

ENCEPHALARTOS

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SOUTH AFRICA

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COVER / VOORBLAD : Leaf vernation in *Encephalartos ngoyanus*

The photograph shows the way in which the leaflets of emerging leaves of *Encephalartos ngoyanus* are recurved. This *revolute* arrangement is unusual in the cycads, as in most species (especially conspicuous in *Cycas*) the leaflets are curved inwards (*involute* or even *circinate*). Has anyone noticed a similar arrangement in other cycad species in which the leaflets of the emerging leaves are coiled back like this?

Photo: Piet Vorster

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**This issue of "Encephalartos" is dedicated to Roy Osborne, founder of
"The Cycad Society of South Africa"
(See communication on page 18)**

**Hierdie uitgawe van "Encephalartos" word opgedra aan Roy Osborne, stigter van
"Die Broodboom Vereniging van Suid-Afrika"
(Kyk mededeling op bladsy 18)**

FROM THE PRESIDENT

Suggestions for the improvement of the Society in the letter's columns of "Encephalartos" elicited various favourable responses. Among others, a regional branch called the Northern Province Cycad Working Group was recently established under the chairmanship of Dr Gerrie de Haas. The founder meeting in Pietersburg was attended by 32 cycad enthusiasts from far and near.

This Working group hopes to work more closely with the Department of Nature Conservation. They realise that a lack of funding and manpower is hampering the activities of Nature Conservation. Therefore, the Working Group would like to assist Nature Conservation with the relocation of cycad populations to their natural habitat. They also endeavour to clarify, improve and standardise the relevant legislation.

The group realises that many of the endangered species occur in their region and that the main responsibility for conserving and increasing the number of rare plants rests on their shoulders. Consequently, they would like to collect pollen systematically and distribute it so that the propagation process can be managed in the most favourable way.

It is the declared policy of the Northern Province Cycad Working Group to make an impact on the development of knowledge about cycads. More specifically, they would like to do research on the DNA of each plant group in their environment, in conjunction with university researchers. With this knowledge, it would be possible to establish the origin of every plant and to use plants with the right DNA when relocating.

The group also intends to organise trips for its members and to invite other branches to participate. In fact, this group intends to organise an annual meeting of representatives of the various branches, so that the people could get to know each other better, exchange ideas, address community problems and develop strategies. It is self-evident that personal contact has advantages over electronic contact or contact through correspondence.

Congratulations to the Northern Province Cycad Working Group on their commendable objectives.

For further information about the Working Group, Please contact Dr Gerrie de Haas at the following numbers: (015) 2972180 (w) or (015) 2954021 (h).

Frederick de Jager

VAN DIE PRESIDENT

Voorstelle vir die verbetering van die Vereniging in die briewekolomme van "Encephalartos" het verskeie gunstige reaksies uitgelok. Onder andere is 'n streektak genaamd die Noordelike Provinsie Broodboom Werkgroep onder voorsitterskap van dr Gerrie de Haas onlangs gestig. Twee-en-dertig broodboomgeesdriftiges het van heinde en verre by die stigtingsvergadering op Pietersburg opgedaag.

Die Werkgroep beoog om nouer met die Departement Natuurbewaring saam te werk. Hulle besef dat 'n gebrek aan fondse en mannekrag Natuurbewaring se werksaamhede kortwiek. Daarom wil die Werkgroep Natuurbewaring graag behulpsaam wees met die hervestiging van broodboombevolkings in hulle natuurlike habitat. Hulle wil hulle ook vir die verheldering, verbetering en standaardisering van toepaslike wetgewing beywer.

Die groep besef dat 'n hele aantal van die mees bedreigde spesies in hulle gebied voorkom en dat die hoofverantwoordelikheid vir die bewaring en vermeerdering van die skaars plante op hulle skouers rus. Gevolglik wil hulle planmatig stuifmeel versamel en so versprei dat die voortplantingsproses op sy gunstigste bestuur word.

Dit is die verklaarde beleid van die Noordelike Provinsie Broodboom Werkgroep om 'n impak op die ontwikkeling van kennis oor broodbome te maak. Meer bepaald wil hulle in samewerking met universitêre navorsers oor die DNS van elke plantgroep in hulle omgewing navorsing doen. Met die kennis sou dit moontlik wees om die oorsprong van elke plant te bepaal en by terugplasing plante met die regte DNS te gebruik.

Die groep is verder van voorneme om uitstappies vir sy lede te reël en om ander takke uit te nooi om daaraan deel te neem. Om die waarheid te sê beoog die groep om 'n jaarlikse byeenkoms van afgevaardigdes van die verskillende takke te bewerkstellig. Daar kan mense mekaar beter leer ken, gedagtes wissel, gemeenskaplike probleme aanspreek en strategieë ontwikkel. Dit spreek vanself dat persoonlike kontak voordele bo elektroniese kontak of kontak deur briewewisseling inhou.

Geluk aan die Noordelike Provinsie Broodboom Werkgroep met hul lofwaardige doelstellings.

Indien u verdere inligting oor die Werkgroep verlang kan u gerus dr Gerrie de Haas by die volgende nommers skakel: (015) 2972180 (w) of (015) 2954021 (h).

Frederik de Jager

FOCUS ON ...

FOKUS OP ...

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

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

LEPIDOZAMIA PEROFFSKYANA Regel

Roy Osborne

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

INTRODUCTION

One of the problems in trying to promote cycads horticulturally is that so many of them have quite vicious leaflet and/or petiole prickles of various kinds. "Useful for security outside your bedroom window" doesn't seem to work well as a sales spiel for *Encephalartos natalensis* in placid Queensland. But the demand for a softer, non-prickly cycad is easily met by *Lepidozamia peroffskyana*, a most rewarding and versatile Australian native cycad which is being used more and more in various horticultural applications both nationally and internationally. Of the various "Focus on ..." articles, only two native Australian species have been featured to

date, viz. *Macrozamia lucida* (December 1998) and *M. moorei* (March 1997). This article then introduces our readers to another Australian cycad, another genus, and a really important horticultural subject.

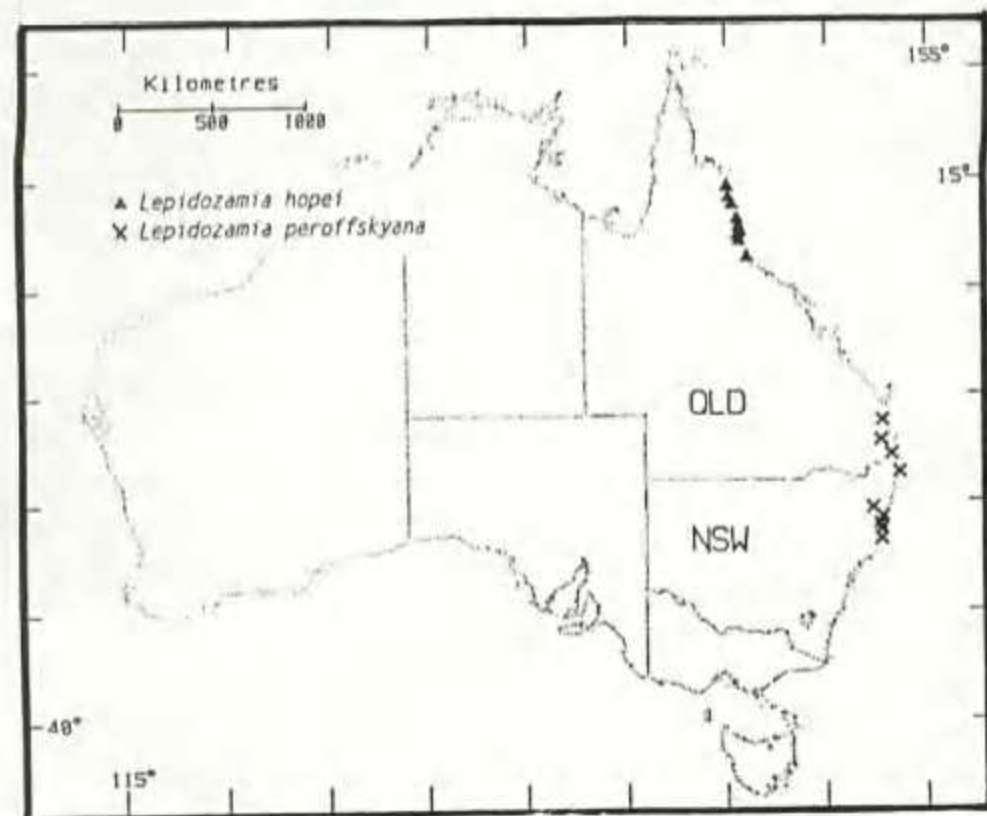


Figure 1 Distribution of *Lepidozamia* in Australia. *L. hopei* is a tropical species from north-eastern Queensland while *L. peroffskyana* is more subtropical, occurring in south-eastern Queensland and north-eastern New South Wales. From Hill, 1995.



Figure 2 *Lepidozamia peroffskyana* with *Cyathea* ferns under eucalypts on the slopes of the Middle Brother, about 40 km south of Port Macquarie, New South Wales, and towards the southern end of the distribution range. Photo: Greg Croom.

DISCOVERY

Long before its botanical description, *Lepidozamia peroffskyana* had been collected in Australia and distributed to private and public gardens in Europe. One such plant reached the St. Petersburg Botanical Garden in Russia and attracted the attention of renowned Russian botanist, Eduard August von Regel. Curiously, Regel was led to believe that the specimen came from Mexico, and he took pains to compare this new find with other "Mexican" cycads. In 1857 he coined the genus name *Lepidozamia*, deriving this from the Greek word "lepidos" or "lepis" for scale, and in



Figure 3 *Lepidozamia peroffskyana* under eucalypts on the steep slopes of Mount Glorious, outside Brisbane, towards the north of the distribution range for the species.

recognition of this plant being (distantly) related to the American genus *Zamia*. Indeed *Lepidozamia* is sometimes called "The Scaly *Zamia*" in reference to the very prominent and persistent scaly leaf bases that are a feature of their trunks. Regel added the species name to recognise the support of Count Peroff, Governor of Orenburg Province in the 1840's and an enthusiastic patron of the St. Petersburg Garden. The official description for *Lepidozamia peroffskyana* was presented in the *Bulletin de la Société Impériale des Naturalistes de Moscou* in 1857 and later that same year in the magazine *Gartenflora*.

The genus *Lepidozamia* comprises four species, two are living (*L. peroffskyana* and *L. hopei*) while two are known only as fossils from south-eastern Australia (*L. hopeites* and *L. foveolata*).

Like many of the cycads described in the mid 1800's, *Lepidozamia peroffskyana* has been referred to under a number of different names, most of which signify incorrect relationships. In the literature over the period 1850–1950, one finds references to this species under the names of *Macrozamia denisonii*, *Encephalartos denisonii*, *Macrozamia peroffskyana*, *Macrozamia peroffkyana*, *Macrozamia perowskiana*, *Lepidozamia denisonii* and

Katakidozamia (or *Catakidozamia*) *macleayi*. Strangely, it was not until Johnson's 1959 publication that the generic status for *Lepidozamia* was unambiguously accepted.

DISTRIBUTION AND ECOLOGY

Lepidozamia peroffskyana is scattered in a number of quite widely-separated small and large populations in wet coastal sclerophyll forests or along rainforest margins. The species is distributed from subtropical zones just north of Brisbane in south-eastern Queensland (near Gympie) through to the warm temperate area of the Manning River district in New South Wales (near Taree), a north-south belt about 800 km long (Figure 1). Populations are found from sea-level to altitudes of 1000 m. Rainfall is mainly during summer in the northern part of the plants' range but during both summer and autumn in the southern parts; it averages about 1500 mm annually. Plants commonly grow on slightly acidic humus-rich steeply-sloping ground, especially in the north, but also occurs on deep sandy soils quite near the coast in the south. Like so many of the Australian cycads, this species often grows as understorey to various *Eucalyptus* species but may also occur in association with



Figure 4 The author surrounded by *Lepidozamia* plants on the D'Aguilar Range, just north-west of Brisbane. Photo: Chris Osborne.



Figure 5 "Lepidozamia Grove", part of a national park on Mount Tambourine, on the Gold Coast hinterland, where the species is abundant.

grasstrees (*Xanthorrhoea* spp.), treeferns (*Cyathea* spp.) (Figure 2) and bangalow palms (*Archontophoenix cunninghamiana*). Particular sites where the plants are easily seen are in the Mount Glorious (Figure 3) and D'Aguilar Ranges (Figure 4) just outside Brisbane, on Mount Tambourine (Figure 5) and in the Lamington

National Park of the Gold Coast hinterland, on the Middle Brother Range (Figure 2) in northern New South Wales and especially at the Bruxner Park summit look-out near Coff's Harbour in that province.



Figure 6 Branching occurs in some stands of *Lepidozamia peroffskyana* although it is not common. The charring on the trunk of this specimen is the result of a fire during the previous winter. Photo: Paul Kennedy.

Cultivated specimens are plentiful in public landscapes and in private gardens. In Australia, specimens can be seen at botanic gardens in Brisbane, Townsville, Rockhampton, Sydney, Adelaide, Canberra and Perth. In Europe, specimens are cultivated at Kew, Edinburgh, and Dublin (United Kingdom); Naples (Italy); Amsterdam (Holland); Meise (Belgium); Porto (Portugal); and even in Turku (Finland). In the USA, this species is present at Lotusland Foundation, Fairchild Tropical Gardens, Montgomery Botanical Center, Huntington Botanical Gardens, Los Angeles Arboretum and San Diego Zoo. In southern Africa, plants are growing in the Durban Botanic Gardens and at Ewanrigg in Zimbabwe. In the east, the gardens at Bogor (Indonesia) have specimens.

Fires occur naturally in National Parks and some other areas where populations of this species are found, but



Figure 7 *Lepidozamia peroffskyana* performing well in a shaded section of a Pretoria garden.

not throughout the distribution. Within the State Forests, controlled burning practices affect some *Lepidozamia* populations. The fires appear temporarily to remove competitive vegetation without adversely affecting the cycads and it may be that these fire events stimulate coning.

