R28 938-74. It is impossible for the Society to afford four editions of R29 000 per year without drastically increasing the membership fees. Another possibility is to try to raise sponsorships or earn more advertisements. Unfortunately there is good reason not to become over-enthusiastic about these two options. I will only mention that the production and distribution of a normal black and white edition cost aproximately R14 000.

In this issue of "*Encephalartos*" only the cover and four *pages* with photographs are printed in colour. We will compare the costs of the two issues in the December issue.

In the Eastern Cape the regional branch of the Cycad Society has difficulty to get started. Even the call for co-operation and the interesting suggestions of Marius Helm in the March edition did not yield the desired results. The expanse of the area and the small number of society members scattered across it make it difficult to function like a normal society with formal meetings and communal activities. Still, it would be desirable for members to know about each other and have the confidence to contact each other. Therefore, we will try to provide each member in the Eastern Cape with a list of names, addresses and telephone numbers (if available) of other members in the area. Should coordination be necessary in this regard, Mr Marius Helm would be prepared to take the responsibility.

Mr Norman Kachelhoffer acted as auditor of the Society's finances during the past few years without any renumeration. The Society conveys its heartfelt appreciation towards him and wishes his successor all of the best.

Frederick de Jager

VAN DIE PRESIDENT

Alle intekenare op "*Encephalartos*" is sekerlik beïndruk met die agt-en-vyftigste praguitgawe van ons tydskrif. Die kleurfoto van die ongewone *Encephalartos ngoyanus* op die voorblad is net so kunstig as wat dit indrukwekkend is. Ewe kleurvol en karaktervol vertoon die foto's van die mees westelik geleë *Encephalartos middelburgensis*. Ongelukkig sal hierdie pragstuk, net soos die broodbome wat daarin beskryf word, ook net 'n versamelaarsitem word indien die Vereniging nie fondse uit ander bronne kan genereer nie. Want die druk- en versendingskoste van uitgawe nr 58 het R28 938-74 bedra. Die Vereniging kan hoegenaamd nie jaarliks vier uitgawes van R29 000 bekostig sonder om die ledegeld drasties te verhoog nie. 'n Ander moontlikheid is om borgskappe te probeer werf of om meer met advertensies te verdien. Daar is ongelukkig goeie rede om nie te geesdriftig oor laasgenoemde twee opsies te raak nie. Ek mag net noem dat die produksie en versending van 'n gewone swart en wit uitgawe ongeveer R14 000 kos.

In hierdie uitgawe van "*Encephalartos*" is net die buiteblad en vier bladsye met foto's in kleur gedruk. Die kostes van die twee uitgawes sal in die Desember-uitgawe vergelyk word.

In die Oos-Kaap sukkel die streektak van die Broodboom Vereniging om aan die gang te kom. Selfs die oproep om samewerking en die interessante voorstelle van Marius Helm in die Maart-uitgawe het nie die gewenste uitwerking gehad nie. Die uitgestrektheid van die gebied en die klein aantal verenigingslede wat oor die gebied versprei is maak dit uiteraard moeilik om soos 'n gewone vereniging met formele vergaderings en gemeenskaplike aktiwiteite te funksioneer. En tog is dit goed as lede van mekaar weet en die vrymoedigheid het om met mekaar in verbinding te tree. Daarom sal ons probeer om aan elke lid in die Oos-Kaap 'n lys met die name, adresse en telefoonnommers (indien beskikbaar) van ander lede in die gebied te stuur. Indien daar in dié verband koördinering nodig is, is mnr Marius Helm bereid om daarvoor verantwoordelikheid te aanvaar.

Mnr Norman Kachelhoffer het vir die afgelope aantal jare sonder vergoeding as die ouditeur van die Vereniging se geldsake opgetree. Die Vereniging spreek sy opregte dank teenoor hom uit en wens sy opvolger alle sterkte toe.

Frederick de Jager

FOCUS ON ...

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

FOKUS OP ...

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

MACROZAMIA MACDONNELLII (F. Muell. ex Miq.) A. DC.

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

INTRODUCTION

Central Australia is a zone which has seen a turbulent history over many millions of years. At times the area was underwater as part of a great inland sea, at times the territory was covered with tropical forests. Huge upheavals created awesome mountain ranges which have since been partially eroded to reveal fascinating coloured rock strata. At present, this semi-arid area in the very centre of Australia, set amongst low mountains, contains several important floral components that are relicts from past times, trapped as they are by seven different deserts (principally the Gibson Desert in the west and the Simpson Desert in the east). Amongst this relictual flora is the plant which I have come to call the "Big Mac", *Macrozamia macdonnellii*.

DISCOVERY

It is obvious that the Macdonnell cycads were known to the aboriginal people long before the arrival of European settlers in Australia. Records show that the plant was called "atyikwarle" or "atywekekwerle" (pronounced "a-cheer-kwahl") in the language of the Arrernte people of central Australia. Unlike the situation with many other Australian cycads, there is no data supporting aboriginal use of *M. macdonnellii* seeds in times of need, nor in ceremonial events (Latz, 1995).

The "discovery" of this species by Europeans is not known with certainty. It seems that cycad samples of some kind were collected by the explorer John McDouall Stuart during one of several epic trans-Australian expeditions in the 1860's. The notes on this collection, however, refer to the "Neales River", which is in an inhospitable region somewhat distant from any known cycad locality. More reliable are the writings of Baron Ferdinand von Mueller, a major contributor to the exploration of Australia's flora, whose records allude to a species of *Encephalartos* in the Macdonnell Ranges of central Australia. The scientific description was subsequently made by the Dutch botanist F.A.W. Miquel who followed von Mueller's notes and, in 1863, described the plant as *Encephalartos macdonnellii*. It was left then to the Swiss botanist, Alphonse de Candolle, to separate the African cycad genus *Encephalartos* from the Australian genus *Macrozamia*. Hence in the "Prodromus Systematis Naturalis Regni Vegetalis" - an ambitious description of the world's flora - of 1868, the name *Macrozamia macdonnellii* became official. The sequence of referrals here is recorded in the rather clumsy authorship of the name as *Macrozamia macdonnellii* (F. Mueller ex Miquel) A. de Candolle, abbreviated by convention as indicated in this article's title.

DISTRIBUTION AND ECOLOGY

Macrozamia macdonnellii is confined to rocky gorges which transect the Macdonnell and associated ranges in central Australia, within the country's Northern Territory (see Map). The Macdonnell Range, named for Sir Richard G. Macdonnell (19th Century Governor of South Australia), is a complex series of low mountains about 500 km in length in an east-west orientation more-or-less along the Tropic of Capricorn, with several associated minor ranges running mainly in a parallel direction (e.g. the Hartz Range, Fergusson Range, Ooraminna Range, Waterhouse Range, James Ranges, Krichauff Range, Gardiner Ranges, Middle Ranges and the Petermann Hills).

Following a boom in tourism (Figure 1) in the area, largely focussed on the well-known Uluru (Ayers Rock) and the nearby Kata Tjuta (the Olgas), sealed roads now

MAP: Distribution of *Macrozamia macdonnellii* in Australia.

Figure 1 Attractive plantings of *Macrozamia macdonnellii*, together with native grasstrees, at the Yulara Resort, a tourist centre serving Uluru (Ayers Rock) and Kata Tjuta (the Olgas) in central Australia.

provide access to many sites in central Australia. Impressive cycad stands can easily be seen on single day trips, conveniently from the town of Alice Springs, to sites in the western Macdonnells, such as Simpson's Gap, Standley Chasm (Colour Photo 5), Ellery Creek (Colour Photo 2) and Serpentine Gorge. Slightly further to the southwest, and accessible at present only by 4 x 4 vehicles, cycads are seen in spectacular scenery in "Cycad Gorge" and "Palm Valley" in the Finke Gorge National Park (Colour Photo 4) - where the plants grow near the stands of the relict palm, *Livistona mariae*. Yet further to the southwest, more cycads and more spectacular scenery are found at both valley sites and elevated areas of King's Canyon in Watarrka National Park (Colour Photos 1, 3). Within walking distance of the town of Alice itself, cycads are present in the Old Telegraph Station Reserve (although these are not easy to locate) and at Heavitree Gap at the town's southern entrance. To the west, *M. macdonnellii* stands are found in the Trephina, N'dhala and Ruby Gap Gorges. In addition to these occurrences in various "popular" localities, an estimated 30-40% of the plants occur on Aboriginal or pastoral lease properties which are not generally accessible to the public. Clearly, the conservative "guestimate" for a total of 7 000 mature plants in habitat (Osborne, 1995) must be a considerable underestimate.

Macrozamia macdonnellii grows in a singularly harsh climate. The rainfall is variable at around 250-285 mm p.a., the summers are fearsomely hot and the short winter periods have temperatures dropping to freezing. The plants grow in shallow soil pockets in rocky areas near sources of underground water; hence the scattered distribution through a fairly wide area. The cycads may be exposed to full sun for at least part of the day on rocky gorges, they may be on more gentle slopes covered with *Triodia* (spinifex) grass, or they may be in sheltered valleys in association with eucalypts and other trees. Because of the rocky nature of the terrain, the vegetation in most sites would not be adapted to any regular fire cycles.

The reproductive behaviour of this species has not been studied in detail, but it is reasonable to anticipate the presence of a specific insect pollinator. Male plants cone fairly regularly but the female plants produce cones only under suitable environmental conditions - principally adequate rainfall. Animals such as the euro and rock wallaby are known to enjoy the fleshy outer layer of the seeds and are implicated in their distribution. There is some concern that a decline in numbers of the Black-footed rock wallaby (*Petrogale lateralis*) may adversely affect future "normal" seed dispersal.

Only a few specimens of *M. macdonnellii* are present in international botanic gardens. I know of plants in the collections at Lyon Jardin Botanique (France), Naples Botanical Garden (Italy) and at the Los Angeles Arboretum, Lotusland Garden and at the San Diego Zoo (all California, USA). Similarly, the species is not well represented in private collections.

DESCRIPTION

[Dimensions are taken largely from Jones (1993) and from Hill (1998).]

1. STEM

Macrozamia macdonnellii is a slow-growing plant, older trunks typically up to 3 m in length and 750 mm in diameter, these sometimes becoming procumbent with age. The trunk apex is rounded and covered with a "wool" of pale brown hairs. Suckering sometimes occurs at the base, possibly as a response to damage by rockfalls, erosion or animal activity.

2. LEAVES AND LEAFLETS

Mature *M. macdonnellii* plants bear from 50–100 leaves, straight or gently curved, and typically 1.5–2.2 m long. The emergent leaves are covered with a powdery or waxy bloom giving a striking overall pale grey-blue tone to the foliage, but this fades to a dull green colouration with age and environmental conditions. Petioles are broad, flattened, 15–30 cm long and 15–25 mm wide, bearing numerous sharp spines towards the base. Leaflets are 20–30 cm long and 7–11 mm wide, flat and terminating in a sharp point and more-or-less evenly spaced along the rachis (Figure 2). A pink swollen callous zone is a further attractive feature at the point of insertion of each leaflet onto the rachis. Stomata are present on both the upper and lower leaflet surfaces, an unusual feature on an arid-zone plant.

3. REPRODUCTIVE STRUCTURES

Macrozamia macdonnellii male plants bear about five cylindrical cones each season; these are typically 25–40 cm in length by 8–10 cm across and supported on a peduncle 10–14 cm long. The sporophylls are narrowly triangular, 30–40 mm by 15–20 mm with a single spine projecting from the terminal facet.

Female plants bear one or more large barrel-shaped cones about 40–50 cm long by 20–27 cm in diameter on a peduncle up to 25 cm long. Female sporophylls are triangular to broadly wedge-shaped, 70–100 mm by 80–120 mm, also with a single erect spine emerging from the terminal facet. The seeds are possibly the largest of all cycad seeds, typically 60–80 mm long by 40–50 mm across, each seed weighing about 50 g and having the orange-red sarcotesta characteristic of most other *Macrozamia* species.