The use of seeds of *Lepidozamia hopei* by the aboriginal people of northern Queensland is fairly well known, but little information is available on any similar exploitation of its sister species. It would be surprising, however, if *L. peroffskyana* seeds were not regarded at least as an emergency foodstuff - after appropriate detoxification processes.

DESCRIPTION

1. STEM

Lepidozamia peroffskyana is an arborescent cycad typically with an erect trunk up to about 4 m in height and 40–50 cm in diameter. With age and appropriate conditions, trunks can reach 7 m in height and 80 cm in diameter. The trunk is reinforced by closely-packed

ranks of scale-like leaf bases, left from all previous leaves, which form a characteristic pattern captured in the *Lepidozamia* genus name. In most stands the trunks are generally unbranched but there are some sites where branching is not uncommon (Figure 6).

The sometime mentioned figure of 7 m height for these plants has led to some imaginative calculations involving poorly-estimated growth rates, and has resulted in pronouncements that taller plants are up to 10 000 years old - claims which found their way into tourist centres and the popular press in the mid 1950's and which are still heard occasionally to the present day. More critical calculations would lead to the conservative view that the large trunks of these plants could not be more than about 500 years old (although it must be conceded that rootstocks could have supported prior stems).

2. LEAVES AND LEAFLETS

Given particularly good conditions, mature garden-grown specimens of this species can produce up to 25 leaves in any flush and at least two flushes will be present on any plant at the same time. In the wild, light, water and nutritional factors may be limiting and slower growth



Figure 8 Leaves of *Lepidozamia* emerge without any coiling and with the two rows of leaflets tightly packed against each other along the rachis. Photo: Paul Kennedy.



Figure 9 The foliage of *Lepidozamia peroffskyana*, unlike that of most cycads, is entirely without prickles of any kind.

rates are more common.

Leaves are 2–3 m long, dark glossy green and gently arching (Figure 7). The juvenile leaves emerge without any circinate coiling (Figure 8) and with the leaflets

tightly overlapping along the rachis. The emergent foliage has an attractive bronze colour that can be retained for several months.

The petiole is 30–60 cm long and the straight rachis bears 150–250 pairs of leaflets that are evenly-distributed and inserted near the uppermost part of the rachis. (This is one character which distinguishes the genus from *Macrozamia*, where the leaflets are inserted more-or-less horizontally on opposite sides of the rachis). Leaflets are falcate in shape, tapering to an acute apex, flexible, recurved and decurrent at the base, 20–40 cm long by 5–13 mm wide, with 7–13 parallel veins best seen from the lower surface. Unlike the situation in *Macrozamia*, there are no teeth on the leaflet margins (Figure 9) nor is there any prominent basal callus to the leaflets (although there may be a slight yellow colouration at the point of attachment).

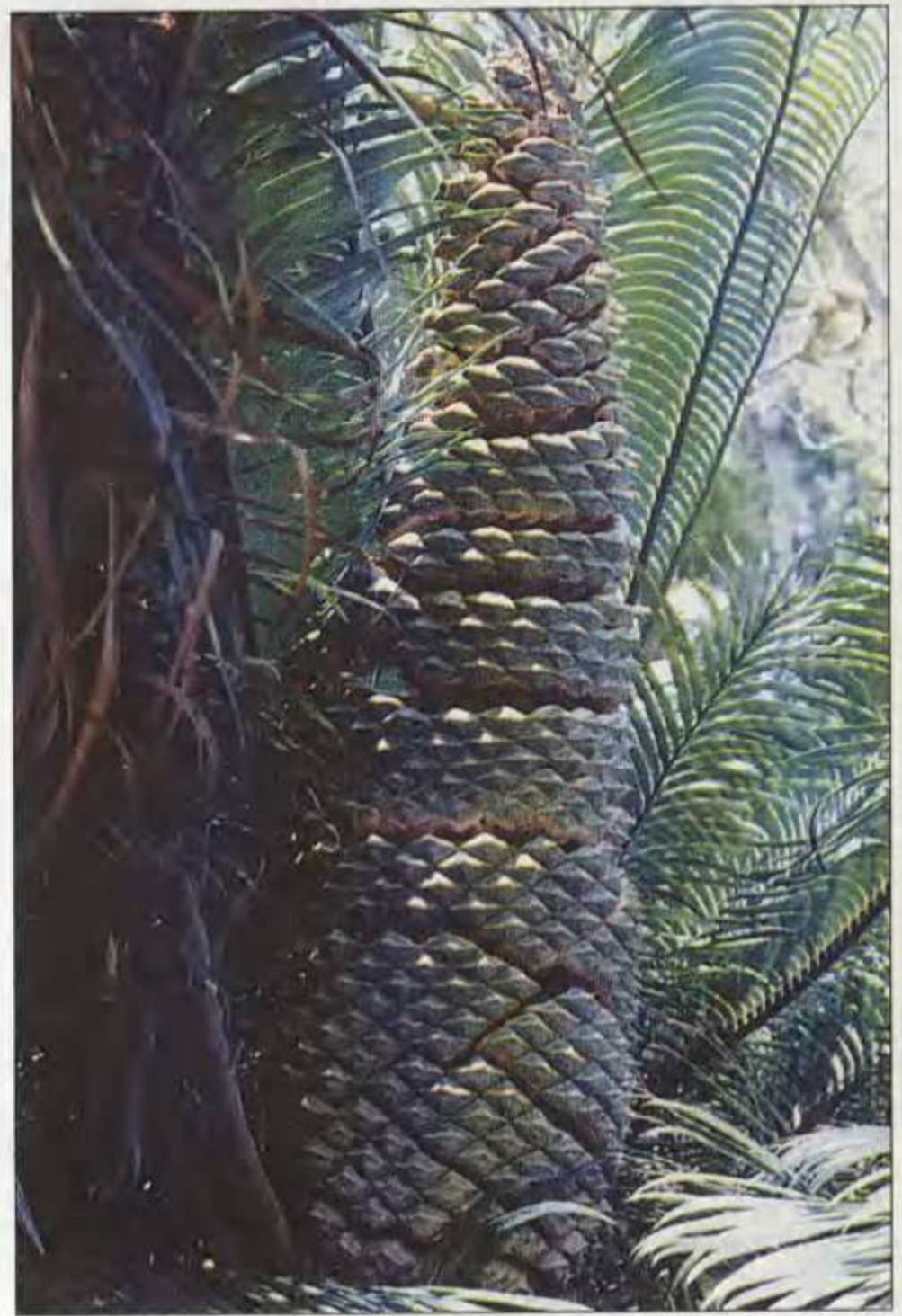


Figure 10 The male cone of *Lepidozamia peroffskyana* is an impressive structure, opening along a prominent spiral fissure at the time of pollen release. Photo: Paul Kennedy.

3. REPRODUCTIVE STRUCTURES

Male cones, usually borne singly, are 45–75 cm long by 12–19 cm in diameter and borne on only a short



Figure 11 Female *Lepidozamia peroffskyana* bear cones which are amongst the largest in the plant kingdom. Photo: Paul Kennedy.



Figure 12 *Lepidozamia peroffskyana* female cones break up at the end of winter to drop their large seeds with attractive red seed coats. Photo: Will Kraa.

stubby stalk. At the time of pollen shedding, the cone axis extends so that the microsporophylls are separated along a remarkable and characteristic spiral fissure running from top to bottom of the structure (Figure 10). Microsporophylls are wedge-shaped, up to 50 mm long

by 30 mm wide and without any apical protrusion on the facets.

Female cones, usually borne singly but occasionally as "doubles", and also on only a short stalk, are typically 40–90 cm long and 12–25 cm in diameter and produce some 200 seeds. Large cones on old plants may attain a metre in length and weigh as much as 40 kg, which ranks the female cones of this species as one of the largest of all cone-producing plants (Figure 11). Megasporophylls are 5–7 cm long by 4–8 cm wide, also without any apical spine on the facets. The megasporophylls separate only slightly at the time of receptivity to pollination. Although each megasporophyll usually has the conventional two ovules and two seeds, one-seeded and three-seeded sporophylls are sometimes found.

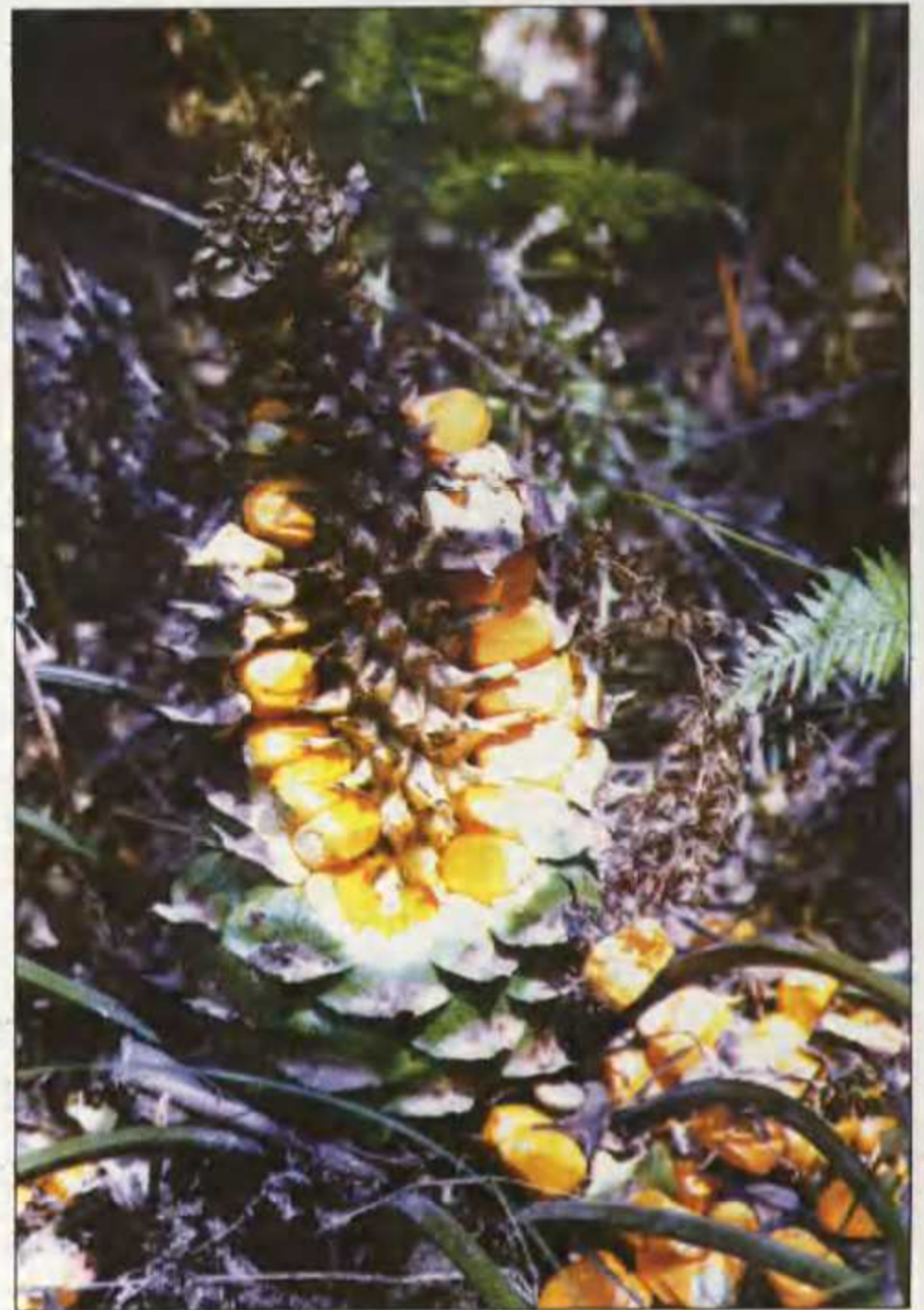


Figure 13 Occasionally, stands of *Lepidozamia peroffskyana* have some plants which produce yellow-seeded cones. Photo: Paul Kennedy.

Seeds are 40–60 mm long by 25–30 mm in diameter with a deep red colouration to the sarcotesta (Figure 12). Curiously, there are occasional stands of this species that have some plants which produce bright yellow seeds (Figure 13) - a phenomenon also seen in



Figure 14 Male cones of *Lepidozamia peroffskyana* are often the home of swarms of a *Tranes* weevil which is thought to be a specific pollinator of these plants. Photo: Paul Kennedy.

several species of *Macrozamia* and some other cycads.

Large numbers of *Tranes* sp. weevil are sometimes seen in *Lepidozamia peroffskyana* male cones (Figure 14) in habitat; these insects use the microsporophylls as breeding chambers (Kennedy 1991). This insect is almost certainly a species-specific pollinator to its host cycad. It is closely related to the *Tranes lyterioides* group which is implicated in *Macrozamia* reproduction.

It is reasonable to predict that the fleshy portion of *Lepidozamia peroffskyana* seeds would be attractive to large birds, small mammals, marsupials and fruit-eating bats, all of which may contribute to seed dispersal. Paul Kennedy believes that possums are the main dispersal agents as they carry the seed some distance from the plant before eating the flesh and discarding the core. Kangaroos also eat the seed flesh but do so in the vicinity of the plant. Rats take the seeds but eat the internal portion as well as the sarcotesta.

AFFINITIES

Lepidozamia peroffskyana is most closely related to its single sister species, *L. hopei*, from north-eastern Queensland. It is easily distinguished from the latter species by its narrower leaflets with fewer veins and by its smaller overall stature. The genus *Lepidozamia* itself is considered to be closely related to *Macrozamia*; these two genera in turn are thought to have an association with *Encephalartos* and *Dioon*.

CONSERVATION AND CULTIVATION

Although many plants have been removed, both legally and illegally, from habitat sources, *Lepidozamia peroffskyana* occurs in such numbers that this has not posed a real threat and the species is not considered to be at risk. Thus, in the IUCN classification it is coded as LR,lc and, in common with all Australian cycads, placed in CITES Appendix 2. In terms of the Queensland Nature Conservation legislation it is listed as a "common" protected species.