AFFINITIES

Macrozamia macdonnellii falls well within the concept of section *Macrozamia* in its genus. Although the species is separated by huge desert barriers and a distance of some 1750 kms from its western Australian relatives (*M. riedlei, M. dyeri* and *M. fraseri*) and a distance of about 1400 kms from *M. moorei* in central Queensland, all these species show some affinities. However, the glaucous foliage and the huge seeds, clearly adaptations to survival in its isolated environment, are unique to *M. macdonnellii.*

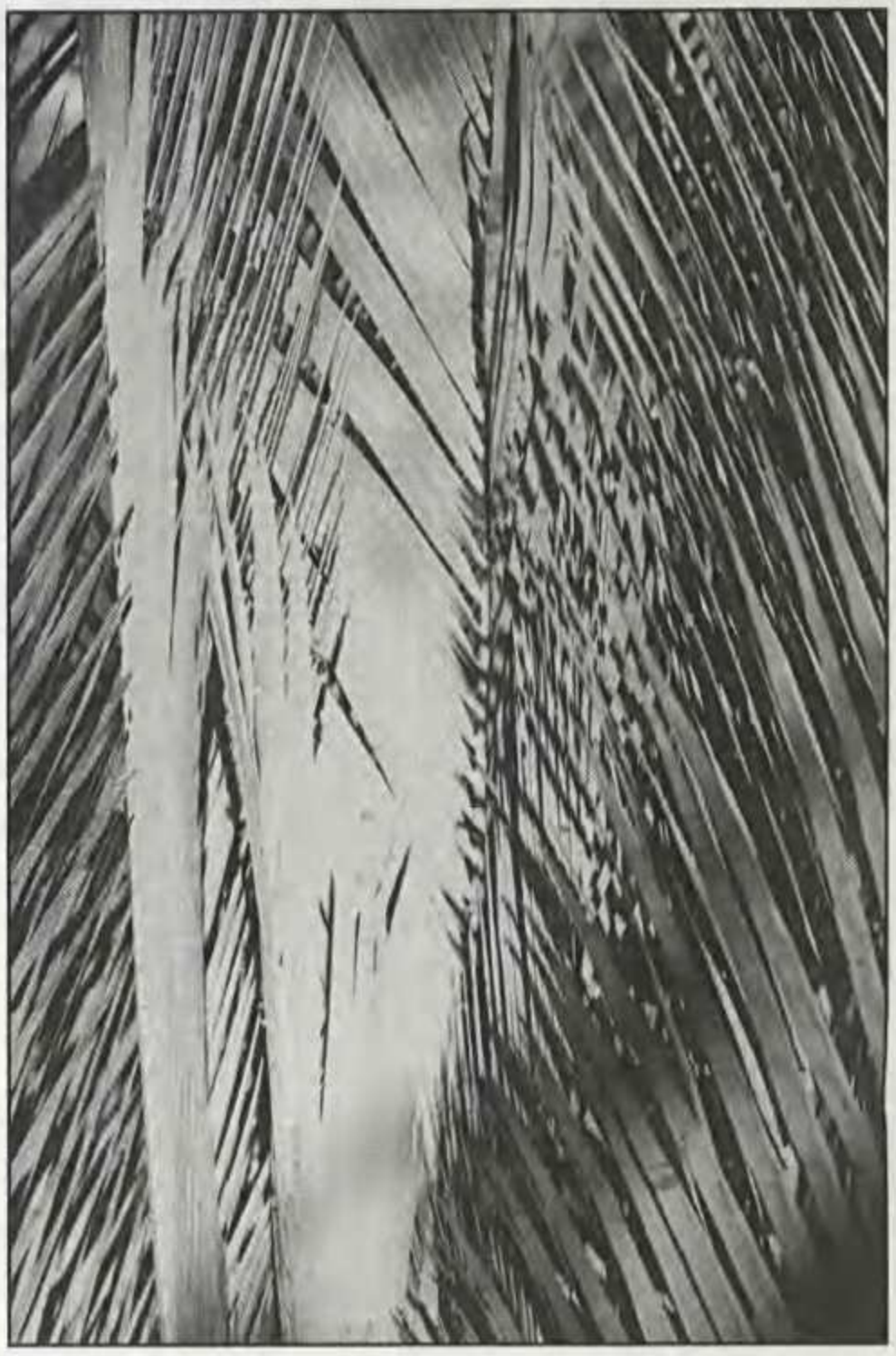

Figure 2 Foliage of *Macrozamia macdonnellii* indicating the close and regular packing of leaflets.

CONSERVATION AND CULTIVATION

Macrozamia macdonnellii is the only Australian cycad to be listed as "vulnerable" in the 1997 Australia and New Zealand Environmental and Conservation Council's list of national threatened plants. The Northern Territory has the species listed in its *Territory Parks and Wildlife Conservation Act* of 1993 as a component of "specially-protected flora" which requires in Sections 50 and 52 that ministerial permission is required for any exploitation or destruction of this species. Perhaps more importantly, most of the *M. macdonnellii* stands are within the borders of National Parks - which are managed with careful attention to population dynamics

balanced with controlled public access. There seems little risk to the survival of this species although clearly wild plant numbers are unlikely to increase.

Notwithstanding the appropriate and well-managed *in situ* conservation of this cycad, *M. macdonnellii* is much sought after by collectors nationally and internationally. It would seem reasonable that a percentage of seeds from particularly good years should be made available for purchase by cycad growers, particularly those who indicate the intention to establish *ex situ* colonies for long-term seed production. It might not be too far-fetched to propose that local central Australian Aboriginal communities might be involved in a "farming" project of this kind.

The cultivation requirements for *M. macdonnellii* would be much the same as for other species in section *Macrozamia*, particularly with respect to well-drained soil in either garden plantings or in containers. The grey-green bloom to the foliage appears to be a waxy secretion related to light intensity, and is most obvious on young foliage in very strong light (Colour Photo 8). The bloom "colour" fades with age and in lower light conditions. For example, plants in coastal gardens in Australia do not show the full beauty of the species, but I recall seeing a specimen in a Highveld garden in South Africa, where clearly the high solar intensity brought out the best in the plant.

ACKNOWLEDGMENTS

I am grateful to Paul Forster, Ken Hill, Lou Randall, and Gary Wilson for their kind assistance in the preparation of this article. Photographs are by the author unless otherwise acknowledged.

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ARTICLE / ARTIKEL

THE FAMILIES OF THE CYCADACEAE

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Ever since L.A.S. Johnson divided the Cycadales into three families in 1959 the cycads have been recognized as comprising several families. The three generally accepted, however, contradict certain relationships among the cycads and require some changes.

The separation of *Cycas* from the rest of the cycads into a distinct family, Cycadaceae, is not in dispute. The important distinctions here involve the seed producing structures. The megasporophyll-bearing axis of *Cycas* resumes growth after the seeds are formed in contrast to the rest of the cycads, whose seed cones, although also terminal, are determinate. That the ancestral condition for *Cycas* was a cone is seen by the production of pollen cones hardly different from those of other cycads, the flattened apex of the megasporophyll which corresponds to those of the other cycads, the rather cone-like form of the early seed producing aggregation, and the very similar but cone-formed fossils in early cycads. Originally the cycads were wind pollinated, but a connection with beetles to facilitate pollen distribution developed. Apparently because of this in the cycads other than *Cycas*, the ovules became reduced to an opposite pair on each megasporophyll that were twisted around so that the micropyles face inward towards the cone axis, while the cone scales are distinctly imbricated

at pollination time. The beetles, which actually feed on the pollen cone, can not distinguish the two cone sexes from outside and enter ovulate cones as well as pollen cones after hatching in a pollen cone and leaving, pollen covered, to mate. Thus, as they clamber around inside the ovulate cone looking for a way back out, they brush up against the micropyles and leave pollen behind. The fact that many species of *Cycas* display elongated pinnule-like teeth on the apical part of the megasporophyll is often noted but not significant. In many other species of *Cycas* the teeth are reduced to serrations and *C. edentata* displays no teeth at all, essentially similar to the megasporophyll apices of various other cycad genera. Another oft-cited difference for *Cycas* is the single median vein of the pinnae whereas numerous veins occur in each pinna of all other cycads.

The cycad genera other than *Cycas*, as they became known, were easily placed into three groups, which Miquel called tribes in 1861. Bentham and Hooker called them subtribes in 1883 (and Hutchinson, 1924), the separate tribe being assigned to *Cycas*. These groups can clearly be seen in the cladograms of Stevenson (1990), especially Trees 1 and 2. One grouping includes *Dioon, Encephalartos, Macrozamia*, and *Lepidozamia*. A second includes *Ceratozamia, Zamia*, and the microgenera *Microcycas* and *Chigua* (only slightly different from *Zamia*). The third grouping pairs *Stangeria* and *Bowenia*, although the latter has also been grouped with *Zamia*. Unfortunately, Eichler in 1887 combined the first two of these groups, contrasting only *Stangeria* as a separate subtribe, starting a trend. Pilger (1926) did the same, except that he raised all his categories to subfamilies equal to *Cycas* and separated *Bowenia* and *Dioon* also into subfamilies. Johnson (1959) continued the trend but with whole families, one for *Cycas*, one for *Stangeria*, and one for all the rest (Zamiaceae, actually named by Reichenbach in 1837 when only three genera had been descibed). Stevenson briefly had a separate family for *Bowenia* (1981). Crane (1988) constructed a cladogram using a data matrix with 23 characters (5 for Cycadales) that grouped *Bowenia* with *Stangeria*. Stevenson further (1990) expanded the matrix to 30 characters and generated three equally parsimonious cladograms, of which he selected the one that most corresponded to the earlier classifications (Tree 1). Adding 22 more characters to produce a single cladogram, he further expanded his classification (1992) to include suborders, families, subfamilies, tribes, and subtribes such that only two of his ultimate categories had two genera, the rest being monogeneric. The differences within the cycads hardly demand such parsing. Stevenson does distinguish the *Encephalartos* group from the *Zamia* group at the subfamily level but unites them in contrast to the *Stangeria* group at the family level. *Dioon* finally was put into the *Encephalartos* group.

The combining of the *Encephalartos* group with the *Zamia* group opposed to the *Stangeria* group is only possible by ignoring, as the data matrix does, the differences of the "cataphylls" between the former two groups as well as the contrasting morphologies of the sporophyll apices between them. On the other hand, there are only two characters that these two groups actually share in opposition to the *Stangeria* group. One is that they lack the circinate condition in developing pinnae and the other is that the vascular traces in the *Stangeria* group form circles while those of the others are arranged to resemble a Greek omega. Admitted differences between the *Encephalartos* group on the one hand and the *Zamia* group together with the *Stangeria* group on the other are in the latter the naked cone peducles, the presence of stipules, and the lack of petiolar spines. Other differences of just the *Zamia* group are the articulate pinnae bases and the lack of a polyxylic stele (petiolar prickles - quite different from spines - are common but not universal). *Dioon* differs from its group in this last character and has a unique sporophyll apex. Note also that *Bowenia* has the same form of sporophyll apex as does the *Zamia* group. It does appear that a closer look at the data support Stevenson's Tree 2 cladogram emphatically over the Tree 1 (1990) which he chose. Petriella and Crisci (1977) produced a cladogram essentially the same as Stevenson's Tree 3 which differs from Tree 2 only in that, after *Cycas* is removed, *Dioon* is contrasted with all the other genera. Admittedly, *Dioon* has certain unique characters with regard to the sporophyll, for the most part it is quite close to the *Encephalartos* group (as in Trees 1 and 2).

After the removal of *Cycas*, the differences between the *Encephalartos* group and the remaining genera involve primarily the foliar structures (actually *Cycas*, while differing in other ways, has largely the same foliar structures as those of the *Encephalartos* group). Cycads produce a variety of lateral structures including leaves, cataphylls, and sporophylls (male and female). The term "cataphyll" has been applied to a range of objects which will be considered below. The leaves of cycads, like those of their fossil relatives, are not simple units, rather they are aggregations, a lateral fusing of primitive leaves (see de Laubenfels 1962, where it is argued that this is connected with the development of the apparently very desirable condition of dicotyledony). The fusing is manifested by the charateristic lack of an apical termination of the leaves, which often divide into equal halves. The approximately eight leaf traces in cycads come from widely separated nodes and, confronted with a huge pith, travel around the stem as "girding traces". All cycad sporophylls and the cataphylls in *Cycas* and the *Encephalartos* group (including *Dioon*) are not aggregates. They thus correspond to only a portion of each leaf (but note that they involve a group of pinnae, not just one). Large numbers of these cataphylls (whose bases are markedly smaller than the leaf bases) cluster at the shoot apex protecting it between flushes of leaf growth. Other cataphylls, usually of somewhat different

form, precede the cones or sporophyll clusters and clothe their peduncles. These same cycads have reduced pinnae in the form of spines on the leaf petioles (sporadically there may be none). Differences obtain in the remaining cycad genera.

Starting with *Stangeria* and *Bowenia*, there are no cataphylls as described above and no petiolar spines. Instead, the leaf bases produce large vascularized stipules which unite in front of the leaf base, covering the next leaf as it first forms. The cone peducles are naked (sporadically a few rudimentary scales). No scales of any kind are produced among the leaf bases, but reduced leaves do cluster at the bases of cones. These reduced structure have fully developed stipules but the blade is just a spike. That these structures are called cataphylls is misleading. They do not correspond to the cataphylls described above. A modified condition occurs in the remaining group (the *Zamia* group). Here the stipules are much reduced, non-vascular, and do not cover the emerging leaf. Instead, more scale leaves are produced between the leaves, again equally stipulate with the leaf bases and with essentially equally large basal attachments. They occur in far fewer numbers than the cataphylls described above but do not perform essentially the same function. Already in *Bowenia*, as in the *Zamia* group, the cone scale apex is reduced to a blunt knob with a truncated termination drawn out laterally and a broad hexagonal shape to the exposed part in the cone, with the scales arranged in vertical rows. *Bowenia* no more has terminal pinnae than other cycads (Stevenson 1990), it not being unusual, to be sure, for a pinna in many genera to take a more or less terminal position, but not always the case in *Bowenia*. The lack of a polyxylic stele and the articulate pinna bases have already been mentioned. The apices of the sporophylls in the *Encephalartos* group other than *Dioon* are also reduced, but there is no lateral extension so that the exposed part is characteristically diamond shaped and not arranged in vertical rows. Clearly, the *Encephalartos* group can not be united with the *Zamia* group as opposed to the *Stangeria* group.