Cultivation of this species is almost always from seed since branching is very rare and suckers do not occur in these plants. As with many cycads, seeds fall from their cones in the southern Hemisphere at the end of winter but conventionally require a few months for maturation (during which the embryo slowly develops) before germination can be initiated. Seedlings are slow in leaf production for the first year or two but then accelerate as the plants age. Plants prefer a slightly acidic humus-rich medium and light shade, consistent with their habitat environment. In humid subtropical areas, plants grow successfully in full sun (and in fact produce more leaves in full sun). Given good drainage and moderate attention to watering and feeding, both species of *Lepidozamia* are fast-growing plants compared to other cycads. This species can tolerate temperatures down to -6°C without undue damage.

Apart from being a very attractive garden feature plant, *Lepidozamia peroffskyana* does very well as a container specimen requiring only limited maintenance - plants can be brought to cone within 8-10 years in large containers. Smaller plants can be used decoratively indoors but should be placed outside when a "new" foliage flush is produced (to avoid "stretching"). Indoor plants of this cycad are prone to scale insect infestations that need attention.

A minor problem in larger and outdoor specimens is that of the trunk-boring pests *Melanotrane internatus* and *Demysus meleoides* which predate *Lepidozamia peroffskyana* and several *Macrozamia*

species. Oberprieler (pers. comm.) believes that target plants for these infestations are usually plants stressed by fire, light, nutritional or water problems and that "normal" plants have an inherent resistance to such attack.

ACKNOWLEDGEMENTS

I am grateful to Ken Hill, Pau! Kennedy, Will Kraa, Rolf Oberprieler and Lou Randall for their kind assistance in the preparation of this article. Photographs are by the author unless otherwise acknowledged.

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ARTICLE / ARTIKEL

WHAT DOES *ENCEPHALARTOS ITURIENSIS* REALLY LOOK LIKE?

Piet Vorster¹ and Roy E. Gereau²

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Received 29 March 1999

INTRODUCTION

While conducting fieldwork in Zaire, one of us (Roy Gereau) collected and photographed material of *Encephalartos* (Figure 1). Although these plants occurred within the known distribution area of *Encephalartos ituriensis*, they differed so much from the description of *E. ituriensis* that they were thought to represent a different species, and material was sent to Piet Vorster for a second opinion.

The original description of *Encephalartos ituriensis* (Bamps & Lisowski 1990) was fairly detailed, but some of the data were ambiguous or incomplete. The most obvious difference between the description of *E. ituriensis* and the plants Roy Gereau observed concerns the size of the female cone (200 x 120 mm according to Bamps & Lisowski, but 550 x 200 mm in our plants). Ambiguous information concerns the surface sculpture of the exposed faces of the sporophylls (Bamps & Lisowski's Figure 1 shows tubercled scale faces, our



Figure 1 *Encephalartos ituriensis*, as encountered during fieldwork in Zaire. Photo: R.E. Gereau.

material had smooth faces); while lacking information concerns the colour of male and female cones, the



Figure 2 *Encephalartos ituriensis*: plant in habitat. Photo: R.E. Gereau.

presence or absence of a petiole to the leaf, indumentum of the cones, texture of the leaflets, and distribution of teeth on the leaflets; all considered diagnostic by Vorster (1990; and *in press*). Bamps & Lisowski (1990) supplied no illustrations of any part of the leaf, except for a line drawing of a seedling plant with two leaves.

The type material as well as the additional specimens cited by Bamps & Lisowski (1990), all come from near Nduye. The plants seen by us (Gereau *et al.* 5413) come from near Nzaro, which is close enough to Nduye. This does not mean that more than one species cannot grow close together; because in South Africa such centres of diversity are known from areas like the Eastern Cape Province, KwaZulu-Natal, Mpumalanga, and the Northern Province, where as many as eleven good species may occur almost within sight of each other (Robbertse *et al.* 1988; Vorster 1993, 1996; Vorster *personal observations*).

Heibloem (1998: 32) stated that plants from Bunia, in the same general area as *E. ituriensis*, represent an undescribed species. It is not clear from his text and illustrations of these plants how they differ from *E. ituriensis*: their leaflets appear to be more spiny, and are said to be wider, but this does not necessarily mean that



Figure 3 *Encephalartos ituriensis*: plant in habitat, showing well-developed reclining stem. Photo: R.E. Gereau.

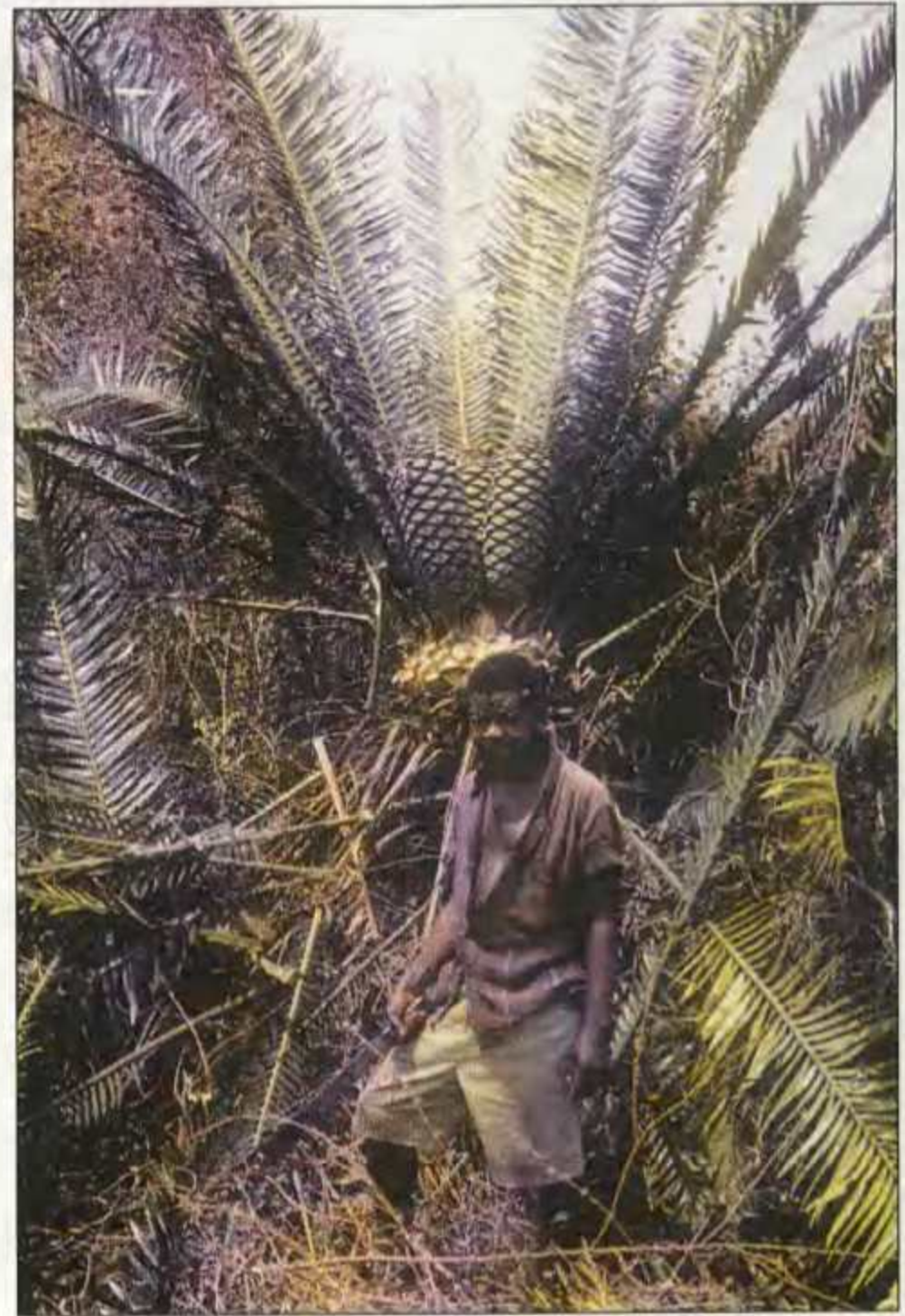


Figure 4 *Encephalartos ituriensis*: plant in habitat, with a local citizen to provide scale. Photo: R.E. Gereau.

these plants are a different species.

After due consideration of the original description, allowing for information lacking in that description; and herbarium material and photographs of Gereau *et al.* 5413 in the Herbarium of the Missouri Botanical Garden (MO) and the National Herbarium in Pretoria (PRE),

and Lisowski 41057 in the Herbarium of the National Botanical Garden in Brussels (BR), we concluded that there is insufficient evidence that Gereau *et al.* 5413 represents a species different from *E. ituriensis*. We consider that the markedly small female cones reported for *E. ituriensis* by Bamps & Lisowski (1990) were either depauperate, or not fully developed. It seems to us that Bamps & Lisowski's description is both deficient and misleading, and accordingly we supply the following amplified description.



Figure 5 *Encephalartos ituriensis*: the crown of a plant, with some leaves removed, to show how the proximal leaflets are reduced to a series of prickles.

DESCRIPTION

The plants are large, palm-like with well-developed trunks (Figures 1–4), and sometimes suckering from the base. The stems are up to 6 m long and 400 to 500 mm thick, usually procumbent when more than 2 m long with only the apical portion being erect (Figures 1, 3). The apex lacks shaggy hairs (Figure 5), but the cataphylls and leaf bases are covered in a tawny felt-like hair coat. There are numerous leaves which are straight, dark glossy green, 2 to 3 m long, without a leaf stalk. There are about 80 pairs of leaflets which are gradually reduced to a series of prickles towards the base of the leaf (Figures 5, 8a). The median leaflets are orientated at an



Figure 6 *Encephalartos ituriensis*: mature female cones *in situ*. Photo: R.E. Gereau.

angle of about 60° with the rachis, pointing towards the apex of the leaf, and opposing leaflets are set at an angle of slightly less than 180° towards each other. In shape the median leaflets are very narrowly ovate and tapering to acute but not sharp-pointed apices, and not or only slightly curved (Figure 8b). On each margin are 3 to 9 teeth distributed along the entire margin, but with about three teeth crowded near the base of the upper margin. The leaflets are not or only slightly overlapping, somewhat soft-textured, and 190 to 300 mm long by 20 to 30 mm wide (excluding teeth). We haven't seen male cones, but according to Bamps & Lisowski (1990) they are narrowly ellipsoid, borne on a stout peduncle of up to 160 mm long and 18 mm thick, hairless, and [in dried state?] 260 mm long by 70 mm across. The exposed faces of the male cone are moderately raised and slightly drooping at maturity. The colour wasn't mentioned, but we presume that it is initially glaucous green and turning yellow-green at maturity, like the female cones. Up to 4 female cones are borne by each stem (Figure 6). At maturity these are ovoid-cylindrical, shortly stalked with a stalk about 100 mm long, initially glaucous-green but turning yellow-green at maturity, hairless, and about 550 mm long and 200 mm across (Figure 7). The exposed scale faces are somewhat raised in the shape of



Figure 7 *Encephalartos ituriensis*: a female cone removed to prepare herbarium specimens. Sorry, no seeds were saved for the seed bank.

pyramids, with smooth facets except for the margins which are tubercled (Figures 8c, 8d). The seed (Figures 8e, 8f) has a red sarcotesta, and the kernel is 36 to 38 mm long by 21 to 28 mm across. [Figures 1–8].

ARE THE PLANTS ALL SIMILAR?

Probably not. The plants from Nzaro are in all respects larger and more luxuriant than those at Nduye. Their leaves at the two localities are about equal in length, but at Nzaro the median leaflets are about 300 mm long compared to 190–250 mm at Nduye. The apices of the leaflets at Nzaro are noticeably more acute than at Nduye (*cf.* Lisowski 41057, 2nd sheet, BR). The female cones are much larger at Nzaro than at Nduye, but in view of a personal communication from Mr. Douglas