It is here proposed that the *Encephalartos* group merits equal distinction with the Zamiaceae as a new family, Ultracycadaceae, the type genus to be *Macrozamia* because *Encephalartos* is somewhat more specialized. It is further suggested that Stangeriaceae is too close to Zamiaceae to be distinguished at the family level. The number of living families in the Cycadales then remains at three. The Mesozoic fossil *Nilsonia* probably should form another family, Nilsoniaceae. No subfamilies are recognized here but might merit consideration.

Ultracycadaceae, fam. nov. Inter folia et bases strobilorum pluribus squamibus vascularis simplicis productis. Petiolus utrimque spinis. Stipulis nullibus. Ovulis megasporophyllorum binis. Gen. typ.: *Macrozamia*. Gen add.: *Encephalartos, Lepidozamia, Dioon*.

With the three living families proposed here, an interesting pattern of distribution can be seen. *Dioon* is essentially a primitive genus in the Ultracycadaceae and survives in Mexico (and Honduras). The more advanced genera occur in Africa (*Encephalartos*) and Australia (*Macrozamia* and *Lepidozamia*). *Stangeria* is the most primitive genus of Zamiaceae and occurs in Africa. The transitional genus *Bowenia* occurs in Australia, while the more advanced genera *Zamia* (with the hardly different *Microcycas* and *Chigua*) and *Ceratozamia* occur in tropical America. In Cycadaceae, *Cycas* is anchored in Asia, spreading to Madagascar and Australia, while the somewhat more primitive recently described *Epicycas* is limited to a small area in southeast Asia.

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THE CYCAD SOCIETY OF SOUTH AFRICA

INCOME & EXPENDITURE STATEMENTS FOR THE TWO YEARS ENDED 31.12.98

	1998	1997	1996
INCOME	97 255	69 539	58 755
Subscriptions	73 718	54 797	45 792
Donations	6 597	5 469	4 615
Interest Received	12 672	7 540	4 705
Sales Back-issues	3 685	870	3 643
Sundry Income	583	863	-
LESS: EXPENDITURE	64 673	56 002	59 077
Bank Charges	709	1 972	615
Branch Transfers	2 304	-	2 395
Depreciation	2 018	2 018	2 018
Grants & Subsidies	-	-	5 500
Printing 'Encephalartos'	31 836	28 246	25 439
Postage	26 427	21 498	22 054
Sundry Expenditure	1 379	2 268	1 056
NET SURPLUS (LOSS) FOR YEAR	32 582	13 537	(322)
Unappropriated Surplus - Prior Years	68 778	55 241	35 835
Surplus - 'Cycad '93'	-	-	19 728
UNAPPROPRIATED SURPLUS AT YEAR END	**R 101 360**	**R 68 778**	**R 55 241**

THE CYCAD SOCIETY OF SOUTH AFRICA

BALANCE SHEET AS AT 31.12.98

	1998	1997	1996
CAPITAL EMPLOYED :			
Unappropriated Surplus	**R 101 360**	**R 68 778**	**R 55 241**
EMPLOYMENT OF CAPITAL :			
FIXED ASSETS	1 851	3 869	5 887
NET CURRENT ASSETS	99 509	64 909	49 354
CURRENT ASSETS :			
Cash at Bank	83 247	44 526	13 442
Fixed Deposits	32 605	32 605	45 304
Stock - Back issues	8 514	6 000	6 000
	124 366	83 131	64 746
LESS: CURRENT LIABILITIES	24 857	18 222	15 392
Prepaid Subscriptions	24 857	17 825	11 889
Sundry Creditors	-	397	3 503
NET ASSETS	**R 101 360**	**R 68 778**	**R 55 241**

I hereby declare that I am a member of the Cycad Society of South Africa, but that I have no interest in its financial affairs. The Cash Book and Ledger of the Society have been written up from documents and information provided by the President and Officials of the Society.

I therefore certify that the accompanying Income and Expenditure Statements for the years ended 31st December, 1997, and 1998, and the Balance Sheet as at those dates, are in accordance with the information provided.

Pretoria, 14th June, 1999

N J Kachelhoffer

SHORT COMMUNICATIONS / KORT MEDEDELINGS

MONTE PALACE TROPICAL GARDEN, MADEIRA

Ian Watt
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Received 21 May 1999

Figure 1 General view of one of the *Encephalartos* beds. Female cones of *E. senticosus* in foreground.

In 1987 and after years of neglect, businessman Mr Berardo bought the former Monte Palace hotel. Over the next few years landscaping and replanting of the garden took place on a grand scale.

The garden is in a beautiful setting occupying about 7 hectares of south facing hillside high above Funchal harbour. From the entrance the paths zigzag their way through pine trees underplanted with tall Cyatheas and numerous *Cycas revoluta*. Water is in abundance and follows you down the valley to a large pool near the hotel building.

The collection of *Encephalartos* is planted in this area, mainly on open south facing slopes (Figure 1). It's a breathtaking sight. Over 600 cycads massed together in great drifts. It's almost too much. Having so many different species side by side made it difficult to appreciate individual plants (Figures 2, 3).

With the exception of the odd rotted out stump the cycads appear to be in good health and enjoying the near perfect Madeira climate. I saw no signs of scale, mealy bug, mite or leaf damage at all. Some of the plants were coning and fertile seed is being produced. I spoke

Figure 2 Left to right: ***E. altensteinii***, ***E. horridus***, and ***E. latifrons***.

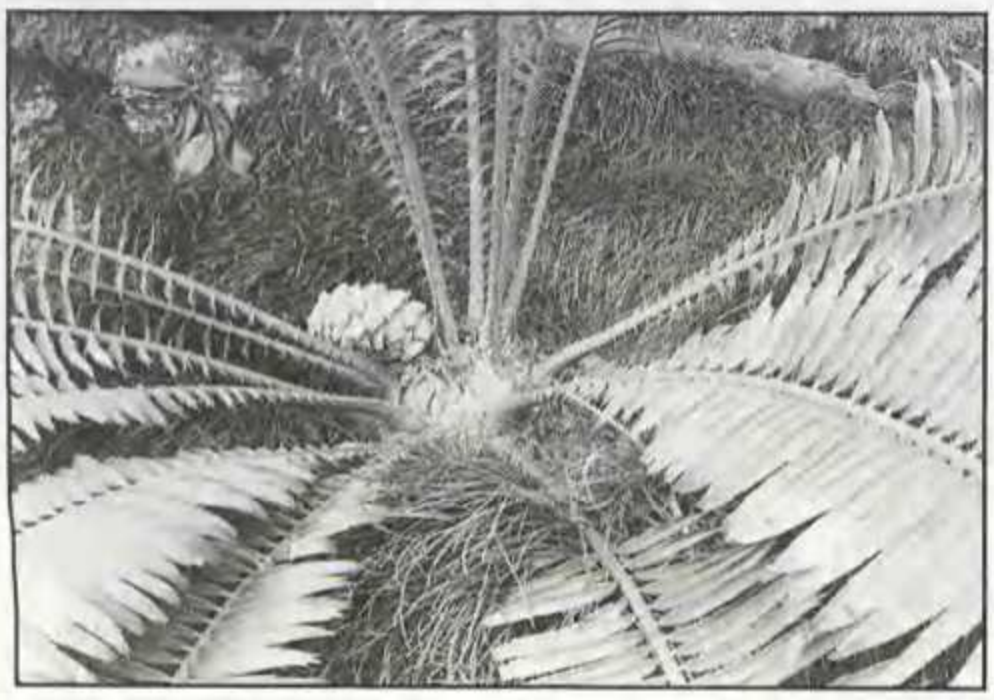

Figure 3 ***E. villosus***.

briefly with the horticulturist in charge and he told me of the pollination and germination techniques they were using.

There are several hybrid plants in the collection, *E. lehmannii* x *E. horridus*, *E. altensteinii* x *E. villosus* and *E. altensteinii* x *E. arenarius* to name a few. Particularly impressive were the large *E. princeps* (Figure 4). Numerous other species are represented including rarities such as *E. latifrons*.

Having no previous knowledge of this collection I was quite overwhelmed by the sheer number and size of these plants, indeed I was surprised how many *Encephalartos* are dotted around the rest of Funchal, in private and public gardens. In the central park there is an enormous *E. natalensis*.

I understand there was a certain amount of controversy surrounding these plants at the time of export. Well I can only say that while I would much prefer to see these plants in the wild. It's good to see they are flourishing and that many visitors to Madeira can take pleasure in seeing them. Hopefully one day they will have a surplus of seed and seedlings for distribution to societies and botanical gardens to further aid cycad conservation and education.

Figure 4 *E. princeps.*

[Some more *Encephalartos* species at the Monte Palace Tropical Garden can be seen in Figures 2 and 4 on p. 28–29. - **Editor.**]

INVERTEBRATES ASSOCIATED WITH *MACROZAMIA COMMUNIS* (ZAMIACEAE) - AGAIN

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Received 8 March 1999; Revised 23 May and 24 June 1999

Apparently Forster *et al.* (1998) have not understood the purpose of my publication (Chadwick 1998). It is recommended that the authors read the paper again and make a genuine attempt to understand it, instead of over-reacting by indulging in petty hairsplitting. The objective was to make a survey of fauna, especially invertebrates, associated with one species of cycad, viz. *Macrozamia communis*. No other species of cycad was even mentioned in my paper.

M. communis has a limited distribution in New South Wales, to which it is confined (Chadwick 1998, Text Fig. 1). The most northerly records are from the Macleay River. In Queensland, Brisbane is more than 500 km north of the Macleay and Mareeba about 1800 km north of Brisbane. The authors have not given any indication of having made field observations on this species of cycad under natural conditions. The invertebrates were collected from five sources inside or on the plant, not "around" or "near" as stated by the authors.

The paper published in *Biotropica* (Forster *et al.* 1994) had no reference to any original work having been done by the authors on *M. communis* and is thus scarcely relevant. Some time after its publication I had occasion to write to the editor of *Biotropica* in relation to the editorial policy of the journal and other topics. Included in his reply was a statement that the paper mentioned above did not satisfy present publication requirements and would no longer be acceptable to that journal. Obviously there had been changes in the meantime. No doubt they did have their paper "peer refereed". Their timing proved to have been impeccable.

The objectives and results of their work are not particularly obvious. Their collecting was restricted to mature cones, which are only mature for a limited part of any year, and not every year, while ignoring the caudex and leaves, where invertebrates occur in all months of the year. No mention is made of work on *M. communis*. It is not clear at all why cones only were examined. The authors state "These are the first published observations on the insect life associated with *Cycas cairnsiana, C. megacarpa, C. ophiolitica* and *C. platyphylla* and all of the *Macrozamia* species." (Sic). Hairsplitting; others had already published on insects found on cycads. What they meant by "all of the *Macrozamia* species" is not clear, as they mention only eleven species in Table 2, while they (1994: 217) and Jones (1993) state that there are about 25 species of the genus. The addition of more species of *Macrozamia* to their list (Forster *et al.* 1998) without mention of *M. communis*, only adds to the irrelevance of their criticism of my publication. In their 1994 paper the authors mention only nine species of insect associated with cycads. My study of *Macrozamia communis* resulted in more than 140 species of invertebrate being recorded. It is very likely that other species of cycad native to Queensland would have at least TEN times the number mentioned in their total of nine species (1994: 218).

Entomologically the publication is not exactly flawless, e.g. in Table 1 the Family Apidae (honey bees and *Trigona* sp., Order Hymenoptera) is placed in the Order Diptera (flies) and Braconidae (parasitic wasps, Hymenoptera) in Coleoptera (beetles).

The authors mention "pupation sites for various Lepidoptera". What is a pupation site, how can it be recognised and how can it be connected with

Lepidoptera? Apparently the term is original and undefined (?Undefinable). In my paper (1998: 17) the scarcity of species of Lepidoptera on *M. communis* is commented on. The oecophorid moth *Conobrosis haplochroma* (= *Eulechria* n.sp.) was common and the butterfly *Theclinesthes onycha onycha* much less common. The larvae feed, respectively, in the rachis of the male cone and on the pinnae. Two other species were each represented by a single specimen.

Forster *et al.* listed me among authors favouring wind pollination, and on the same page state that "Chadwick demonstrated that *Tranes lyterioides* provided pollination of *M. communis*". I did not hold two conflicting and probably incompatible views simultaneously.

Some aspects of the 1998 paper have been dealt with already. It is irrelevant to the subject of invertebrates associated with *M. communis*, the penultimate paragraph being particularly interesting. The authors state: "We have yet to conclusively prove what is the actual relationship ....." To be relevant to *M. communis*, it would be necessary to carry out adequate investigations within the area where this species of cycad grows.

Re collecting. Invertebrates were collected directly from individual plants or bred from *M. communis* material. Light trapping, done at night, would have attracted irrelevant fauna from other sources. This method of collecting can be used for several purposes, e.g. to obtain material for taxonomic and morphological studies, distribution and abundance data, or to ascertain if certain species, e.g. pests, are found in a particular area and so on. The writers appear to lack any first hand experience in this aspect of entomology on which they comment.

The authors complain that it is difficult to determine which taxa are directly associated with the cycad *M. communis*. Agreed. They would certainly have difficulty in doing this from a distance of hundreds of kilometres, and without access to field work and the material on which I based the paper; knowledge of insect biology and behaviour would also come into consideration.

It is stated that less than 60 species of insect are involved. It is interesting that the authors have made "a casual and generous interpretation of his listing". It is very unusual for authors to categorise their own work in these terms; mostly they leave it to their critics. When authors state that their own work is "casual and generous" (with what?) they can hardly expect others to disagree with them. However, there is no indication of who was responsible for this "casual" examination and what might be his/her understanding of insect biology and behaviour. It would appear that my record of species was used, in the absence of field work, specimens and probably entomological literature.

In the same paragraph the authors mention my "quite voluminous data" and later that "his data should be regarded as preliminary". My observations refer to more than 140 species. The authors refer to nine species of insect and none of them on *M. communis*.

Of the species of insect they mention (1994) only three are recorded from *M. communis* in N.S.W. (Without mentioning unpublished work on *Tranes* spp.). The authors give the impression of believing that insects on cones in the areas where they collected are the same as those recorded from *M. communis*. This is obviously not the case.

Insect species mentioned in Western Australian literature seem to differ significantly from species in N.S.W. and Queensland. A more detailed study of invertebrates associated with a number of species of cycad in different localities might uncover significant information on cycad-invertebrate relationships. Oberprieler (1995) has discussed host-specificity between weevils and cycads in a world-wide context. Studies of other invertebrates associated with cycads may produce additional enlightenment.

Although the first cycad-inhabiting thrips was found initially in *M. communis* it has since then been collected from four additional species of *Macrozamia* (Forster *et al.* 1994) and a second species of thrips has been found in a sixth species of *Macrozamia* in Western Australia (Mound *et al.* 1998). Is this genus of thrips restricted to *Macrozamia* spp.?

Some of the invertebrate genera found in *M. communis* might be sought in other species of cycad, e.g. *Coptaspis, Dysmicoccus, Cycadothrips, Xyroscelis, Brachypeplus, Sericoderus*, some genera of Curculionoidea, *Conobrosis, Theclinesthes*, etc., in relation to host/specificity. The study of invertebrate-cycad relationships is only in its infancy and could be investigated much further.

(Although obviously irrelevant to M. communis, there is a great deal of information available relating insects to Angiosperms, especially those of commercial importance, such as fruit, vegetables, crops, timber, etc. Investigations should be of considerable interest. So far, the author has not encountered any publications dealing with host/specificity in this context.)

The final paragraph is curious, having no connection with invertebrates on *M. communis* or even with the preceding paragraphs. In fact, at first I thought it was material from another paper, which had become misplaced from the rest of the contribution. Also there are clear indications that quite a large amount of taxonomic work, both on cycads and cycad-associated invertebrates, still has to be done. In the same paragraph the authors extol "invertebrate diversity" while they call my paper "preliminary", although it

is probably the most comprehensive yet published on this theme. It illustrates the diversity of invertebrates associated with one species of cycad. The authors appear not to have noticed this.

References. Of the thirteen quoted by the authors only three (or to be generous, four) have any reference to *M. communis* and/or invertebrates associated with it.

The authors possibly did not understand that the paper was primarily to record fauna, especially invertebrates, associated with this species of cycad, to submit the facts *as seen by direct observation and not necessarily to agree or disagree with the ideas of others*. Apparently they do not accept the demonstrated fact that a large number of species and a diversity of invertebrates are associated with *M. communis*.

For many years it has been my considered opinion that anyone studying insect-cycad relationships would benefit greatly by acquiring either a good knowledge of both entomology and cycads, or to be working with an entomologist having a knowledge of insect biology, behaviour and classification. So far nothing has occurred to change that viewpoint. In fact I feel an obligation to thank Forster *et al.* for providing examples to demonstrate, so convincingly, the truth of my conclusion on this matter.

To sum up: the publications of Forster *et al.* refer almost entirely to other species of cycad, have very little to do with *M. communis*-invertebrate relationships and are thus mostly irrelevant and redundant to the literature on this species of cycad.

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RAPID GROWTH IN CYCADS

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Received 2 July 1999

I often hear the question: "What is the fastest growing cycad?". Although *Zamia* has the record for the shortest time from germination to cone production (see *Encephalartos* **24**: 24–27), *Cycas* must hold the record for vegetative growth. I planted a specimen of *Cycas tanqingii* in the garden two years ago. It was seed grown and its largest leaf was 33 cm long. In one year's time, its leaves were up to 180 cm long (Colour Photo 9). One more year later its longest leaf was 248 cm long (Colour Photo 10). This specimen received moderate fertilizing and little irrigation besides runoff from the roof and suffered periods of drought. How much faster would it have grown under optimum conditions?

ENCEPHALARTOS UMBELUZIENSIS: UNTIDY FLUSH OF LEAVES

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17 July 1999

Over a period of several years I have observed in the gardens of the National Botanic Institute in Pretoria, the University of Pretoria, and my own, that mature specimens of *Encephalartos umbeluziensis* usually produce 3–8 leaves per flush and seldom up to 9 or 10. In January 1994 one of my plants produced a new flush of 12 leaves and at first the full-grown leaves had a rather untidy appearance with the lower leaflets of adjoining leaves being intertwined (Colour Photo 14).

Colour Photo 1 The upper part of King's Canyon, a spectacularly-eroded sandstone chasm in central Australia's Watarrka National Park, where cycads grow in relative profusion both in the valley and on rocky shelves in the upper sections. Photo: Roy Osborne.

Colour Photo 2 Cycads growing on steep cliffs in the Ellery Creek Reserve in the West Macdonnell Ranges. Photo: Roy Osborne.

Colour Photo 3 The author inspecting the "skirt" of dead leaves on this impressive ("Big Mac") specimen of *Macrozamia macdonnellii* in the Watarrka National Park. Photo: Angela Osborne.

Colour Photo 4 A fine example of *Macrozamia macdonnellii* at "Cycad Gorge" in the Finke Gorge National Park. Photo: Roy Osborne.

Colour Photo 5 ***Macrozamia macdonnellii*** **specimens at Standley Chasm in the West Macdonnell National Park.**

Kleurfoto / Colour Photo 6 Manlike keëls van / Male cones of ***Encephalartos concinnus*****. Foto /Photo: Leon Pienaar.**

Kleurfoto / Colour Photo 7 Manlike keëls van / male cones of ***Encephalartos ferox*****. Foto / Photo: Nat Grobbelaar.**

Colour Photo 8 Lou Randall, of Cycad Connections, demonstrating a nursery-grown 5-year old seedling of *Macrozamia macdonnellii*. Other cycads in view are *Encephalartos senticosus* and *Cycas revoluta*. Photo: Stan Walkley.

Colour Photo 9 A specimen of *Cycas tanqingii* in Florida. The arrow indicates the largest leaf at the time of planting one year previous. Photo: William Tang.

Colour Photo 10 The same plant of *Cycas tanqingii* one year later. The metal pole next to the stem allows comparison to Colour Photo 1. Photo: William Tang.

Kleurfoto / Colour Photo 11 Manlike keëls / Male cones of *Encephalartos friderici-guilielmi*. Foto / Photo: Nat Grobbelaar.

Regs / Right: **Kleurfoto / Colour Photo 12** Vroulike keëls van / Female cones of *Encephalartos friderici-guilielmi*. Foto / Photo: Nat Grobbelaar.

Kleurfoto / Colour Photo 13 Vroulike keël van / Female cone of *Encephalartos arenarius*. Foto / Photo: Nat Grobbelaar.

Colour Photo 14 *Encephalartos umbeluziensis*. Photo: Isabella Claassen.

a b c

Colour Figure 15 Female cones of (a) E. *umbeluziensis*, (b) *E. lehmannii*, and (c) *E. umbeluziensis* x *E. lehmannii*. Photos: Isabella Claassen.

CYCAD TRADE IN CHINA

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Received 2 July 1999

In May, 1998 I visited Fujian Province in southern China. This is a subtropical province along the coast, known for its horticulture. At the town of Zhang Zhou, a centre for horticultural trade I was startled by the sight of large piles of *Cycas* stems along the street (Figures 1, 2). I asked a young worker attending the piles and he said they had been shipped in by truck from Vietnam. Perusal through the various nurseries in the area revealed large numbers of *Cycas* with similar stems at various stages of reestablishment. They fit the description for *Cycas miquelii*, an inhabitant of limestone cliffs in northern Vietnam and adjacent areas in southern China. This is a slow-growing, dwarf species with stiff leaves. Their small size make them amenable for bonsai. Houses with private yards are rare in urban areas of China. These plants were probably intended as

Figure 2 Close-up of recently wild-collected female *Cycas* stems, in Zhang Zhou.

Figure 1 A street in Zhang Zhou, China with piles of *Cycas* stems probably originating from Vietnam.

decoration for balconies of city appartments - the market, probably the growing middle class of southern Chinese cities. Judging from the establishment of the plants, this trade has been going on for at least two years.

Other cycads were also seen, including the common *Cycas revoluta*, a stem of a giant *C. pectinata* and even a New World species, *Zamia furfuracea*. A few plants of what appeared to be *C. taiwaniana* were also seen in local gardens. This species is believed to have once been common in the mountains of the local region, but collection for the horticultural trade over many decades appears to have lead to its extinction or near extinction in the wild. Herbarium specimens documented wild cycads in this Province as recently as the 1950's.

RESPONSE TO QUESTIONNAIRE IN "*ENCEPHALARTOS*" NOS. 56 AND 57
REAKSIE OP VRAELYS IN "*ENCEPHALARTOS*" NRS 56 EN 57

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Received 14 July 1999

The following people/institutions responded to the questionnaire. Please contact them directly for further

details.

Die volgende persone/institute het op die vraelys gereageer. Tree asseblief direk met hulle in verbinding vir verdere besonderhede.

1. Cycad Centre (D. Nel), P.O. Box 45, 3730 Umlaas Road. Tel: 0332 510478; Cell: 082 9252540, 082 9246969
   Seedlings: *Encephalartos* spp., *Zamia* spp., *Macrozamia* spp., *Cycas* spp., *Dioon* spp.
   Seed: *Encephalartos* spp., *Cycas* spp.
   Books, Posters, Memorabilia on Cycads.

2. Cycad Solutions CC, P.O. Box 7045, 6055 Newton Park. Tel & Fax: +27-(0)41-3642032, e-pos/e-mail: gmschwellnus@iafrica.com
   Dryf handel in alle spesies van Afrika en sommige Meksikaanse spesies / Trade in all African species and some Mexican species.

3. Leon Pienaar, Jan Visselaan 626, 0084 Roseville. Tel: 012-3354444
   Saad / Seed: *Encephalartos dyerianus, E. cerinus*

4. André Louis Topham, Posbus / P.O. Box 44, 1380 Hoedspruit. Tel & Faks/Fax: 015-7955220
   Stuifmeel / Pollen: *Cycas revoluta, C. circinalis, Encephalartos nubimontanus, E. arenarius, E. ferox, E. gratus, E. horridus, E. inopinus, E. laevifolius* (Mariepskop), *E. lebomboensis, E. longifolius, E. manikensis, E. natalensis, E. transvenosus, E. trispinosus, E. villosus, Zamia frufuracea*
   Saailinge / Seedlings: *Cycas revoluta, Encephalartos nubimontanus, E. ferox, Zamia furfuracea* (ook groter plante / also larger plants)

5. Gerrie de Haas & Diekie de Klerk, Privaatsak / Private Bag X9474, 0700 Pietersburg. Tel: 015-2972180 (w), 015-2954021 (h), Fax / Faks: 015-2973947
   Stuifmeel / Pollen: 30 Suid Afrikaanse / South African *Encephalartos* spp., *Stangeria eriopus*; 14 res van Africa / rest of Africa *Encephalartos* spp.
   Saad/ Seed: 25 Suid-Afrikaanse / South African *Encephalartos* spp.