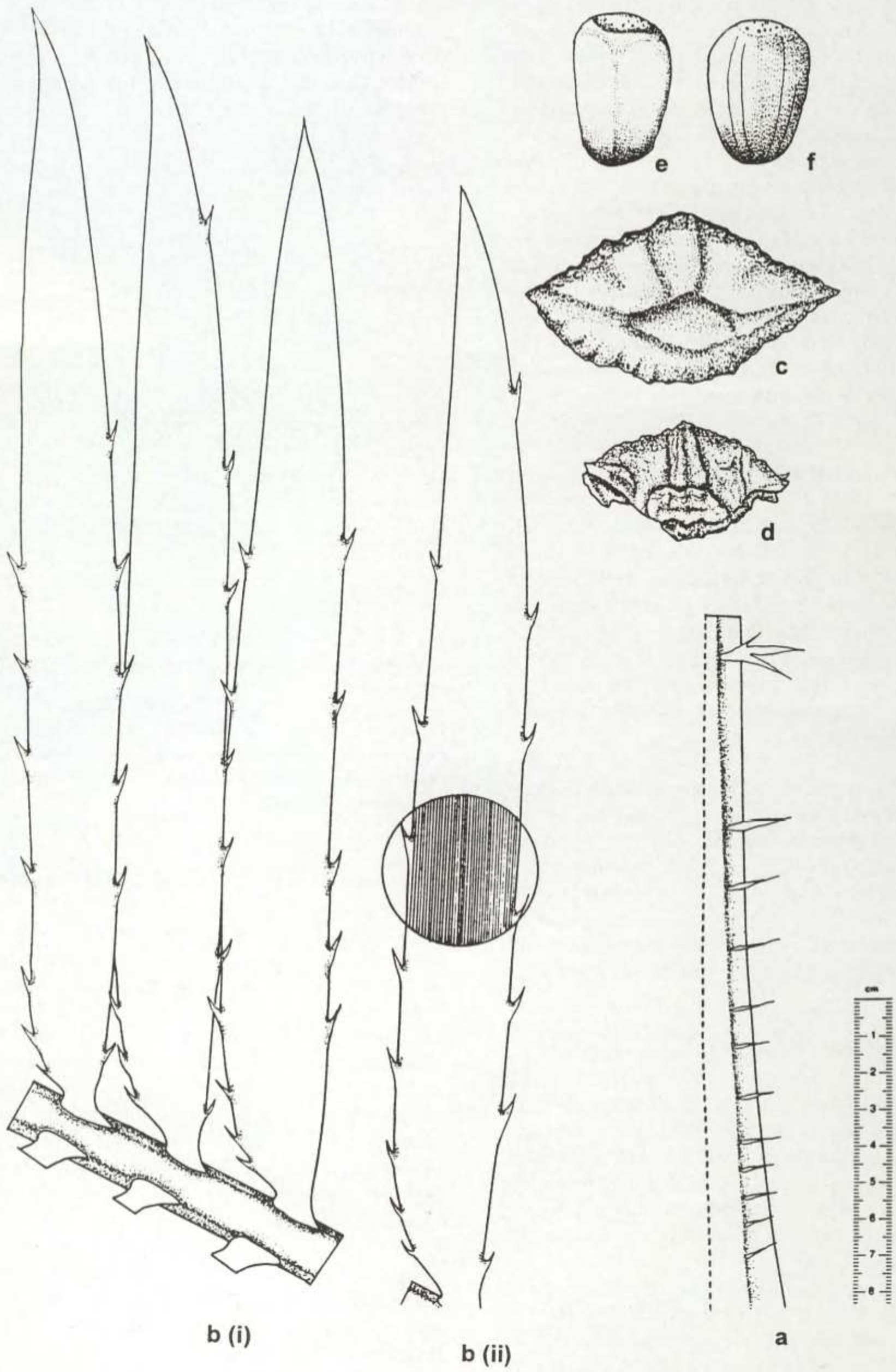
Goode, author of Goode (1989), about the size of cones of a garden plant (see below under *Additional information*), we suspect that the cones seen by Bamps & Lisowski were immature. Goode (1989) reported the number of female cones as 1 to 2, whereas at Nzaro 3 to 4 per plant were noted. These differences are striking, but in our opinion insufficient to award separate taxonomic status to the two populations. While it is premature to express an opinion, further research may well prove that the plants from Bunya reported by Heibloem (1998), represent yet another variant of *E. ituriensis*.

ADDITIONAL INFORMATION

Douglas Goode's book (1989: 228–231) contains



Figure 8 *Encephalartos ituriensis*: a, basal part of rachis showing leaflets reduced to a series of prickles; b, median leaflets in (i) adaxial and (ii) abaxial view; c, exposed face of fresh female sporophyll, showing well-defined and smooth facets; d, exposed face of dried female sporophyll, presenting a tuberculate aspect; e, seed with sarcotesta intact; f, seed with sarcotesta removed. Scale bar = 10 cm. All from Gereau, Esuljanji, & Arubeni 5413. Del. E.C. Vorster.



beautiful and detailed colour plates from watercolour paintings, of the whole plant, leaflets, cones and sporophylls. We have not taken these into consideration for the present account because the precise provenance of the material used, could not be established. Douglas told Piet Vorster that his illustration was based on a photograph of a cultivated plant growing on the shore of Lake Kivu, and claimed to be from the Ituri Forest. The cones were received from a collector in Zimbabwe, but without collecting data. His description was largely taken over from Bamps & Lisowski (1990) (the author probably had seen Bamps & Lisowski's manuscript before its publication), but with noteworthy additions such as the number of cones and colour of the cones. Other problems with Goode (1989) are that no scale of magnification is provided for the illustrations of the leaflets, and the dimensions of 200 x 120 mm for the female cone (taken over from Bamps & Lisowski 1990) is obviously not correct in view of the relative size of the stem and leaves attached. In fact, Goode told us that the cones were about 600 mm long.

SEASONAL BEHAVIOUR

At near-equatorial locations such as those where *E. ituriensis* has been recorded, one would not expect a marked seasonality in growth behaviour, and it seems likely that cones are produced throughout the year. On the other hand, it is possible that growth is regulated by the seasonal rainfall (see below). The following is a list of coning material (we presume all the Lisowski specimens have been preserved in either/or BR and POZG):

Male cone (maturity unknown) (Lisowski 42234): April
 Male cone (Lisowski 45310): date not stated
 Female cone (immature?) (Lisowski 42909): April
 Female cone (Lisowski 42938): date not stated
 Female cone (Gereau *et al.* 5413): 3rd March

From this scant information it can only be deduced that mature cones can be expected in March and April.

GEOGRAPHICAL DISTRIBUTION AND HABITAT

Encephalartos ituriensis is known with certainty only from the Ituri Forest in Zaire, from five localities strung out in an arch over a distance of some 160 km, from near Nzaro south-eastwards to near Nyankunde, in the region 1–2°N/28–30°E. For conservation considerations we do not publicise the localities in greater detail. (Figure 9).

The plants occur in association with evergreen equatorial rain forest, at an elevation of 1100 to 1200 m. Hart *et al.* (1996: 547) reported the average rainfall at Epulu, which probably applies to the area as a whole, to be 1700 mm with annual totals varying between 1300 and

2800 mm. Rainfall is seasonal with a single well-demarcated rainy season from January to March during which the precipitation may vary between 80 and 360 mm per month. The plants grow on exposed granite domes emerging from the equatorial forest, under very well-drained conditions, more or less fully exposed (Figures 1–4). At one locality they grow in a rather open savanna-like vegetation, amongst grass, but we suspect that this is secondary due to denudation by cattle.

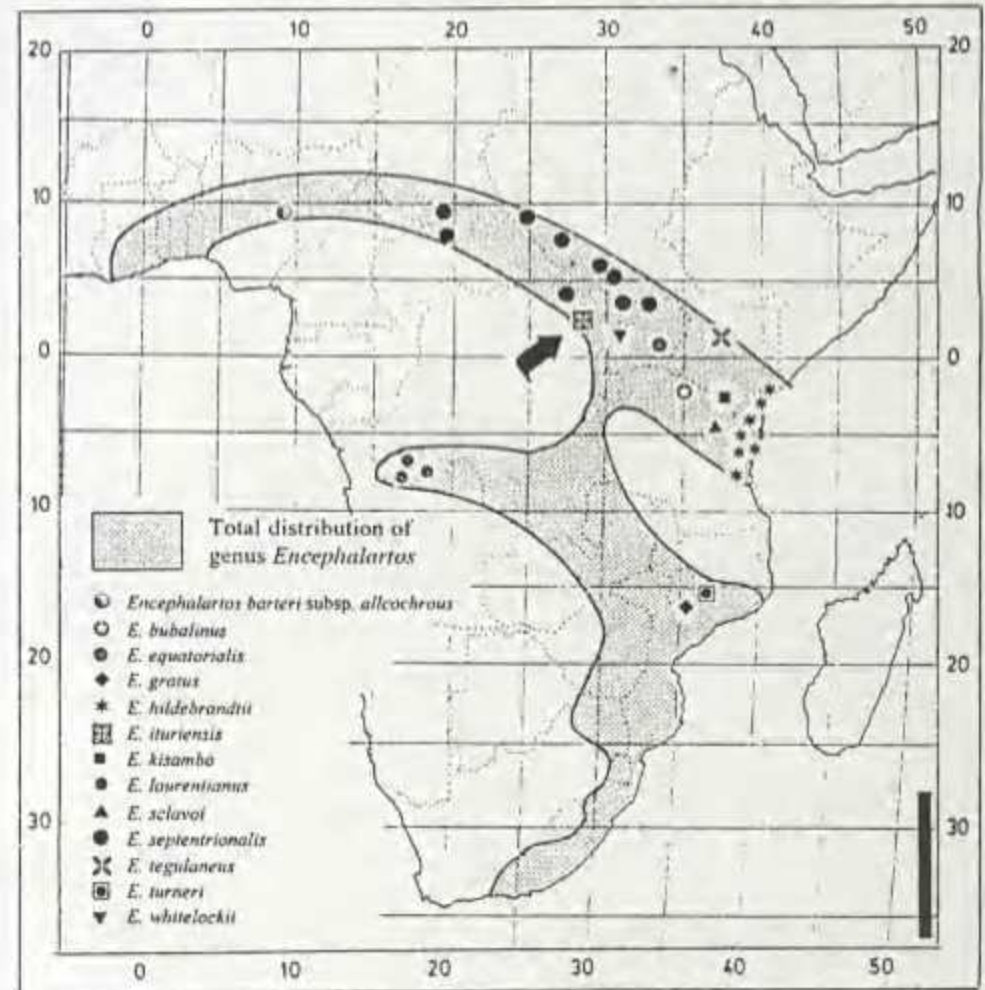


Figure 9 *Encephalartos ituriensis*: map showing geographical location in relation to other arborescent species in neighbouring territories. Scale bar = 1000 km. Based on Stevenson *et al.*, 1990.

DIAGNOSTIC FEATURES AND AFFINITIES

Geographically *E. ituriensis* occurs closest to *E. whitelockii* in western Uganda, but is separated from it by the Rift Valley which probably represents a strong isolating factor (Figure 7). It strongly resembles *E. whitelockii* by its blue-green cones which at least sometimes turn yellow at maturity (Hurter 1995), long peduncled male cones, more or less smooth and hairless exposed faces of female sporophylls, and little or not overlapping leaflets (Vorster & Heibloem 1995, as *E. successibus*). Bamps & Lisowski's Figure 2 shows the exposed faces of the female sporophylls to be tuberculate, but they are only so when dried - in the fresh state they are smooth. This is the case with several South African species (Vorster *personal observations*), and is clear from a comparison of the dried specimens and photographs of fresh cones of Gereau *et al.* 5413 (Figures 8c, 8d). Like in most other tropical African species of *Encephalartos* (Vorster *in press*), there is no leaf stalk and the proximal leaflets are progressively

reduced to a series of prickles towards the base of the leaf (Figures 5, 8a). It differs from *E. whitelockii* by having soft- instead of hard-textured leaflets with a concentration of teeth near the base of the upper margin of each leaflet (Figure 8b), and apparently fewer male cones compared to *E. whitelockii* where up to 8 cones are borne at a time.

The only other near-equatorial species with soft-textured leaflets known to us, is *E. laurentianus* from the Kwango River valley between Zaire and Angola. That is an even larger species with leaflets up to 500 mm long and 50 mm wide, stalked female cones, and a reddish indumentum on the cones of both sexes (not unlike in *E. lehmannii* or *E. eugene-maraisii*) (De Wildeman 1903a, b, c, 1907; Bois 1907; Gentil 1904a, b; Lebrun 1930).

North of the known localities of *E. ituriensis*, localities are indicated by Stevenson *et al.* (1990) for what they call *E. septentrionalis* (Figure 9). We have not seen plants from these places and therefore cannot comment on their relationship with *E. ituriensis*. In view of the relatively small distribution areas of practically all cycad species, we consider it unlikely that these are really *E. septentrionalis* which was originally described from southern Sudan.

The circumscriptions of tropical African species of *Encephalartos*, including *E. ituriensis*, remains rather vague, and field studies are needed to express these more precisely.

CULTIVATION

Seedlings of this species is supposed to be in cultivation in South Africa, but we haven't seen any of them. Heibloem (1998: 34–35), writing from subtropical Queensland, says:

"In cultivation [it] ... is very vigorous ... The seedlings produce 3 or 4 sets of leaves a year and produce an extensive root system quite quickly. They need to be grown in deep containers so that their rapid root development is not restricted. When planted in a garden situation, they seem to thrive in full sun or shade ...".

HERBARIUM SPECIMENS SEEN

ZAIRE.-- Near Nduye, *Lisowski* 41057 (BR, 2nd sheet); near Nzaro, *Gereau, Esuljanji, & Arubeni* 5413 (MO, PRE).

ACKNOWLEDGEMENT

This paper, in a slightly different form, was first

published in *Adansonia* sér. 3, 20: 211–216 (1998).

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SHORT COMMUNICATIONS / KORT MEDEDELINGS

FOUNDING OF THE CYCAD SOCIETY OF SOUTH AFRICA STIGTING VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

Some 15 years ago Roy Osborne (see Figure 4 on page 6) wrote in the *Newsletter for the South African Palm & Cycad Collector* 1(2): 8 (1984):

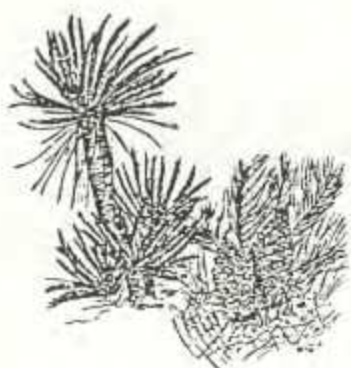
"Dear Fellow Cycad Enthusiast,
With the ever-increasing interest in these plants, there are many who feel that the time to establish ourselves on an organised basis has come. You are thus invited to join The Cycad Society of Southern Africa; your positive response is vital to the success of this organisation."

This was the initial steps to found the Society. During 1992 the name of the Society was changed to "The Cycad Society of South Africa".

After the Society was instituted the first number of our journal, "*Encephalartos*", appeared in March 1985, Maans Kemp being the editor. Before Roy emigrated to Australia he was one of the most devoted contributors of articles to the journal. He wrote most of these articles himself, but also submitted articles written by many of his foreign cycad friends at his request. Of the 57 "Focus on ..." articles received up to now, Roy is the author of 23 (2 in collaboration with a co-author), of which his third one on a native Australian cycad species appears in this issue of "*Encephalartos*".

In appreciation of Roy's contributions to "The Cycad Society of South Africa" this issue (No. 58) of our journal is dedicated to him.

Editor.