6. H.W. Hanaczeck, P.O. Box 44, 0835 Duiwelskloof. Tel & Fax: 015-3099544
   Seedlings of most *Encephalartos* spp. of South Africa (rare ones), few of Africa north of Limpopo River, few *Zamia* spp., also larger plants if available

7. S.W.K. Trollip, Grass Roots Nursery, P.O. Box 3622, 0250 Brits. Tel: 012-2527235, Fax: 012-2527582, E-mail: trollip@lantic.co.za
   35 South African *Encephalartos* spp., 10 African *Encephalartos* spp., Certain exotic species of *Cycas*

8. Kirstenbosch Botanic Garden, Private Bag X7, 7735 Claremont. Tel: 021-7621166, Fax: 021-7970002 (attention John Winter),
   E-mail: winter@nbict.nbi.ac.za
   Pollen: *Encephalartos altensteinii, E. friderici-guilielmi, E. ghellinckii, E. horridus, E. inopinus, E. lebomboensis, E. paucidentatus, E. transvenosus, E. trispinosus, E. villosus, E. woodii*
   Young plants: *E. altensteinii, E. caffer, E. cycadifolius, E. friderici-guilielmi, E. ghellinckii, E. lanatus, E. latifrons* (when available), *E. lebomboensis, E. lehmannii, E. longifolius, E. natalensis, E. transvenosus, E. trispinosus, E. villosus* (seedlings)

9. Leon Bezuidenhout, Posbus / P.O. Box 6376, 2572 Flamwood (Klerksdorp). Tel & Fax/Faks: 018-4682790, Sel/Cell: 082 4218298
   Pollen: *Encephalartos ferox, E. altensteinii, E. lehmannii, E. longifolius, E. villosus, E. senticosus*
   Seed: *E. ferox, E. altensteinii, E. lehmannii, E. natalensis, E. longifolius, E. villosus, E. senticosus*
   Seedlings: *E. ferox, E. altensteinii* (also larger plants), *E. lehmannii, E. natalensis, E. trispinosus, E. longifolius, E. villosus* (also larger plants), *E. transvenosus, E. senticosus*

10. F.M. Myburgh, Posbus / P.O. Box 268, 6400 Kareedouw. Tel: 042-2880093
    Saad / Seed: *Encephalartos longifolius*

11. Marius Helm, 6 Waterberg St., Van Collerpark, Queenstown or P.O. Box 9612, 5320 Queenstown. Tel: 0451-5728, Fax: 0451-81424, Cell: 082 8071029
    Pollen: *Encephalartos friderici-guilielmi*
    Seed: *E. altensteinii, E. friderici-guilielmi, E. ferox, E. natalensis, E. senticosus*
    Seedlings: *E. altensteinii, E. friderici-guilielmi, E. ferox, E. manikensis, E. umbeluziensis, E. natalensis* x *E. woodii, E. natalensis, E. princeps, E. senticosus*

12. William Nel, P.O. Box 87, 3867 Mtunzini. Tel: 0353-401831, e-mail: wnel@pan.uzulu.ac.za
    Seedlings: *Encephalartos ferox, E. lebomboensis, E. villosus, E. gratus*
    Suckers: *E. natalensis, E. arenarius, E. trispinosus*

13. Charles M. de Beer, P.O. Box 1107, 1240 White River. Tel & Fax: 013-7500719, Cell: 082 5723233
    Seedlings up to 4 year old plants: *Encephalartos lebomboensis, E. ferox*

14. K.W. Walters, P.O. Box 6150, 1508 Dunswart. Tel & Fax: 011-9181942
    Various plants

15. Andre Cilliers, P.O. Box 351, 2520 Potchefstroom. Tel: 018-2971602 (h), 018-2996308 (w), Fax: 018-2976572, E-mail: andre-c@ops1.agric.za
    Seedlings: *Encephalartos altensteinii, E. natalensis,*

E. villosus, E. transvenosus, E. lebomboensis, E. senticosus, E. ferox, E. kisambo, E. trispinosus

16. Nat Grobbelaar, Posbus 15357, 0039 Lynn-Oos. Tel & Faks: 012-8080995, E-pos: natgrob@hotmail.com
Saailinge van alle beskikbare soorte, gewoonlik: *Encephalartos altensteinii, E. aemulans, E. lanatus, E. lebomboensis, E. ferox, E. umbeluziensis, E. lehmannii, E. villosus, E. longifolius, E. senticosus, E. horridus, E. paucidentatus, E. manikensis, E. gratus, E. concinnus, E. hildebrandtii, Macrozamia communis, M. diplomera, M. miquelii, M. fearnsidei, M. johnsonii, M. moorei, Cycas revoluta, C. thouarsii, Dioon spinulosum, D. edule*

17. J.J. de Jong, P.O. Box 934, 2162 North Riding. Tel: 011-7936579 (h), 012-3091251 (w), cell: 082 7839538, Fax: 012-3091250 (w), 011-7936579 (h) (ask for)
Pollen: *Encephalartos longifolius, E. transvenosus, E. trispinosus*
Seed: *E. transvenosus*
Seedlings: *E. tegulaneus, E. hildebrandtii, E. transvenosus, E. ferox, Dioon edule*
Plants: *Cycas revoluta*

18. J.C. Hoole, 1 Kennelly Road, Walmer Downs, 6070 Port Elizabeth. Tel: 041-381360
Seedlings: *Encephalartos altensteinii, E. lehmannii, E. longifolius, E. arenarius, E. villosus, E. trispinosus*

19. G.L. Day, Posbus 2043, 1725 Roodepoort of Malcolmweg 46, Poortview, Roodepoort. Tel: 011-7634795 (w), Faks: 011-7661253
Seedlings: *Encephalartos friderici-guilielmi, E. transvenosus, E. villosus, E. ghellinckii, E. longifolius, E. lehmannii, E. gratus*

NOTES ON *ENCEPHALARTOS UMBELUZIENSIS*, *E. LEHMANNII* AND THEIR ARTIFICIALLY BEGOTTEN OFFSPRING

Isabella Claassen
P.O. Box 25688, 0105 Monument Park, R.S.A.

17 July 1999

Years ago, when I knew next to nothing about cycads, two of the *Encephalartos* specimens in my garden produced cones, a male *E. lehmannii* in December 1978 and a female *E. umbeluziensis* in January 1979. I dry-pollinated the receptive female cone towards the end of April 1979 using the *E. lehmannii* pollen.

The "seeds" were harvested in February 1980 and put out to germinate in October 1980. The seeds started to germinate in March 1981.

In April 1981 I gave two of the germinating seeds to Piet Vorster but only one survived. In May 1995 Piet sent me a photo of the specimen in his garden. His plant has a subterranean stem, has suckered freely, and coned for the first time in January 1996 (female).

In December 1988 I planted my specimens in large containers (55 cm in diameter and 34 cm deep). Perhaps the containers are not deep enough because my five specimens do not have subterranean stems. The stem of the largest one is now 24 cm in diameter and 13 cm long. Up to now my plants are all non-suckering.

These hybrids are interesting because at first glance they rather resemble *E. cerinus*. On the aerial parts of the stems each leaf-base is surrounded by a tan to reddish-brown collar.

My largest specimen produced its first cone (female) in December 1997. In comparing the female cone of the hybrid with those of the mother species (*E. umbeluziensis*) and the father species (*E. lehmannii*) (Colour Figure 15 a, b, c), one can see that the peduncled cone of the hybrid more closely resembles the *E. umbeluziensis* cone than the *E. lehmannii* cone, but the colour is more bluish-green compared to the yellowish-green in *E. umbeluziensis*, and in the hybrid a layer of fine dark brown hair covers the terminal facet of each megasporophyll (inherited from the father?) whereas the terminal facets of the megasporophylls of *E. umbeluziensis* female cones are smooth. The colour of the hybrid's cone gradually changed and at maturity it became yellowish, but not as brightly yellow as in *E. umbeluziensis*, and the megasporophylls shed the layer of dark brown hair.

STUKKIES EN BROKKIES / BITS AND PIECES

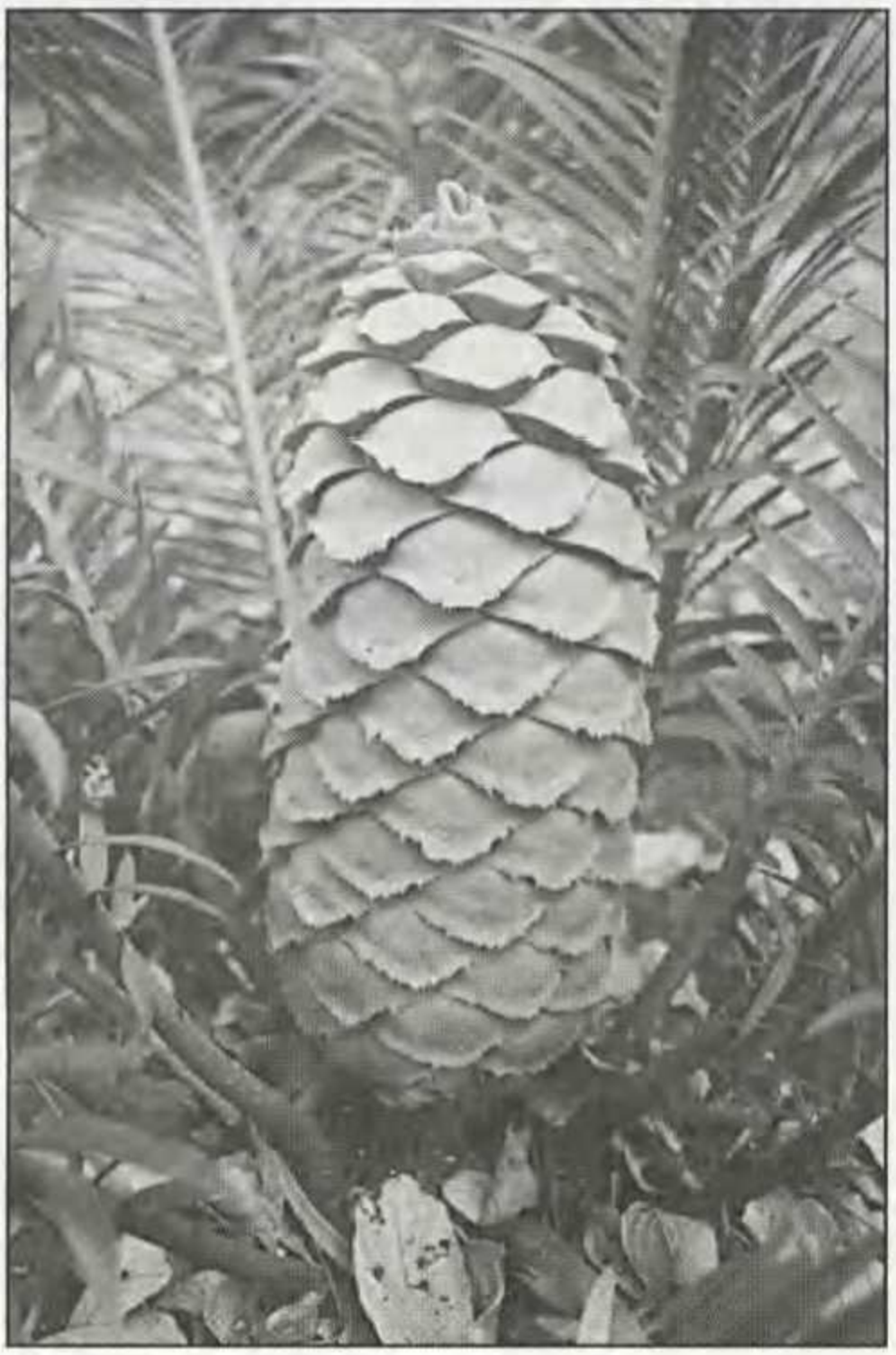
Nat Grobbelaar
Posbus/P.O. Box 15357, 0039 Lynn-oos/Lynn East, R.S.A.

Ontvang/Received 19 Julie/July 1999

KEËLS VAN ENKELE BROODBOOMSPESIES

Manlike keëls van *Encephalartos concinnus* in 'n Pretoria tuin 14 dae voor stuifmeelvrystelling (Kleurfoto 6).

Vroulike keëls van twee *E. cerinus* plante. Let op die variasie in die grootte en getal megasporofille (Figuur 1, 2).



Figuur 1 *E. cerinus* **vroulike keël met 'n kleiner getal maar groter megasporofille. / Figure 1** *E. cerinus* **female cone with larger and a smaller number of megasporophylls.**

Manlike keëls van *E. ferox* met stele wat 15–20 cm lank is (Kleurfoto 7). Vergelyk dit met die 2–3 cm stele wat in 'n moderne boek vir hierdie spesie aangegee word.

Manlike (Kleurfoto 11) en vroulike (Kleurfoto 12) keëls van *E. friderici-guilielmi* in die Laeveldse Botaniese Tuin, Nelspruit.

Vroulike keël van *E. arenarius* met tipiese opvallende steel (Kleurfoto 13).

Vroulike *E. caffer* keël met ongewone? keëlskubbe in die Kirstenbosch Botaniese tuin (Figuur 3).

Figuur 2 *E. cerinus* **vroulike keël met 'n groter getal maar kleiner megasporofille. / Figure 2** *E. cerinus* **female cone with a larger number but smaller megasporophylls.**

Vroulike keël van *Dioon edule* (Figuur 4) en 'n lengtesnee deur hierdie onbestuifde volwasse keël (Figuur 5) om die blaarvormige keëlskubbe, relatiewe

groot oop ruimtes in die keël en die klein saadknoppe aan te toon.

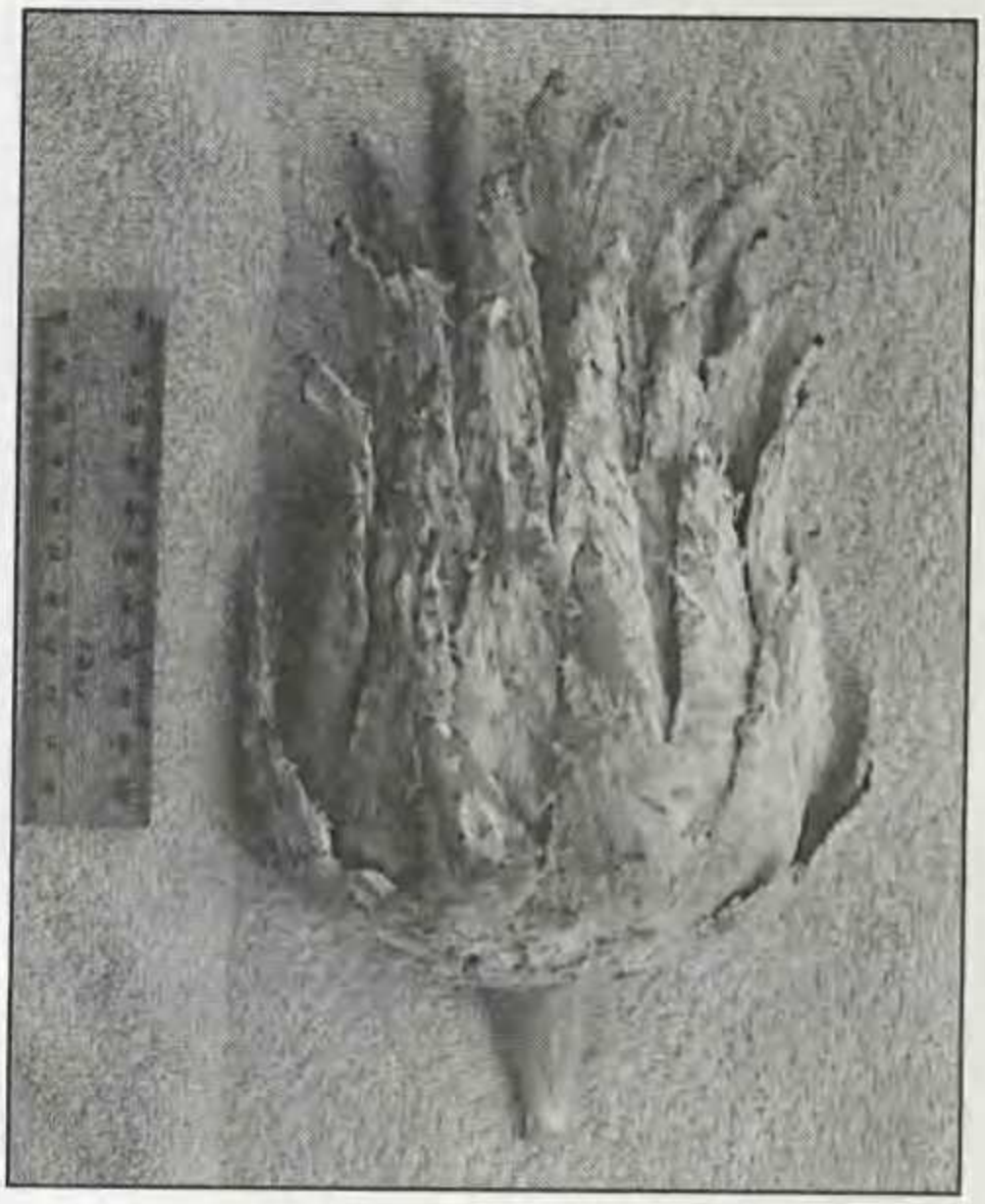
Figuur 3 Vroulike *E. caffer* keël. / **Figure 3** Female *E. caffer* cone.

CONES OF SOME CYCAD SPECIES

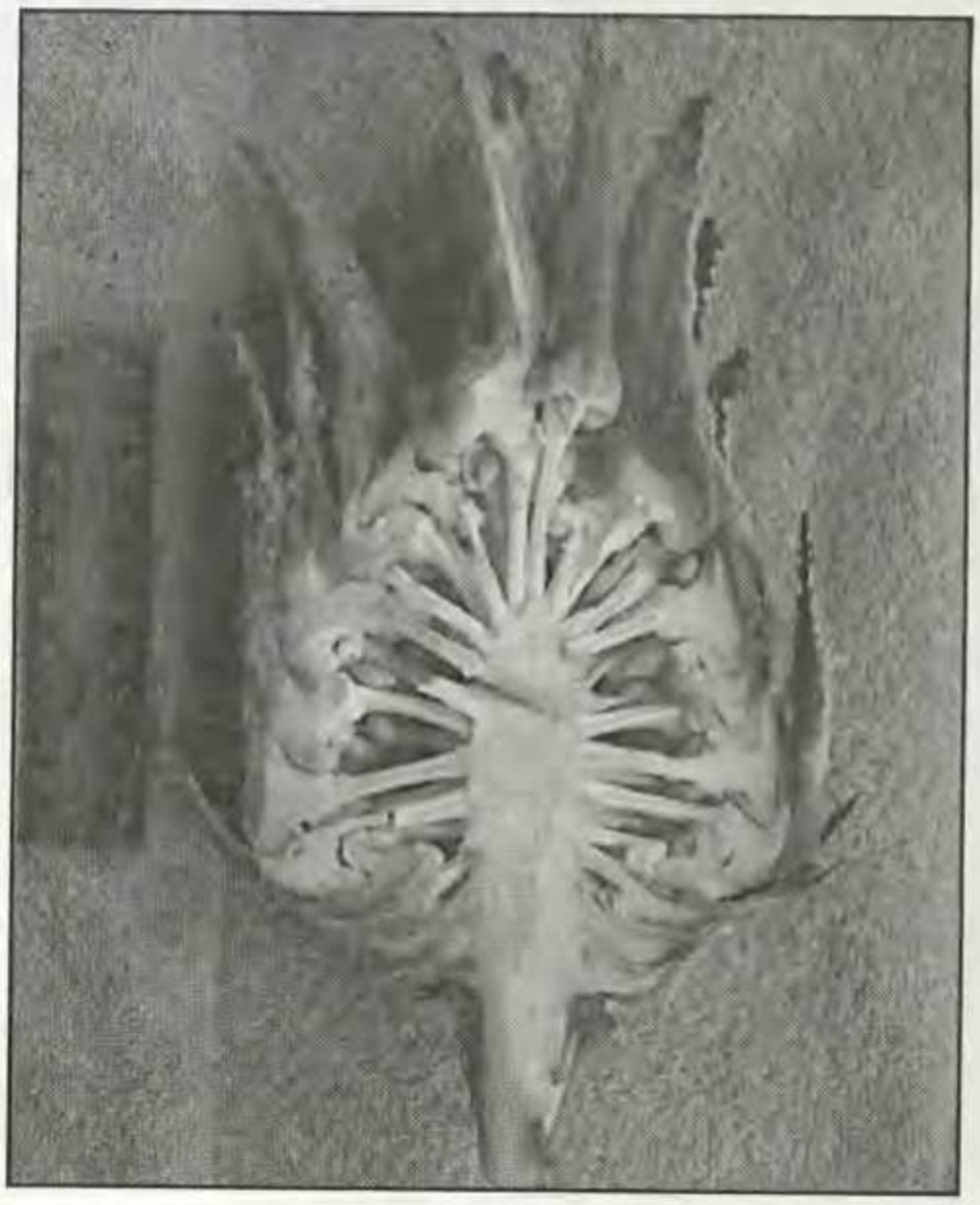
Male cones of *Encephalartos concinnus* in a Pretoria garden 14 days before shedding pollen (Colour Photo 6).

Female cones of two *E. cerinus* specimens (Figures 1, 2). Note the variation in the number and size of the megasporophylls.

Male cones of *E. ferox* with 15–20 cm long peduncles (Colour Photo 7). Compare this with the 2–3 cm long peduncles that are recorded for this species in a modern book on cycads.



Figuur 4 *Dioon edule* vroulike keël. / **Figure 4** *Dioon edule* female cone.



***Regs/Right*: Figuur 5** Lengtesnee deur 'n onbestuifde volwasse vroulike keël van *Dioon edule*. / **Figure 5** Longitudinal section through a mature unpollinated female cone of *Dioon edule*.

Male (Colour Photo 11) and female (Colour Photo 12) cones of *E. friderici-guilielmi* in the Lowveld Botanical Garden, Nelspruit.

Female cone of *E. arenarius* with typical prominent peduncle (Colour Photo 13).

Female *E. caffer* cone with unusual? cone scales in the Kirstenbosch Botanical Garden (Figure 3).

Female cone of *Dioon edule* (Figure 4) and a longitudinal section through this mature unpollinated cone (Figure 5) to demonstrate the leafy nature of the cone scales, large cavities in the cone and small ovules.

NEWS FROM THE TRANSVAAL REGIONAL BRANCH OF THE SOCIETY

Derik Minnaar
302 Hiperbool Street, 0184 Meyerspark x 8, R.S.A.

Received 9 July 1999

Report on recent activities

CYCADS OF THE MONTGOMERY BOTANICAL CENTER

On 15 May 1999 Dr Terrence Walters, Executive Director and co-founder of the cucurbit network in Miami, Florida, U.S.A., presented an interesting talk about the Montgomery Botanical Center. Thirteen members and visitors of the Cycad Society attended the presentation, in which Dr Walters informed us about the history and "Master Site Plan" of the Botanical Center.

According to the plan, the 120 acre property is subdivided into four geographic areas: the Coconut Grove Palmetum, the South Palmetum, the Lowland Palmetum and Research area. The research area contains a conservation collection of endangered species as well as research, library, herbarium and nursery facilities operated by Fairchild Tropical Garden. Fairchild's facilities are on eight acres leased by the Center to the Garden. The Center has three departments, namely Collections Development, Horticulture and Facilities, and Administration. The purpose of the institution is to establish scientifical valuable collections of cycads and palms, and to make these available for research by scientists.

To continually increase the scientific and conservation value of the collections, the latest computer techniques for plant mapping, accessioning, identification, labeling, data storage and imaging are employed. These substansial programs are used to track all individual plants.

The Center is active in expanding its collections of cycads and palms by mounting international expeditions each year. Many new species were added recently from expeditions in Australia, Brazil, China, Guyana, Madagascar, Mexico, Philippines and Thailand.

Over 3500 cycads representing more than 135 species can be found on the grounds of the Center. Although the collection is designed to be internationa' in coverage, the major emphasis is on cycads from Asia and the Americas. In 1995, the Cycad Walk was upgraded by planting about six acres with cycads. Also, 6000 palms representing more than 400 species are growing at the Botanical Center. The 13 acre area will contain one of the world's leading collections of scientifically valuable palms.

Scientists around the world are encouraged to study and develop research projects at the Center. Accomodation at an on-site guest-house facilitates such research processes. The Montgomery Archive documents the lives of Robert and Nell Montgomery in Florida as well as the history of the Center since its founding in 1959. The Archive is open by appointment.

The Botanical Center also host students, teachers and members of plant societies during the year. The Center is open by appointment to organized tour groups. Persons from many walks of life volunteer their services in areas of landscaping, facilities, the nursery, the archives, administration, plant records (labeling and computerization), surveying and plant inventory.

After the very informative slide show, Mr Heilgendorf of the Pretoria National Botanical Gardens thanked the speaker and invited the audience to join him at the cafetaria for tea.

Toekomstige aktiwiteit:

SATERDAG 6 NOVEMBER 1999 OM 16H00 IN DIE HOOFGEBOU VAN DIE NASIONALE BOTANIESE INSTITUUT, PRETORIA: Afsluitingsfunksie. Ons onderhandel nog met 'n persoon om 'n praatjie en skyfievertoning te lewer. Die praatjie sal deur 'n bring-en-braai by Velcichhuis in die gronde van die Botaniese Tuin, waar ons in November 1997 ontspan het, gevolg

word. Die bestuur sal pap en vleis gratis voorsien, maar elkeen moet hul eie drinkgoed, glase en eetgereedskap voorsien. Bring ook asseblief jou eie veldstoel en musiek-instrument saam indien jy ons verrigtinge met musiek wil opvrolik. Lede wie se vanne op **A** tot **M** begin moet asseblief vrugteslaai bring terwyl diegene wie se vanne op **N** tot **Z** begin mengelslaai moet bring. R.S.V.P. asseblief aanDerik of Lynette by telefoon (012) 8033061 (na-ure) teen 31 Oktober 1999.

BACK COPIES OF OUR MAGAZINE STILL AVAILABLE
VORIGE UITGAWES VAN ONS TYDSKRIF WAT NOG BESKIKBAAR IS

Guillaume Theron
P.O. Box / Posbus 1790, 0027·Groenkloof (Pretoria), R.S.A.

Received / Ontvang 21 July 1999

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± 12 copies of/eksemplare van **Proceedings of the Third International Conference on Cycad Biology - P. Vorster (Editor)** available/beskikbaar @ **R90.00** per copy/eksemplaar locally/plaaslik. (Prices per copy to foreign countries available on request.)