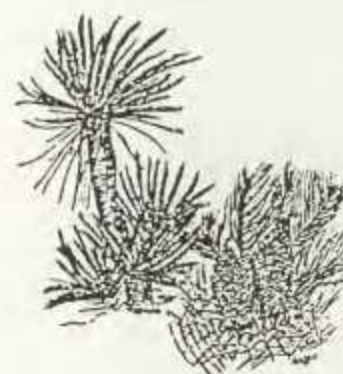


Sowat 15 jaar gelede het Roy Osborne (kyk Figuur 4 op bladsy 6), in die *Newsletter for the South African Palm & Cycad Collector* 1(2): 8 (1984), die stigting van "Die Broodboomvereniging van Suidelike Afrika" aangevoer (kyk aanhaling uit sy brief in Engels hierbo. Die naam van die Vereniging is gedurende 1992 verander na "Die Broodboom Vereniging van Suid-Afrika".

Die stigting van die Vereniging het gelei tot die totstandkoming van ons tydskrif "*Encephalartos*" waarvan die eerste nommer, met Maans Kemp as redakteur, in Maart 1985 verskyn het. Voordat Roy na Australië geëmigreer het, was hy een van die ywerigste insenders van artikels vir die tydskrif. Hy het die meeste van die artikels self geskryf, maar het ook artikels ingestuur wat op sy versoek deur verskeie van sy baie broodboom-vriende in die buiteland geskryf is. Van die 57 "Fokus op ..." -artikels wat tot dusver ontvang is, het Roy 23 geskryf (2 in samewerking met 'n mede-outeur), waarvan sy derde een oor 'n inheemse Australiese broodboomspezie in hierdie uitgawe van "*Encephalartos*" verskyn.

Uit waardering vir Roy se bydraes tot "Die Broodboom Vereniging van Suid-Afrika" word hierdie uitgawe (No. 58) van ons tydskrif aan hom opgedra.

Redaktrise.



BOTANICAL TERMS OFTEN ENCOUNTERED IN CYCAD PUBLICATIONS

Part 3

Nat Grobbelaar

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Received 13 January 1999

- pachycaulous (pagikoulies)** - Said of cycad trunks because they are more or less succulent with well-developed pith and cortex and very little secondary wood.
- palmate (handvormig)** - Hand-shaped. Said (i) of a compound leaf whose blade is once divided and the leaflets all arise from the apex of the petiole, or (ii) of the venation of a leaf or leaflet whose veins radiate from one point at the base.
- papilla (papil, tepel)** - Small raised protuberance.
- paripinnate (ewe geveer)** - Said of a pinnately compound leaf lacking a terminal leaflet.
- parthenocarpic (partenokarpies)** - Fruit development without fertilisation of the ovules - resulting in seedless fruit.
- patent (spreidend)** - Spreading out.
- pectinate (gepektineer, kamvormig)** - With teeth like a comb.
- peduncle (keëlsteel)** - In cycads, the stalk which supports a cone.
- peltate (skildvormig)** - Having a petiole attached to the abaxial (lower) surface at a distance from the margin.
- persistent (nablywend)** - Applied to plant parts that remain attached to the plant after they (the parts) die or cease to function.
- petiole (petiool, blaarsteel)** - Leafstalk. In cycads the part of the leaf between the stem and the most basal leaflet.
- petiolule (petioluul)** - The stalk of a leaflet.
- phycobiont (fikobiont)** - An algae living mutualistically in the tissue of another organism.
- pinna (pinna)** - The leaflet of a pinnately or palmately compound leaf.
- pinnate (veervormig)** - Said of a compound leaf whose blade is once divided in a feather-like fashion, with the divisions extending all the way to a well-developed midrib (rachis).
- pinnule (pinnuul)** - The segment of a compound leaf whose blade is divided more than once (also called a leaflet).
- platyspermic (platispermies)** - Cycad seeds that are distinctly flattened and upon germination split into two halves near the micropyle, as in *Cycas revoluta*.
- plicate (gevou)** - Said of a leaflet that is folded longitudinally into pleats.
- plumose (gepluim)** - Having a feathery appearance.
- pollination (bestuiwing)** - The transference of pollen from the male cone to the female cone.
- praemorse (afgestomp)** - Jagged-toothed.
- prickles (prikkels)** - The terms "prickles" (prikkel), "spines" (stekels) and "thorns" (dorings) are used differently by different authors. It would be useful to standardise this terminology, at least when applied to cycads. In this list the author presents his personal preferences. **Prickles** - Sharply pointed, hard epidermal projections such as is commonly found on the petioles of many *Zamia* species.
- procumbent (leunend)** - Said of a stem that is leaning over or reclining, often to the extent of lying along the ground or, on cliffs, hanging over the edge.
- proximal (proksimaal)** - Towards the base or attached end.
- ptyxis (prefoliasie, ptiksie)** - The shape of an emerging leaf before expansion (also vernation).
- pubescent (donserig, sagharig)** - Covered with short downy hairs.
- pulp (moes, vleis)** - Used for the soft fleshy layer of the sarcotesta.
- punctations (stippels)** - A term to describe the presence of small, rounded scales.
- punctulations (fyngestippel)** - As in "punctations" but describing very small scales.
- pyriform (peervormig)** - Pear-shaped.
- rachis (ragis)** - The stem-like part of a once-divided compound leaf which bears the pinnae. (Sometimes spelt "rhachis").
- radical (wortelstandig)** - Arranged in a basal rosette.
- radicle (radikula, kiemworteltjie)** - The undeveloped root of the embryo; also the primary root of a seedling.
- radiospermic (radiospermies)** - Cycad seeds which are round in cross section and germinate by forcing the radicle out of the micropylar pore, as in *Encephalartos* species.
- ramenta (ramenta, strooiskubbe)** - Elongated, entire scales attached at one end only.
- recurved (teruggekrom)** - Curved backwards, in an abaxial direction.
- reduplicate (terugverdubbel)** - leaflets folded with the V opened on the abaxial side of the leaflet.
- reflexed (teruggebuig)** - Bent backwards (abaxial direction) and downwards.
- regular (reëlmatig)** - Leaflets arranged in pairs directly opposite on either side of the rachis.
- revolute (revoluit)** - With the margins rolled backwards (abaxial direction).
- rhizome (risoom)** - Underground stem which grows

- horizontally.
- rostrate** (gesnawel) - With a beak.
- ruminate** (gerumineer) - Streaked seed or endosperm due to indentations of the seedcoat into the endosperm.
- sarcotesta** (sarkotesta) - The outer fleshy layer of a cycad seed.
- scabrous** (skurf) - Rough to the touch.
- scale** (skub) - A dry, flattened, papery body.
- sclerotesta** (sklerotesta) - The hard bony layer of a cycad seed which surrounds the megagametophyte and embryo.
- scurfy** (skilferagtig) - Bearing small, flattened, papery scales.
- secondary thickening** (sekondêre diktegroei) - The increase in trunk diameter as the result of cambial growth.
- secund** (eensydig, unilateraal) - With all parts directed to one side.
- seed** (saad) - A fertilised ovule consisting of an embryo, endosperm and protective coat.
- seedcoat** (saadhuid, testa) - The protective outer layer of a seed, also called "testa". The seedcoat of a cycad consists of an outer fleshy sarcotesta and an inner bony sclerotesta.
- seedling** (saailing, kiemplant) - A young plant raised from seed.
- segment** (segment) - A subdivision or part of an organ.
- senescent** (verouderend) - Growing old: becoming dysfunctional due to age.
- serrate** (saagtandig) - Toothed like a saw.
- serrulate** (fynsaagtandig) - Minutely toothed.
- sessile** (sittend) - Without a stalk.
- sigmoid** (sigmoïed, S-vormig) - S-shaped.
- simple** (enkelvoudig) - Undivided, as opposed to compound.
- sinus** (sinus) - A junction.
- sorus** (sorus) - An aggregation of sporangia.
- species** (spesie) - A taxonomic group of closely related plants, all possessing a common set of characteristics which sets them apart from another species.
- spermatozoids** (spermatozoïede) - Motile sperm cells.
- spines** (stekels) - Reduced leaflets which are short and terminate in one or more stiff and sharp points. (see "prickles".)
- spinous** (stekelrig) - Resembling a spine.
- sporophyll** (sporofil) - A reduced and often extensively modified leaf-like structure which bears or subtends sporangia. The scales of cycad cones are sporophylls.
- staminate** (manlike) - A term often applied to the male cone of cycads.
- stem clasping** (stingelomvattend) - Enfolding a stem, as in the base of the petiole.
- stipe** (stipe) - A small stalk; the ovules of *Dioon* species are attached to the sporophyll by a stipe.
- stipitate** (gestipiteer) - Stalked.
- stipule** (stipuul) - A swollen or leafy protective growth situated at the base of the petiole.
- stolon** (stolon) - Above-ground, prostrate stem that usually roots at the nodes.
- stomates** (stomas, huidmondjies) - An epidermal pore which facilitates gas exchange (also stomata).
- strain** (lyn, kultivar) - An improved selection within a variety; also a cultivar.
- striate** (gestrieer) - Marked with narrow lines.
- strobilus** (strobilus, keël) - A technical term for a cone.
- subspecies** (subspesie) - A taxonomic subgroup within a species used to differentiate geographical isolated variants.
- subulate** (elsvormig) - Narrow and drawn out to a fine point; awl-shaped.
- succubous** (dakpansgewys) - Said of laterally overlapping leaflets in which the lower (proximal) margin of a leaflet overlaps the upper (distal) margin of the adjoining more basal (proximal) leaflet.
- succulent** (sukkulent) - Fleshy or juicy.
- sucker** (suier) - A shoot arising from the roots or trunk below ground level.
- sulcate** (gegroef) - Grooved or furrowed.
- symbiotic** (simbioties) - When two different kinds of organisms live intimately together.
- sympatric** (simpatries) - Growing in the same or overlapping areas.
- syngonium** (singanium) - A fertile body formed by the fusion of two or more sporangia.
- taxon** (takson) - A term used to describe any taxonomic group, e.g. genus, species.
- taxonomy** (taksonomie) - The classification of plants or animals.
- teeth** (tande) - The name sometimes applied to the small, sharp-tipped protuberances which can be found on the leaflet margins of some *Encephalartos* species. They may be one to two millimetres long (as in *E. villosus*) or up to 10 millimetres long (as in *E. kisambo*).
- terete** (tereet) - Slender and cylindrical.
- ternate** (trimeer, trimeries) - Divided or arranged in threes.
- testa** (testa, saadhuid) - The outer layer of a seed, the seedcoat.
- thermogenesis** (termogenese) - The production of heat, as in male cycad cones during pollen shedding.
- thorn** (doring) - A hard, usually long and narrow, sharply pointed structure. Usually a modified leaf, stipule or branch. Rare, if present at all on cycads. (See "prickles".)
- tomentose** (digwollerig) - Densely covered with short, matted soft hairs.
- tomentum** (tomentum) - A felt-like covering of downy hairs.
- transpiration** (transpirasie) - The loss of water vapour to the atmosphere by a plant.

transverse section (dwarssnee) - A cross cut through the longitudinal axis.
tribe (tribus) - A taxonomic group of related genera within a family or subfamily.
trichomes (trigome) - A term used to describe outgrowths of the epidermis such as scales or hairs.
trifid (tweespletig) - Divided into three lobes by two deep clefts.
truncate (afgeknot) - Ending abruptly, as if cut off.
trunkless (stamloos) - Without a trunk; in cycads apparently trunkless species, usually have a subterranean trunk.
tuberous (knol-) - Swollen and fleshy.
turgid (turgied, geswel) - Swollen or bloated.

unarmed (onbewapen, doringloos, stekelvry) - Smooth, without spines, hooks or thorns.
undulate (golwend) - Wavy.
unisexual (eenslagtig, uniseksueel) - Of one sex only.
united (vergroei) - Joined together wholly or partially.
upper margin (distale blaarrand) - That margin of a leaflet nearer to the apex of the leaf.

valvate (kleppig) - Two parts that meet exactly and do not overlap.
variety (varieteit) - A taxonomic subgroup within a species used to differentiate variable populations.
vascular (vaat-) - Relating to the circulatory system.
vegetative (vegetatiewe) - Asexual development or propagation.
vein (aar) - The conducting tissue of leaves.
venation (bearing, aarstelsel) - The pattern formed by veins.
vernation (prefoliasie, ptiksie) - The shape of an emerging leaf before expansion (also "ptyxis").

verrucose (verruka-agtig) - Rough and warty.
verticillate (kransgewys, kransvormig) - Arranged in whorls as in the leaflets of *Ceratozamia hildae*.
viable (kiemkragtig) - Alive and able to germinate.

whorl (krans) - Simultaneously produced set of leaves arranged in a circle around the crown of the stem.

xeric (xeries) - Dry conditions.
xerophytic (xerofities) - Adapted to growing in dry conditions.

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The assistance and encouragement of Mr Leon Pienaar of 626 Jan Visse Avenue, Roseville, 0084, Pretoria, is gratefully acknowledged.

NONG NOOCH TROPICAL GARDEN: CYCAD PARADISE

Donald J. Kurth

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Received 4 February 1999

The 1998 Biennial Meeting of the International Palm Society was held in September at the Nong Nooch Tropical Garden just outside the seaside resort town of Pattaya in Thailand. Our host was Kampon Tansacha, former Asian movie industry magnate and founder of the palm and cycad collections at Nong Nooch. (His exclusive interview will appear shortly in *The Cycad Newsletter* in which he explains how he developed his massive cycad collection.)

On the way to Nong Nooch we were dazzled by the private palm and cycad gardens of Mr. Tansacha's friends in Bangkok who graciously opened their private collections to us. After a visit to the Chatujak Plant Market we went on to tour the private residence of Khun Charlie to see his many beautiful, mature specimens of palms and *Encephalartos*. Later, we visited the private museum and garden of Khun Prasart where we chatted with our cordial and friendly host.

The real treat, however, was yet to come when we finally arrived at Nong Nooch Tropical Garden. The palms, of course, were spectacular. But, of key interest to the cycad lovers of our group were the five acres of cycads planted in the ground at Nong Nooch. Hundreds of mature cycads planted in containers and boxes lined the roadways as well and thousands of smaller plants were kept in open walled, fiberglass roofed plant buildings to keep them dry during the rainy season. If the names sound a bit familiar, it's Nong Nooch for which *Cycas nongnoochiae* was named (K.D. Hill 1998) and Kampon Tansacha for whom *Cycas tansachana* was named (K.D. Hill & S.L. Lang 1998).

Nong Nooch Tropical Garden was founded originally in 1954 by Kampon's mother, Mrs. Nongnooch Tansacha. She and her husband, Pisitt, bought a 1300 rai (520 acres) plot of land in Chonburi province to grow fruit trees. Inspired by international tropical gardens which she had seen on her trips abroad, she began to develop the orchard into a tropical garden in 1972. Cultural performances featuring traditional dances, martial arts shows, and an elephant show were soon introduced and Kampon took over development of the palm and later cycad collections.

Nong Nooch Tropical Garden has now become a private plant collection of international stature that is probably the largest of its kind in Asia. Kampon has established educational opportunities with Chonburi Agricultural College and now gives training courses to students from about 30 different agricultural colleges from all over

Thailand, accommodating up to 80 students at a time. The garden boasts well over 200 species of cycads from all over the world. One of Mr. Tansacha's stated goals is to be able to maintain breeding colonies of endangered cycads for world wide seed distribution in the future.

"We usually display only five or six of each species", explained Anders Lindstrom, cycad curator at Nong Nooch. "We could put out a lot more but it just didn't make sense to put 50 of each species on display." Although many of the specimens are still immature, with the meticulous care (Nong Nooch has several hundred employees who care for the plants), warm climate, and heavy fertilization I am certain that all of the cycads will grow rapidly.

Mr. Tansacha hopes to host the international cycad meeting within the next few years. All in all, it was a wonderful Biennial. I, for one, would love to have an excuse to visit the Nong Nooch Tropical Garden again in the near future.

[Donald J. Kurth, M.D. is a physician on the staff of the Loma Linda University Medical Center in southern California and is a member of the Board of Directors of The Cycad Society.]

[See also Willie Tang's article "Cycads at Nong Nooch Tropical Garden" (*Encephalartos* 54: 19-21, June 1998). - Editor.]

A WHITIE!

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Received 29 March 1999

Variiegated specimens of cycads are rare, and the very few that have been found are collectors' pieces. The photo (Figure 1) shows a plant which not merely has pale stripes, but is entirely snow white (an albino).

Alas, like other whities, this one has no future. It entirely lacks chlorophyll, and therefore cannot produce its own carbohydrates. Perhaps one could prolong its life by feeding it on sugar water, but it has no prospect of reaching reproductive age.

The photograph shows another interesting phenomenon, concerning germination of seed. We are all familiar with the distressing situation where seeds crack open but the radicles never emerge. It has been

suggested, not without reason, that the embryos of such seeds get destroyed by desiccation, pathogens, or minute insects. It has also been claimed that seeds planted with their micropyles pressed into the ground rather than pointing upwards, attained a higher germination percentage. A problem with the former method is that one cannot see whether a seed starts germinating until a leaf emerges, and then it is a disruption of the seedbed to get the seedling out.

Stangeria seeds have always been difficult for me to germinate: they often took two to four years, and the percentage success was low. I did, however, notice that seeds which were carried off by birds (mostly Thrushes) in my garden before I had opportunity to harvest them



Figure 1 An albino amongst normal *Stangeria eriopus* seedlings.

myself, came up all over after being buried by the birds, far more so than I would have expected from my presumed few seeds lost to birds. Therefore, when last year I had some seeds of *Stangeria*, I buried them completely but shallowly in fine pine bark which I kept moist in a cool part of the nursery. To my surprise they came up like hair on a dog's back after the winter, suggesting that the method has merit at least for *Stangeria*.

I had a similar experience with seeds of *Encephalartos altensteinii* and *Macrozamia*. These were sitting in a seed tray for four years, and I really got very few seedlings even though the medium (fine pine bark) was kept moist. Eventually I threw the whole lot out, and we used the bark medium to plant various other things in. Within a matter of months an embarrassing array of seedlings started emerging from these pots, of course all without labels.

I have lately had poor germination results from *Cycas* and *Zamia* seeds, but have now started, on an experimental basis, to bury these seeds completely in fine bark or compost, to see how they react.

ENCEPHALARTOS MACROSTROBILUS

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Received 29 March 1999



Figure 1 General view of habitat with *Encephalartos macrostrobilus* in the middle.



Figure 2 *Encephalartos macrostrobilus*: cluster.

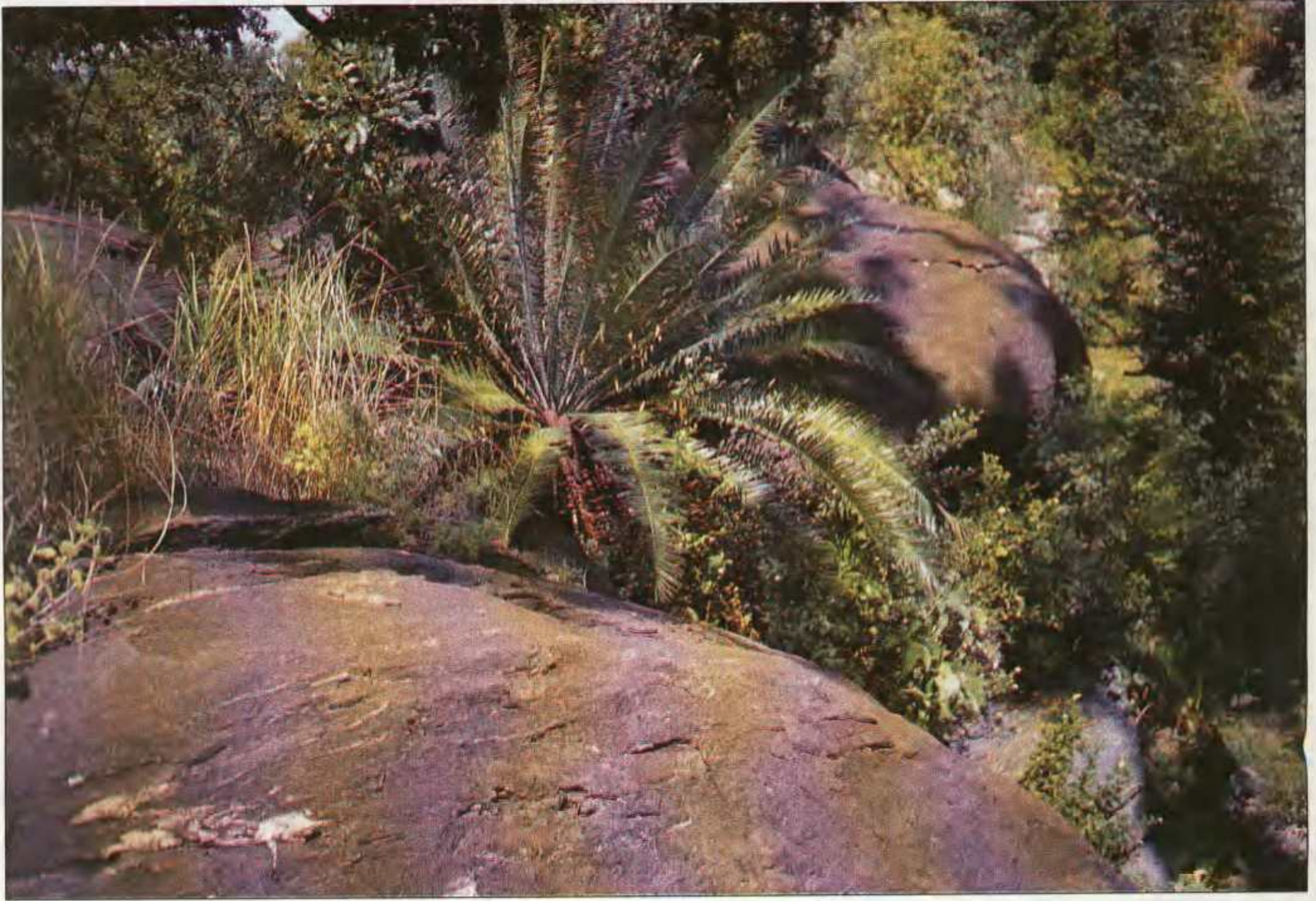


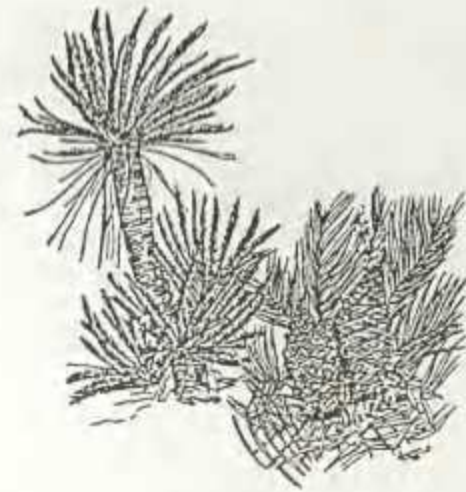
Figure 3 Male plant between granite boulders.



Figure 4 Decaying female cones.

The accompanying photographs of *Encephalartos macrostrobilus* were received from Jeff Wynants, co-author of the species. It was first described in *Encephalartos* 50: 13–16 (1997). This species occurs in a remote part of northern Uganda, and the photographs not only show how the plants look, but also under what conditions they grow.

Photos: Jeff Wynants.



ENCEPHALARTOS KISAMBO IN CONE

Piet Vorster

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Received 29 March 1999



Figure 1 *Encephalartos kisambo* female cone, one of three, about 400 mm long, on a plant coning for the first time in Stellenbosch.

I had a female *Encephalartos kisambo* with three cones during the past season. This plant was raised in the greenhouse where it grew so big that it could hardly be moved out through the door. Since planted out, it has never looked back and grew to a tremendous size.

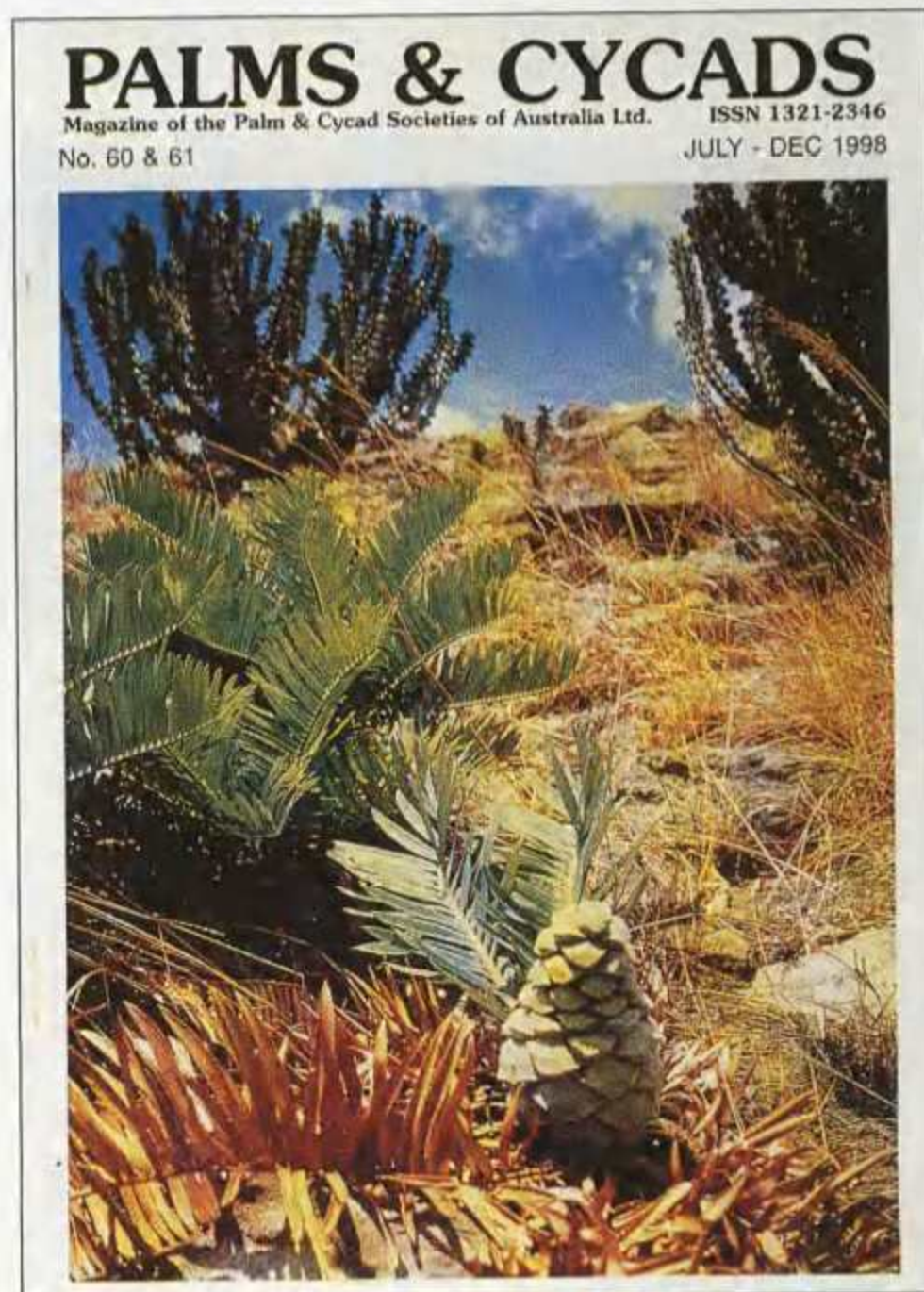
This shows just how adaptable this species is: though from a near-equatorial region, it grows and cones very satisfactorily in Stellenbosch, at 34°S with its short summers and winter rains. In fact, in Stellenbosch this is one of the most successful species, and I have no doubt that it is going to become one of the most popular species for growers with sufficient space (at least 16 square metres).