(Short communications continued on / Kort mededelings vervolg op p. 36)

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

REPRODUCTION OF PHOTOGRAPHS IN THE JOURNAL

With reference to my last letter (*Encephalartos* **58**: 31–32) on the subject of black and white reproduction in the journal, I thought I would send you some photographs I have taken recently (on 6 x 7 cm black and white negative film). The *Dioon* (Figure 1) and other indoors shot (Figure 3) was at Kew, the others were taken at the Monte Palace Garden, Madeira

(Figures 2, 4). I was very surprised at the large number of *Encephalartos* in this garden. Do you have any background information on these plants? How and when they got to Madeira. [See newspaper/magazine clippings in *Encephalartos* **18**: 43 (June 1989), **20**: 42 (December 1989), **21**: 30 (March 1990), **25**: 26–28 (March 1991), **26**: 39–41 (June 1991), and **27**: 36–38 (September 1991). **-Editor.**]

Figure 1 *Dioon spinulosum*, **Kew Gardens, London, England.**

I noticed in *Encephalartos* **54** page 26 the photo taken in 1946 has reproduced better and looks sharper than the one below it. [All the photographs sent in with the relative article were black and white. - **Editor.**]

Some of the pictures in the journal can look very grey and flat. Is this because the originals are in colour? [The majority of photos sent in are in colour and up to now only a small number were black and white. **-Editor.**]

If you have any more early photos of cycads in habitat I would be very interested to see them. Perhaps they could be published as a footnote in the back of each issue.

Figure 2 Male *Encephalartos friderici-guillielmi* with spent cones, Monte Palace Tropical Garden, Madeira.

Alternatively if you had a number of negatives, some quality prints or perhaps a special edition booklet or cycad calendar could be produced. I'm sure they would be of great historical interest to any cycad enthusiast. Any money raised could go towards the journal's printing costs.

If you want to use any of my pictures for the journal you are welcome.

***Ian Watt,** 25 Treves Road, Dorchester, Dorset, DT1 2HE, England.*

Received 8 April 1999

***Opposite page, bottom*: Figure 4 Group of *Encephalartos* species, Monte Palace Tropical Garden, Madeira.**

. . . . . .

Dear Editor

MONTE CYCADS

Thank you, for the reply to my letter.

I was very interested to read the article on the Monte cycads that you sent. Enclosed is a brief article on the collection that I thought you may be interested in putting in the journal. I have also enclosed some more photos. [See p. 12–14 in this issue. - **Editor.**]

I am especially interested in illustrated articles on wild populations and up to date information on conservation

Figure 3 Indoors shot of some cycads, Kew Gardens, London, England.

work in the field.

I'll have to come and visit one day. Is it difficult to see many of the plants in habitat?

Ian Watt, 25 Treves Road, Dorchester, Dorset, DT1 2HE, England.

Received 21 May 1999

. . . . . .

Geagte Redakteur

PROBLEME MET DIE "LUIPERD MOT" (*ZERENOPSIS LEOPARDINA*)

Ek het 'n bietjie meer as twee jaar gelede 'n aantal klein broodboompies aangeplant. Almal aard goed en groei mooi hier aan die Natalse Noordkus. Ek het egter al gou met die sogenaamde "Luiperd mot" te doene gekry en voer sedertdien 'n voortdurende oorlog teen hierdie pestilensie. Ek het die afgelope twee jaar waargeneem dat hierdie mot vanaf Oktober tot en met Meimaand bedrywig is (dit wil sê agt maande van die jaar). Ek het byvoorbeeld sedert Oktober verlede jaar tot nou toe, meer as 800 van hierdie motte met 'n net gevang en doodgemaak. Dit is afgesien van dié wat my aandag ontsnap en waarvan ek die eiers en larwes moes vernietig. Die ergste is dat hulle nie sporadies kom nie, maar elke liewe dag. Hierdie stryd het byna al my lus om 'n broodboom in my tuin te hê, vernietig. Die jong broodboompies stoot tot drie keer per jaar nuwe blare wat net tot my frustasie bydra.

My vraag aan u is:
1. Wat is reeds oor hierdie pes gepubliseer?
2. Is daar intensief oor hierdie mot navorsing gedoen en deur wie?
3. Eet hierdie pestilensie se larwes net broodboomblare, of is daar ander plante waarop hulle teer? Ek lees byvoorbeeld in die boekie "Cycad collection of the Durban Botanic Gardens" (1993) dat hierdie mot se larwes byna uitsluitlik op broodbome teer. Wat sou die ander plante wees?

Hoop dat u my van inligting kan voorsien.

***Derrick J. Coetzee,** Posbus 1271, 4420 Ballito, R.S.A.*

Ontvang 21 April 1999

[Kan enige van ons lesers asseblief Derrick Coetzee se vrae beantwoord? - **Redaktrise.**]

Summary

PROBLEMS WITH THE LEOPARD MOTH (*ZERENOPSIS LEOPARDINA*)

During the past two years the author had a leopard moth infestation on his cycads from October up to and including May. Since October 1998 he caught and killed 800 of these moths. He asks the following questions:
1. Does any publication on this pest exist?
2. Did any research worker investigate this pest intensively, if so, who?
3. Do the larvae only consume cycad leaves, or leaves of other plants as well? He read in the booklet "Cycad collection of the Durban Botanic Gardens" (1993) *That* this moth's larvae live nearly exclusively on cycad leaves, and he would like to know the names of the other plants.

[Could any of our readers please give answers to Derrick Coetzee's questions? - **Editor.**]

. . . . . .

Dear Editor

GOOD SERVICE FROM NATURE CONSERVATION

It is with a great deal of disappointment that one reads about encounters such as experienced by John Kloppers in importing an *Encephalartos altensteinii* from the Eastern Cape to Mpumalanga.

I have not had much experience in this regard but am happy to relate the smooth way in which a recent transaction I was involved in went through.

On Saturday evening, 20th March I collected my mail which also contained my copy of *Veld and Flora*, Journal of the Botanical Society of South Africa. In it I noticed that their Plant Sale was being held that same weekend at Kirstenbosch. I phoned Kirstenbosch on the Sunday morning and was told that there were still three *E. latifrons* plants for sale. I confirmed my willingness to buy one of them (6 cm caudex) and transferred the funds to Kirstenbosch on Monday morning. That same day Kirstenbosch telefaxed me an invoice together with the name of a contact person, Mr. Hughes, at Cape Nature Conservation. The following day I telefaxed my request for an Export Permit together with the invoice for his attention and was pleasantly surprised to receive an Export Permit by telefax a few hours later.

The same afternoon I faxed my invoice and copy of the Export Permit to Gauteng Nature Conservation for the attention of Ms. Onsongo with my request for an Import Permit from Kirstenbosch to Gauteng, which I again promptly received by telefax the next morning.

The Easter Weekend a few of my athletic friends drove down to Cape Town to take part in the Two Oceans Marathon and armed with all the necessary legal documentation picked up my plant and brought it back to Pretoria for me.

To my chagrin they were never stopped along the way and my little *E. latifrons*, shrouded in sheaves of legal protection, eventually reached me uninspected in Pretoria which I am sure is how most of our indigenous cycads travel the country.

The helpfulness of the Plant Sales staff at Kirstenbosch as well as the officials of both the Cape and Gauteng Nature Conservation Departments, however, is truly an inspiration to acquire and dispose of cycads the "right way".

***Fanie Avenant**, P.O. Box 90, 0050 Wapadrand, R.S.A.*

Received 19 May 1999

. . . . . .

Dear Editor

COLOUR ISSUE OF *ENCEPHALARTOS*

Congratulations on the wonderful colour issue (No 58) of "*Encephalartos*". I am deeply honoured that you choose to dedicate this issue to me. Writing about cycads is a rewarding learning experience in itself and I hope I can continue to contribute the occasional article. More importantly, let all our readers acknowledge the enormous contribution of the magazine editor and all those involved with the more modest but vital tasks like typesetting, proofreading, processing photographs, layout design, arranging printing, packing and postage and even worrying about the accounts. Very well done to all involved.

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

Received 28 June 1999

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Dear Editor

REVOLUTE LEAF ARRANGEMENTS IN CYCADS

Congratulations with the beautiful colour photographs in the June 1999 edition of *Encephalartos*.

With regard to Dr. Piet Vorster's question about the unusual leaf arrangement in *Encephalartos ngoyanus* I can reply that I, or rather an *E. inopinus* in my collection, experienced an identical recurving of leaves to the specimen depicted on the front cover of our journal.

The history of the *E. inopinus* in question is briefly as follows:

I obtained a healthy sucker, about the size of a rugby ball, of this species during August last year. It had already formed a healthy set of roots which I left intact but the leaves were all removed when transplanted into a large container. During April this year I noticed that the plant was pushing a new flush of leaves. When the leaves were about 20 cm high it became apparent that the leaflets were greatly recurved and tightly stuck together in groups of three to six. Not knowing what this unusual situation would lead to I proceeded to prise the leaflets apart with a smooth sharp knitting needle. During this operation it appeared to me that the leaflets were extremely waxy, thus causing the leaflets to be glued together and that this might be the cause for their tendency to recurve. It took the best part of a day to get the leaflets apart and the result was an extremely untidy looking cycad. During the following few days some of the leaflets would again curl up into one another and according to my observation their extreme waxiness would again cause them to stick tightly together. Needless to say, the knitting needle treatment would follow.

The leaves, fourteen in total, eventually grew to normal length and appearance and there is no indication left of the unusual delinquency this juvenile had suffered upon it's doting owner apart from a few brownish bruise marks remaining after hardening.

Unfortunately I "treated" the entire flush of leaves and did not leave a control example for later comparison.

I have wondered whether the transplantation of the sucker just before the emergence of new leaves might have retarded their timely appearance and if so whether their longer than usual sojourn in sub-developed form within the sucker might have given cause for the leaflets to stick together.

I further formed the opinion that the power exerted by natural growth working against unnatural adhesion of the leaflets to one another might be the cause of the leaflets coiling back like this.

It will be interesting to share the observations of other cycad enthusiasts in this respect.

Fanie Avenant, P.O. Box 90, 0050 Wapadrand, R.S.A.

Received 2 July 1999

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Dear Prof de Jager

FINANCIAL STATEMENTS FOR THE YEARS ENDED 31-12-97 & 8

I attach hereto a copy of the above-mentioned financial statements; the original have been given to Prof. Theron for publication in "*Encephalartos*".

The finances of the Society as at 31-12-98 are extremely sound, and reflect an increasing surplus of income over expenditure; **the only note of caution I would like to bring to your attention is that there is too great a concentration of duties and responsibilities with the Secretary/Treasurer.**

It is with regret that I hereby tender my resignation as Honorary Auditor of the Society, with immediate effect. This decision has been occasioned by my changed circumstances. I will naturally afford my successor all the assistance I can.

I have delivered all the documents and records of the Society in my possession to Prof Theron.

***Norman J. Kachelhoffer,** P.O. Box 3107, 0001 Pretoria, R.S.A.*

Received 8 July 1999

NEW CYCAD PUBLICATIONS

AN, S.S., MOEPPS, B. WEBER, K. & BHATTACHARYA, D. 1999. **The origin and evolution of green algal and plant actins.** *Molecular Biology and Evolution* 16(2): 275–285.

[The Viridiplantae are subdivided into two groups: the Chlorophyta, which includes the Chlorophyceae, Trebouxiophyceae, Ulvophyceae, and Prasinophyceae; and the Streptophyta, which includes the Charophyceae and all land plants. Within the Streptophyta, the actin genes of the angiosperms diverge nearly simultaneously from each other before the separation of monocots and dicots. Previous evolutionary analyses have provided limited insights into the gene duplications that have produced these complex gene families. We address the origin and diversification of land plant actin genes by studying the phylogeny of actins within the green algae, ferns, and fern allies. Partial genomic sequences or cDNA's encoding actin were characterized from *Cosmarium botrytis* (Zygnematales), *Selaginella apoda* (Selaginellales), *Anemia phyllitidis* (Polypodiales), and *Psilotum triquetrum* (Psilotales). *Selaginella* contains at least two actin genes. One sequence (Ac2) diverges within a group of fern sequences that also includes the *Psilotum* Ac1 actin gene and one gymnosperm sequence (*Cycas revoluta* Cyc3). This clade is positioned outside of the angiosperm actin gene radiation. The second *Selaginella* sequence (Ac1) is the sister to all remaining land plant actin sequences, although the internal branches of this portion of the tree are very short. Use of complete actin-coding regions in phylogenetic analyses provides support for the separation of angiosperm actins into two classes. N-terminal "signature" sequence support these groupings. One class (VEG) includes actin genes that are often expressed in vegetative structures. The second class (REP) includes actin genes that trace their ancestry within the vegetative actins and contains members that are largely expressed in reproductive structures. Analysis of intron positions within actin genes shows that sequences from both *Selaginella* and *Cosmarium* contain the conserved 20-3, 152-1, and 356-3 introns found in many members of the Streptophyta. In addition, the *Cosmarium* actin gene contains a novel intron at position 76-1.]

First author's address: Dep. Biol. Sci., Univ. Iowa, 239 Biology Build., Iowa City, IA 52242-1324, U.S.A.

COSTA, J-L., PAULSRUD, P. & LINDBLAD, P. 1999. **Cyanobiont diversity within corraloid roots of selected cycad species.** *FEMS Microbiology Ecology* 28(1): 85–91.

[The diversity and host specificity of the cyanobionts of several cycad species (*Cycas circinalis* L., *C. rumphii* Miq., *Encephalartos lebomboensis* I. Verd., *E. villosus* Lem., and *Zamia pumila* L.) collected in a botanical garden were examined using the tRNALeu (UAA) intron sequence as a genetic marker. Nested PCR was used to specifically amplify the tRNALeu (UAA) intron directly from the freshly isolated symbiotic cyanobionts. By direct amplification of the biological material the

laborious isolation of the cyanobionts can be avoided. A single DNA fragment, ranging in size from 287 hp to 329 hp, was consistently amplified from the different biological samples. The intron sequences obtained from the cycad cyanobionts show high similarities to the corresponding sequences in the free-living *Nostoc* sp. strain PCC 73102 and *N. muscorum* as well as in several lichen cyanobionts. Although different *Nostoc* strains were found in the present study, no sequence variation was observed when analyzing a single corraloid root. However, different coralloid roots from a single cycad individual may harbour different cyanobacteria. Moreover, cyanobionts in corraloid roots of both *Encephalartos lebomboensis* and *E. villosus* were found to possess the same intron sequence.]

First author' address: Dep. Physiological Botany, Uppsala University, Villavagen 6, S-752 36 Uppsala, Sweden.

DHIMAN, M., MOITRA, S., SINGH, M.N. & BHATNAGAR, S.P. 1998. **Formation of somatic embryos from leaf callus of *Zamia furfuracea* L.: A preliminary report.** *Phytomorphology* 48: 317–322.

[Segments of young leaves (petiolar and rachis portions) from adult plants of *Zamia furfuracea* were cultured on MS medium conatining different auxins (2,4-D, NAA) and cytokinins (BAP, Kn) alone or in combination. Auxins induced only callusing but both cytokinin and auxins initiated embryonic calles after 12 to 14 weeks. Proembryos developed which, on transfer to a hormone-free medium, yielded somatic embryos with suspensor. The number of cotyledons in the embryos varied from one to eight.]

First author's address: Miranda House, Univ. Delhi, Delhi 110 007, India.

JONES, K. 1998. **Robertsonian fusion and centric fission in karyotype evolution of higher plants.** *Botanical Review* 64(3): 273–289.

Robertsonian fusion and centric fission are uniquely detectable in comparative studies of karyotype patterns. They are the most important types of karyotype change in animals but seem to be relatively uncommon in higher plants. Both modify intra- and interchromosomal recombination and linkage relationships and consequently patterns of genetic variation. When differentiating populations or species they can produce postmating barriers to gene flow. The number of reported cases of fusion or fission in higher plants has increased over the years but remains low, and most of these are casual comparisons of karyotypes without any follow-up investigation. This review focuses on more adequate studies made in a few groups. Studies in the Tradescantieaeproduce the strongest evidence for fusion as a type of orthoselection in the subfamily. Some species of *Lycoris* are also considered to have evolved their karyotypes in that way. Some genera of slipper orchids and the cycad genus *Zamia* have populations where atypical chromosome number increase can be attributed to fission probably as a result of stressful influences. It is suggested that fusion may have been involved in the evolution of many stable karyotypes and that fission is generally a secondary destabilizing mechanism which may lead to refusion in the long term. Their proven incidence remains making it unwise to suggest that they have been major influences in karyotype evolution in higher plants.]

Author's address: Jodrell Lab., Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3DS, UK.

MAGGINI, F., MARROCCO, R., GELATI, M.T. & ILIO, D.R. 1998. **Lengths and nucleotide sequences of the internal spacers of nuclear ribosomal DNA in gymnosperms and pteridophytes.** *Plant Systematics and Evolution* 213(3–4): 199–205.

[The nucleotide sequences of the internal transcribed spacers (ITS1 and ITS2) of the nuclear ribosomal DNA were analyzed in species belonging to gymnosperms and pteridophytes. The lengths of the ITS's of sixteen species of gymnosperms and seven species of pteridophytes were estimated. The gymnosperms have ITS1 regions larger than those observed in the pteridophytes and angiosperms (ca. 610–3100 bp versus 159–360 bp). On the other hand, the ITS2 regions appear to be of a conserved length (182–370 bp). We have determined the complete nucleotide sequences of ITS regions from four gymnosperm species and five pteridophyte species by cloning the PCR products. Sequence analysis showed the presence of three short tandem arranged subrepeats of about 70 bp in the 1112 bp ITS1 of *Ephedra fragilis*. Pyrimidine rich (about 90% DNA segments of 40–50 bp were observed in the ITS1 of *Ginkgo biloba*. A highly conserved 16 bp long sequence known to be present in the ITS1 of the angiosperm species has been also found in the ITS1 of *Cycas revoluta, Taxus baccata* and *Ephedra fragilis*.]

First author's address: Dip. Agrobiol. Agrochim., Univ. della Tuscia, Via S. Camillo de Lellis, I-01100 Viterbo, Italy.

MARLER, T., & HIRSH, H. 1998. **Guam's *Cycas micronesia* populations ravaged by supertyphoon Paka.** *Hortscience* 33(7): 1116–1118.

[Abstract not available.]

First author's address: Coll. Agric. and Life Sci., Univ. Guam, UDG Station, Mangilao 96923, Guam.

MOUND, L.A., DEN HOLLANDER, E. & DEN HOLLANDER, L. 1998. **Do thrips help pollinate *Macrozamia* cycads?** *Victorian Entomologist* 28(5): 86–88.

[Large numbers of pollen carrying male as well as female thrips of a new species of the genus *Cycadothrips* was caught on sticky strips that were inserted between the female cone scales of *Macrozamia riedlei* in Western

Australia. Although these observations by no means prove that this thrips is involved in the pollination of *Macrozamia riedlei* it clearly suggests so especially because they are known to breed only in the male cones.]

First author's address: CSIRO Entomology, Canberra 2601, A.C.T., Australia.

RINALDI, L.M.R. 1999. **Factors affecting shoot regeneration from zygotic embryo and seedling explants of *Cycas revoluta* Thunb.** *In Vitro Cellular & Developmental Biology Plant* 35(1): 25–28.

[Adventitious shoot induction from zygotic embryo and seedling explants of *Cycas revoluta* was studied, with reference to both nitrogen formulation of the medium and light. The presence of nitrate as a sole source of nitrogen in Klimaszewska and Keller (KK) medium did not promote shoot inductione; on the other hand, shoot induction was promoted by the use of ammonia-containing media, i.e. Schenk and Hildebrandt (SH) and Murashige and Skoog (MS). In the case of zygotic embryos, the percentage of responding explants and the number of regenerating shoots were significantly higher on SH medium than on MS medium. With seedling explants, shoot induction was not affected by the use of SH medium versus MS medium. Photoperiod also influenced bud formation and development. The absence of light during shoot induction stimulated callus formation and very few differentiated shoots. Shoot induction from zygotic embryos was positively affected by the application of 4- and 8-wk photoperiod exposures, the combination SH medium/8-wk photoperiod exposure giving the best results in terms of shoot induction and development. Rooting of shoots was improved by their culture in medium containing NAA.]

Author's address: Instituto sulla Propagazione delle Specie Legnose, Consiglio Nazionale delle Ricerche (CNR), Via, Italy.

SHARMA I.K., JONES, D.L., FORSTER, P.I. & YOUNG, A.G. 1999. **Low isozymic differentiation among five species of the *Macrozamia heteromera* group (Zamiaceae).** *Biochemical Systematics and Ecology* 27(1): 67–77.

[Starch gel electrophoresis was employed to estimate the levels of generic variation among five entities of the *Macrozamia heteromera* (Zamiaceae) group which can be recognised on morphological grounds. A total of 168 specimens were assayed for 12 enzyme systems coded by 16 loci. Low levels of genetic variation were observed with 10 of the 17 loci (58%) being monomorphic. Mean per cent polymorphic loci (P = 26%), number of alleles per locus (A = 1.3) and expected heterozygosity (He = 0.06) were all low. Although notably morphologically different, the species are very similar genetically. The overall Gst value of 0.10 and the high genetic identity value of (range 0.92–0.97) suggest that these species are either recently evolved or they are depauperate in genetic variation due to inbreeding.]

First author's address: Cent. Plant Biodiversity Res., CSIRO, Div. Plant Ind., GPO Box 1600, Canberra, ACT 2601, Australia.

SCHUTZMAN, B. & VOVIDES, A.P. 1998. **A new *Zamia* (Zamiaceae, Cycadales) from eastern Chiapas, Mexico.** *Novon* 8(4): 441–446.

[*Zamia lacandona*, a member of the *Z. splendens* species group, is described from the Selva Lacandona of eastern Chiapas, Mexico. It is distinguished from *Zamia splendens* Schutzman by its usually single arcuate leaf with falcate leaflets, erect short-peduncled megasporangiate strobili, decumbent microstrobili, and chromosome number of 2n = 16, 17, or 18.]

First author's address: Dep. Environ. Horticulture, Univ. Florida, 1525 Fifield Hall, Gainesville, FL 32611-0670, U.S.A.

SOSA, V., VOVIDES, A.P. & CASTILLO-CAMPOS, G. 1998. **Monitoring endemic plant extinction in Veracruz, Mexico.** *Biodiversity and Conservation* 7(11): 1521–1527.

[We present species extinction information based directly on field work on six endemic vascular plants of Veracruz. Amongst 22 species that have been reported to consist of very few individuals for the State, seven of them are endemic to Veracruz. We looked for six of these species in previously recorded sites to determine if they are totally extinct. We determined the status of the extant species and their actual habitat and populations. The species studied included: *Antirhea aromatica, Diospyros riojae, Eugenia mozomboensis, Impatiens mexicana, Hyperbaena jalcomulcensis* and *Zamia inermis*. We located these in fragments of tropical and dry forests. Juvenile plants of the *Zamia* and *Eugenia* were not seen in the field.]

First author's address: Instituto de Ecologia, AC, 91000, Xalapa, Ver., Mexico.

WU, L.S.H., HONG, G.H.H., HOU, R.F. & TZEN, J.T. 1999. **Classification of the single oleosin isoform and characterization of seed oil bodies in gymnosperms.** *Plant and Cell Physiology* 40(3): 326–334.

[Oleosins are hydrophobic proteins abundantly present in the oil bodies of plant seeds. Two immunologically distinct oleosins are present in seed oil bodies of diverse angiosperms, and classified as high and low Mr isoforms according to their relative molecular masses in each species. Only one putative oleosin was found in seed oil bodies of three representative gymnosperm species, *Pinus koraiensis, Ginkgo biloba*, and *Cycas revoluta*. The three gymnosperm oleosins were restricted to oil bodies, as detected on immuno-assaying. Immunological cross-recognition using antibodies against the three putative gymnosperm oleosins and those against the two (high and low Mr) rice oleosin

isoforms suggests that the single oleosin of pine or ginkgo is immunologically related to the low Mr isoform of angiosperms, while the single cycad oleosin is immunologically distinct from both low and high Mr isoforms of angiosperms. Oil bodies were found in embryos and megagametophytes of these three species, as observed on electron microscopy. Seed oil bodies purified from these three gymnosperms maintained theri integrity via electronegative repulsion and steric hindrance on the surface of the organelles. The composition of the three essential constituents (neutral lipid, phospholipid and protein) in seed oil bodies from these three species were determined and compared with those calculated from the oil body model proposed in angiosperms. The results suggested that seed oil bodies of gymnosperms and angiosperms possess similar surface properties and structural organization.]

First author's address: Graduate Institute of Agricultural Biotechnology, National Chung-Hsing University, Taichung, Taiwan.

YASUDA, N. & SHIMUZU, T. 1998. **Cycad poisoning in cattle in Japan. Studies on spontaneous and experimental cases.** *Journal of Toxicological Sciences* 23 (Suppl. 2): 126–128.

[Abstract not available.]

First author's address: Lab. Veterinary Pathology, Faculty Agriculture, Kagoshima Univ., 1-21-24 Korimoto, Kagoshima 890, Japan.

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MAGAZINE CLIPPING / TYDSKRIFUITKNIPSEL

Oryx Volume 32 Number 2 April 1998

Cycad success

Several nurseries set up during the 1990s for the conservation, propagation and sustainable management of Mexican cycads have been successful at producing plants and are now in need of marketing assistance to find or create regular outlets for sales and export. Many Mexican cycads are threatened by habitat destruction and illegal extraction from the field, and the nurseries were established to enable 'peasant' farmers to conserve the habitats as sources for seed and gain the additional benefit of selling the artificially propagated plants. Experimental reintroductions