SPECIAL ISSUE OF PALMS & CYCADS

Piet Vorster

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Received 29 March 1999



The combined issues numbers 60 and 61 of *Palms & Cycads*, the magazine of the Palm & Cycad Societies of Australia, is devoted almost entirely to a 64-page article on the non-South African *Encephalartos* species, by member Peter Heibloem. For each species there is a short description, something about distribution and habitat, notes on cultivation, and several colour photos of wild and cultivated plants.

This issue is an extract of Peter's forthcoming book, *Cycads of central Africa*, which will be reviewed as soon as we have received a copy.

This issue of *Palms & Cycads* is not offered for sale separately, but is only distributed to members of the Palm & Cycad Societies of Australia.

ENCEPHALARTOS MIDDELBURGENSIS-POPULATION AT RHENOSTERPOORT

Hannes Robbertse¹, Theuns Naudé² and Robert Rousseau³

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Received 6 April 1999



Figure 1 The same male plant as in Figure 4, with seven cones on the main stem (1997).

"RHENOSTERPOORT" is owned by a number of shareholders since 1968 and was declared a Private Nature Reserve in 1973. The reserve forms part of Klipfontein 498JR in the Bronkhorstspuit district of Gauteng Province and lies about 10 km north of the N4 highway, close to Balmoral railway station. Its southern border lies on grid 2528DD and the northern border on grid 2528DB. The reserve is transected by the Wilge River which is flanked by plateaus on the northern and southern sides of the river valley. The veld type is typical Sour Bushveld, characterised by plants like *Acacia caffra*, *Protea caffra*, *Lannea discolor*, *Burkea africana*, *Ochna pulchra*, *Combretum zeyheri*, *Combretum molle* and *Elephantorrhiza burkei*.

A few adult *Encephalartos middelburgensis* plants, which clearly are remnants of a once larger population, occur within the boundaries of the reserve, while a few others occur on adjacent farms (Figure 3). This population represents the most western distribution of *E. middelburgensis* and also is the only natural population of *Encephalartos* occurring within the boundaries of Gauteng (Michelle Pfab, Gauteng Nature Conservation, personal communication, 1998).



Figure 3 One of the plants on an adjacent farm.



Figure 2 The same male plant as in Figures 1 and 4, after a fire during July 1997. After the fire the two stems produced ten cones each.

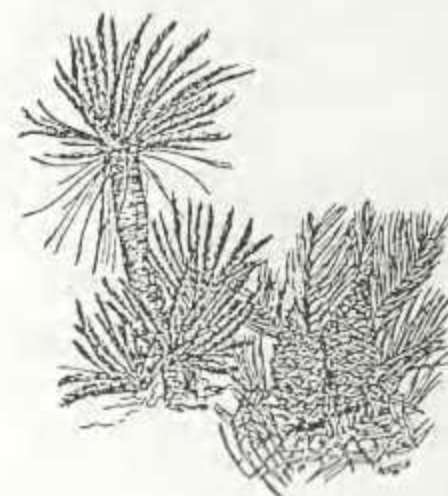




Figure 4 One of the male plants (1996).

The population consists of four very old specimens of which two are male plants, one growing on the plateau south of the river (Figure 4) and the other on the northern plateau about 3 km away from the other plant. The two female plants also occur on opposite sides of the river, about 500 m apart with closest male plant 1.5 km and 1 km away from the females. Identification of male and female plants were based on cone fragments or seed shells found around the tree bases.



Figure 5 Details of one the female cones.

We regard this plant population as unique and in consultation with the owners of the reserve, we decided on a seed propagation programme and to use pollen from local male plants to pollinate female cones that might be produced. For this programme the trees had to be observed on a regular basis not to miss any pollen or female cones ready for pollination. Theuns Naudé visited the reserve on a regular basis during the course of a project on the toxicology of *Dichapetalum cymosum*, undertaken by the Veterinary Faculty of the University of Pretoria. None of either the male or female plants produced cones during 1996. During 1997, one of the male plants produced seven cones (Figures 1, 4) from which pollen was collected and stored at ca. 4°C. During 1998, the same plant consisting of two stems,

produced 20 cones while one of the females produced five cones (Figure 5) which were first noticed on 02/01/98 when they were about 5 cm above the scales of the stem apex. On 08/03/98 male cones on the southern male were at the point of shedding pollen while the scales of the female cones (at this stage about 400 mm long with a diameter of 200 mm) were still tightly packed.



Figure 6 Theuns Naudé on top of a 3 metre ladder, pollinating the female cones.

During a follow-up on 13/03/98, the scales of the female cones had not yet separated, but since the male cones were at the peak of pollen shed, top scales from two of the female cones were removed for applying wet pollination. Making sure not to miss the opening of the female cones, we left one of the pollen shedding male cones in the crown of the female plant. The next routine visit for the *Dichapetalum* project took place on 27/03/98. We were surprised to find the female cones "on heat" with their top scales separated and releasing a strong odour. We applied both wet and dry pollination, using the fresh pollen from the local male plant (Figure 6). Robert Rousseau repeated the pollination and left new male cones in the crown.

There are many baboons at Rhenosterpoort and we were afraid of losing the seed. For this reason, one of the

female cones were harvested on 02/08/98. On inspection we found that some seeds contained developing embryos and decided to harvest the rest of the cones, which took place on 09/08/98. Some details about the cones are given in the table below:

After removing the sarcotestas the "seeds" were cleaned and are being stored at the moment and we will start germinating them during August/September. The seedlings we hope to obtain will be planted back into the

reserve, once they have reached a stage, big enough, to survive.

Early in 1999 the same male plant (situated next to a road) was seen to have coned again. During March it was discovered that the second female plant (situated out of sight) had also coned and that the five large cones were ready for pollination. This was attempted by Robert Rosseau using fresh pollen from the aforementioned male as well as refrigerated pollen from 1998.

Cone No	Weight in Kg	No of "seeds"	Under-developed "seed"	Positive water test
1	11	304	11	293
2	9	258	9	249
3	10	279	10	269
4	11	301	13	288
5	9	266	12	254
Total	50	1408	55	1353

THE WORLD LIST OF CYCADS NOW HAS A WEB SITE:

<http://plantnet.rbgsyd.gov.au/PlantNet/cycad/index.html>

Ken Hill

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Received 29 March 1999

I have been working on a cycad web project off and on for a year now, lately with collaboration of Dennis Stevenson of the New York Botanical Garden. The time seems right for a public announcement, even though the site is not finished (but of course these things never really are), The aim of the site is to provide a complete botanical treatment of the cycads, up to date with latest information and botanical developments.

Individual species treatments are not all there, but look at some in *Cycas* or *Zamia* for an idea of what is eventually planned. Similarly the identification

programs are incomplete and a little crude as yet, but still give some idea. The world list of cycad names is complete and up to date for published names, with a few that are expected very shortly.

Cycad taxonomy is not universally agreed, and I would welcome different viewpoints (with reasons, of course!). I would particularly welcome any comments on the behaviour of the site with different browsers (it has been designed with Netscape 4 and runs in a Microsoft-free zone).



NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Derik Minnaar

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Ontvang 15 April 1999

Toekomstige aktiwiteit

September 1999: Pogings word aangewend om 'n uitstappie na die Broodboomwandelpad naby Middelburg in Mpumalanga gedurende 'n naweek in September te reël. Belangstellendes skakel Derik Minnaar asseblief na-ure gedurende Augustus vir finale reëlings by telefoon (012) 8033061.

Verslae oor onlangse aktiwiteite

Op Saterdag 6 Februarie 1999 het lede van die Broodboom Vereniging en ander belangstellendes die tuin van dr Martin Bruwer in Montanapark, Pretoria, besoek. Die belangstelling was goed en omtrent 45 besoekers het opgedaag.

Vroeg die middag het die besoekers by Ita van der Walt se kwekery in Montanapark byeengekom en toe as 'n groep vertrek na Martin se tuin.

Nadat Derik Minnaar die besoekers verwelkom het, het hy vir Martin voorgestel..

Uitstekende voorbeelde van feitlik alle inheemse broodbooms spesies kon besigtig word en Martin self was deurentyd beskikbaar om die geskiedenis van sy versameling met die besoekers te deel en staaltjies te vertel oor hoe hy van die uiters skaars spesies bekom het. Dit was verstommend om te verneem dat sy tuin slegs agtien maande oud was, en dat hy die broodbome voorheen in potte geplant en versorg het totdat hy die spogerf kon besit. Dit was interessant om te merk dat hy die broodbome op 'n baie klipperige skuins helling geplant het en afgewissel het met klein kaktusplante om die versameling in te kleur. Die verskillende broodbooms spesies is as groepe bymekaar geplant en slegs twee of drie bome verskaf 'n effense skaduwee vir sommige broodbooms spesies. Iets wat dikwels nagelaat word is genoeg ruimte vir plante, maar Martin het vroegtydig sy versameling wyd gespaseer om ruimte aan elke broodboom te bied en toekomstige uitbreiding van die versameling te vergemaklik.

Lynette Minnaar het die besoek afgesluit deur die bedankings te doen en in besonder vir Ita van der Walt te vermeld wat al die voetwerk gedoen het om die uitstappie moontlik te maak.

Baie dankie aan dr Martin Bruwer vir 'n baie besondere besoek.

Op Saterdag 6 Maart 1999, om 14h00, het lede van die Broodboom Vereniging en ander belangstellendes by die hoofgebou van die Nasionale Botaniese Instituut in Pretoria vergader. Dr Heidi Anderson van die Nasionale Botaniese Instituut, Pretoria, het die groep toegesprek oor "Cycads as living fossils". Sy is nie 'n broodboomdeskundige nie, maar 'n baie ervare botanis wat, soos haar CV lui, diep spore getrap het as fossielkundige. Sy het 'n breë oorsig gebied en kleurvolle skyfies vertoon oor hoe die aarde en sy klimaat verander het oor baie miljoene jare. Die plantgenusse en -spesies, en hoe hulle in sekere tye gefloreer en uitgesterf het, is met insiggewende skyfies verduidelik. Sy bevestig dan ook dat broodbome in die uitsterf-fase is, en vroeër baie meer algemeen in die natuur voorgekom het. Heidi het ook 'n groot gedeelte van haar aanbieding gewy aan die tegnologie wat aangewend word om die verlede te ondersoek. Sy het gewilde fossiel-areas op kaarte aangedui en dit ook duidelik gestel dat fossiele op die mees onverwagte plekke gevind word. Sy het foto's getoon en gebiede geïdentifiseer waar sy self met haar span talle broodboomfossiele gevind het. Sommige van dié spesies het miljoene jare gelede uitgesterf en lyk selfs heeltemal anders as hedendaagse spesies. Fossiele van broodbome verteenwoordig feitlik altyd blaarmateriaal, aangesien stamme en keëls gewoonlik vergaan voordat dit fossiliseer en fossiele hiervan is baie skaars.

Heidi het 'n groot versameling besondere fossiele aan die besoekers getoon en bevestig dat die fossiele in 'n baie wye spektrum van klipmateriaal voorkom.

Prof. Nat Grobbelaar het dr Heidi Anderson bedank vir haar besondere skyfievertoning. Na die vraesessie is die groep gelei na die herbarium waar 'n magdom fossiele opgegaan word. Talle fossiele is bespreek en fisies bestudeer. Heidi self was beskikbaar om haar kennis te deel en al die vrae te beantwoord.

Baie dankie aan dr Heidi Anderson vir 'n insiggewende aanbieding oor broodbome as lewende fossiele.

INTERESTING *ENCEPHALARTOS LANATUS*

Isabella Claassen

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

15 April 1999

In 1994 I reported on two *Encephalartos lanatus* specimens in my garden which were burnt to induce leaf formation (*Encephalartos* 37: 24–25, Figures 1–4).



Figure 1 *Encephalartos lanatus*, showing the two stem apices each with its own leaf crown (left: with 14 leaves, right: with 15 leaves; photographed on 14 April 1999).

About a year ago I noticed that the stem apex of one of the plants (*Encephalartos* 37: 24, Figures 1, 2) has divided into two apices (growing-points). This plant had at that time not produced any subsequent leaf flushes since the 24 leaves in November 1993 (see *Encephalartos* 37: 24–25, Figure 2).

In November 1998 both apices simultaneously produced leaf flushes (Figure 1).

An organic potting soil was used as a soil medium when the plant was planted in the container in 1983. Since 1993 the soil in the container became completely dry several times, usually during the winter months when it was watered less frequently. It is difficult to wet dry organic soil as water just runs through it, one has to mix the soil and the water. In September 1998 I scooped out as much of the organic potting soil as possible without damaging the plant's roots and replaced it with a sandy soil mixture.

It would be interesting to learn whether stress caused by the periodically extremely dry conditions of the potting soil could have induced the stem apex to divide.

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

COLOUR WOULD BE BETTER FOR THE JOURNAL

I am a great fan of black & white photography. A fine print of a carefully composed subject displaying shape, texture and form is a joy to look at. But I must agree colour would be better for the journal.

I think it should be a target for the Society to aim for in the not too distant future.

In these competitive times people expect more and they expect continuing progress.

"*Encephalartos*" is possibly the premier journal on cycads in the world. Are membership numbers increasing annually?

I personally don't have a problem with the journal, I'm interested in any and all aspects of cycads and the more material I get the better.

My problem is the availability of the plants themselves. *Encephalartos* species are very difficult to get hold of. Importing seedlings is made so difficult as to be almost impossible, in England.

I believe that the Society seedbank and members overseas should be exempt from CITES regulations. Seed is by far the best plant material to send overseas.

I'm sure it could be done in a controlled and responsible way. And I know it would increase overseas membership.

While I'm writing; I would be interested in any comments on the history of cycads during their decline, particularly *Encephalartos* species. Physical changes to the plants themselves and climatic changes over such a long period of time.

Yours sincerely

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

Received 22 February 1999

Geagte Redaktrise/Dear Editor

GEVURKTE *ENCEPHALARTOS* / FORKED
ENCEPHALARTOS



Figuur 1 Nabyopname van 'n blaar om die gevurkte pinnapunte te toon. (Figure 1 Close-up of a leaf showing the forked apices of the pinnae).



Figuur 2 Vroulike keël met twee toppunte (apekse). (Figure 2 Female cone showing two apices).

Hierdie foto's is deur Edgar Wohlberg in die tuin van John Weeks van "Trout Beck", Zimbabwe geneem. Let op die gesplete strukture wat hierdie *Encephalartos*-plant (wat onder die *E. manikensis*-kompleks ressorteer en afkomstig is uit Mosambiek) vertoon. / This *Encephalartos* plant (a Mozambican specimen in the *E. manikensis* complex) showing forked structures were photographed by Edgar Wohlberg in the garden of John Weeks of "Trout Beck", Zimbabwe.

Piet Vorster, Departement Botanie/Botany Department,
Universiteit van/University of Stellenbosch,
Privaatsak/Private Bag XI, 7602 Matieland, R.S.A.

Ontvang/Received 1 April 1999

Dear Editor

CYCADS OF THE WORLD FOR THE LAYMAN

Greetings to you from a Sydney member of the Cycad Society of South Africa. I am prompted to write to you with some additional information after reading the latest

issue of *Encephalartos* (No. 57). On page 21-26 there appeared an article on "Cycads of the World for the Layman" by Leon Pienaar and Pieter Janse van Rensburg, containing a list of all the currently known cycads and their origin. This list keeps changing as more information comes to light, new species are described, etc. I thought it might be of interest to other readers to add the states of origin of our Australian species to the list where this information is lacking or incorrect.

Cycas angulata, *C. arenicola* and *C. armstrongii* all come from the Northern Territory and not Western Australia as stated.

All three subspecies of *C. arnhemica* come from the Northern Territory.

C. badensis comes from Queensland.

C. lane-polei comes from Western Australia.

All three subspecies of *C. maconochiei* come from the Northern Territory.

C. media subsp. *media* comes from Queensland and not the Northern Territory. The two other subspecies of *C. media* also come from Queensland.

C. pruinosa comes from Western Australia but also across the border into the Northern Territory.

C. semota comes from Queensland.

C. tuckeri, *C. xipholepis* and *C. yorkiana* all come from Queensland.

I think that *C. tokinensis* comes from Burma and Vietnam.

Macrozamia cardiacensis comes from Queensland.

M. concinna comes from N.S.W. as does *M. elegans*, *M. glaucophylla*, *M. humilis*, *M. montana*, *M. polymorpha* and *M. reducta*.

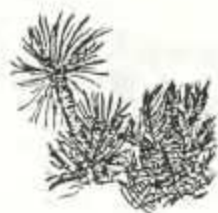
M. macdonnellii comes from the Northern Territory.

M. longispina comes from Queensland.

I hope that this information is of some use to you. I enjoy reading "Encephalartos" magazine or anything remotely to do with cycads and am glad that, despite falling memberships and increasing costs, you are able to keep up the standard. I am currently the editor of the Sydney branch of PACSOA's magazine "Pricipes minor" and am well aware of the reticence of members to contribute something. Here's hoping this is the first of my contributions to "Encephalartos" magazine.

Craig Thompson, P.O. Box 140, Sylvania, NSW 2224, Australia.

Received 27 March 1999



Dear Editor

MICROCHIPS

It was with interest and sympathy that I read the letters dealing with the identification of cycads by using microchips. Being a Plant Pathologist/Microbiologist, I cannot help but to wonder how safe the implantation of the microchips into the plants is. I must add, however, that I have never witnessed the process myself, but am painfully aware of the fact that the inside of a cycad (containing mainly starch and with ample moisture) provides the perfect niche for microbial growth (and therefore rot), by both bacteria and fungi. I have the utmost sympathy for the situation of cycads in the wild, but it seems that even "domesticated cycads" now have to be microchipped before they can be moved between provinces. I just hope that collectors such as myself who already have to deal with root and head rot of our plants, will not now have to deal with microchip rot too.

Andre Cilliers, P.O. Box 351, 2520 Potchefstroom, R.S.A.

Received 1 April 1999

Dear Editor

A REALISABLE DREAM

The maintenance of a pure genepool of cycad species is essential to the existence of the cycad as we know it. Osborne, Donaldson and many others have written reams about the problem. Thus far no practical solution has been found.

The use of garden plants either in private gardens or in organized Botanical Gardens, where a number of cycads are kept in a relatively small area as a breeding point for pure cycads, is not acceptable and can lead to further weakening of available gene material. I quote Dawie Strydom, formerly of the Pretoria National Botanical Gardens, where he states in an article entitled "The advantages of artificial pollination for both *in situ* and *ex situ* pollination". He states "Through the practise of *ex situ* pollination under controlled conditions seed is obtained from which *reasonably pure plants* may be grown and made available to the public" (free translation). This sounds to me like the marriage broker who described the young lady to the prospective groom as "practically a virgin".

The only methods that can be used to ensure that the position does not further deteriorate are the *in situ* schedule which, under present population pressure, becomes less feasible every day, and the *ex situ* which is still possible to initiate.

An ideal solution would be to have isolated (from other cycads) breeding stations with the necessary one species only at each station. These units would have to be fenced with the most impermeable fencing available and must be under twenty-four hour guard. The financial and practical problems facing the implementation of this seed garden project seem insurmountable.

A scaled down version of this idea seems to have practical possibilities. A nursery with large grounds be acquired for the propagation of the seed produced (this would be required for the first scheme also) and a number of the metal bins used by municipalities to remove large quantities of rubbish. These bins would be filled with the correct soil mixture for the female cycad to be planted in and then left quietly in the nursery yard. When the cycad has coned but shortly before pollination has to take place, the specially fitted truck is hired and the unit is hauled to the one safe site required. A few days later when hand pollination has been performed and the cones have closed down, the process is reversed and the presumably encephalocycad is brought back to the nursery to await her time.

Financing: Considering the amount of interest in conservation matters in general and the world-wide interest in cycads it should not be impossible to find a support group prepared to help save our own cycads from extinction.

Plant material: Should the other objectives be reached the question arises where do the plants for the operation

come from? There are numbers of rare cycads held by Provincial authorities having been confiscated from illegal holders which could be acquired if the organization is registered as a non-profit one. It is also considered by many knowledgeable people that there are far more cycads in gardens and collections in South Africa than are left in the veld. I have no doubt that many plants will be donated by wellwishers and others could be obtained from collectors and investors if provided the right incentive.

Verification: A panel of acknowledged experts would be required to adjudicate whether or not a plant complied with the type material on file and was suitable for the breeding program.

Control: Furthermore a committee would be required to control the financial and general management of the foundation. The committee should consist of members from the supporting financial bodies, conservation authorities, private conservation bodies and cycad experts.

The whole idea is obviously floating on a rosy cloud but if it strikes a light somewhere, I have no doubt that future generations of cycad lovers will bless the names of those who made it possible.

Jack van der Merwe, 34 Charles Maberly Street, 0835 Duiwelskloof, R.S.A.

Received 8 April 1999

BOOK REVIEWS / BOEKBESPREKINGS

FLORA OF AUSTRALIA VOL 48. FERNS, GYMNOSPERMS AND ALLIED GROUPS

Editor P. McCarthy

Australia: CSIRO Publishing. 1998.

Available at \$AUD 95.00 from CSIRO Publishing, P.O. Box 1139, Collingwood, Victoria 3066, Australia.

This is the 20th of a projected 59 volumes in the "Flora of Australia" series that aims to document the vascular plants, lichens, bryophytes and liverworts native and naturalised in Australia. At 766 pages it is the largest volume to date and too heavy to use away from a desk. Most of the volume covers the Australian fern flora,

while smaller portions cover the conifers and cycads. This review will concentrate on the cycad sections.

Firstly there is an essay by Ken Hill entitled "Gymnosperms" - the paraphyletic stem of seed plants". This reviews briefly the relationships, morphology and anatomy of the gymnosperms. Cladograms of the Cycadophyta, *Cycas* and *Cycas* subsect. *Endemicae* are presented although with no discussion. There are very short sections on reproductive biology and distribution and ecology, although no reference is made to the various papers by Robert Ornduff and other workers who have now extensively documented the insects associated with Australian cycads.

Secondly there is a concise, yet informative review of the fossil record of cycads in Australia by Robert S. Hill. Perhaps most interesting in this essay is the comment that the genus *Pterostoma* has only recently become globally extinct.

Thirdly there is a detailed, although necessarily concise within the constraints of the series, account of the living Australian cycads by Ken Hill. He chooses to recognise the four genera *Bowenia* (2 spp.), *Cycas* (27 spp.), *Lepidozamia* (2 spp.) and *Macrozamia* (38 spp.). All species recognised have a concise description, details on typification and synonymy, notes on distribution and habitat, selected citation of specimens, a very small dot distribution map and sometimes additional notes. There are keys to all species, often the couplets are based on single character states. With only two species to key out, it should have been possible to have a single couplet for *Bowenia*, rather than two. I have not had a chance to test any of the keys at this stage. For *Macrozamia* the couplets are mainly based on vegetative features, whereas in *Cycas* there are a mixture of reproductive and vegetative features utilised. Many of the descriptions seem to be based on limited data, mainly derived from specimens held at NSW (reflected in the specimen citation) and some errors and inaccuracies in morphological character states are present despite being previously documented [e.g. tripinnate foliage in *Bowenia* (Wilson 1996); male cones to 42 cm long in *Cycas platyphylla* (Forster 1995)].

There are nine new species of *Macrozamia* described in a poorly structured appendix in the rear of the volume. These new species are *M. cardiacensis* P.I. Forst. & D.L. Jones, *M. concinna* D.L. Jones, *M. elegans* K.D. Hill & D.L. Jones, *M. glaucophylla* D.L. Jones, *M. humilis* D.L. Jones, *M. longispina* P.I. Forst. & D.L. Jones, *M. montana* K.D. Hill, *M. polymorpha* D.L. Jones, and *M. reducta* K.D. Hill & D.L. Jones. There are several other innovations in the account. *M. machinii* P.I. Forst. & D.L. Jones from Queensland is rather curiously referred to synonymy of the similar *M. plurinerva* (L.A.S. Johnson) D.L. Jones from New South Wales. The two are quite distinct in morphology and also in allozyme diversity and this move will not be followed by the Queensland Herbarium or the Australian National Herbarium (D.L. Jones, *pers. comm.* 1998). *M. fraseri* Miq. is resurrected from synonymy under *M. riedlei* (Fisch. ex Gaudich) C.A. Gardner. All of the recently described taxa of *Cycas* are included and the rather bizarre assignments of synonymy by de Laubenfels & Adema (1998) were obviously too recently published to be cited.

The account is poorly illustrated with only twelve colour photos and sixteen plates of *Cycas* illustrations reproduced from "Telopea". There are no detailed illustrations of *Bowenia*, *Lepidozamia* or *Macrozamia* and none of the new species are depicted. It is possible to

cite representative illustrations of each species, yet this has rarely been undertaken apart from some published in original descriptions. Some examples of suitable illustrations passed over by Hill include the rather splendid plates of *M. douglasii* W. Hill ex F.M. Bailey in the account of Ballard (1936) and the numerous photographs in Jones (1993), a publication which rather strangely is not mentioned anywhere in the text. The literature on cycads has in fact been very selectively cited or ignored throughout, for reasons obscure to this reviewer. Other examples are the important and detailed papers by Thieret (1958) on economic uses, Beck (1992) on Aboriginal usage of *Cycas* in Australia, and Ahern & Staff (1994) on coralloid roots in *Macrozamia communis*. Likewise the landmark work by Norstog & Nicholls (1997) could have been cited, although it is a relatively recent publication.

Despite the great plethora of new species descriptions for the Australian cycads that have been published in recent years it is unlikely that this flora account will be the last word on the subject. At least two further species of *Macrozamia* remain to be named, and perhaps one or two species of *Cycas* in Queensland. There are typification problems with quite a few of the names and it is possible that the application of some names of well known species could change. Differing and quite radical views as to taxon circumscription (e.g. de Laubenfels & Adema 1998) will also undoubtedly continue to occupy students of the group.

Hill and Osborne are in the process of producing a populist account of the Australian cycads derived from this flora account and to be published by PACSOA. The populist account will be light on taxonomic and nomenclatural detail and heavy on colour photographs. At around \$95 AUD the "Flora of Australia" volume is relatively good value for money (c. 12 cents a page), but will probably be more popular with libraries and collectors of books on the Australian flora, rather than cycad hobbyists who would be better off waiting for the picture book approach.

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 THIERET, J. 1958. Economic botany of the cycads. *Economic Botany* 12: 3-41.
 WILSON, G.W. 1996. Variation in floristic characteristics of *Bowenia serrulata*. *Encephalartos* 45: 12-13.

Paul I. Forster

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HODEL, Donald R. (ed.). *The palms and cycads of Thailand*. PATTYA (Thailand): Kampon Tansacha, Nong Nooch Tropical Garden, 1998. 190 Pages, 90 composite colour plates. Available from Allen Press (P.O. Box 1897, Lawrence, KS 66044-8897, U.S.A., E-mail orders@allenpres.com) at U.S. \$70, including surface postage (about R435 at current exchange rate).



This book consists of two separate sections, on palms and on cycads respectively. This review concerns the cycads only, while the section on palms is reviewed in *The Palm Enthusiast* (the journal of the Palm Society of South Africa).

The section on cycads was written by the doyen of *Cycas* taxonomy, Ken Hill of the Royal Botanic Gardens in

Sydney, Australia. In essence it is a user-friendly preview of his forthcoming scientific publication on *Cycas* in Thailand.

In recent years, Thailand has yielded a number of new *Cycas* species, so that the number of species has quadrupled since Smitinand's account of 1966 (The genus *Cycas* ... in Thailand, *Natural History Bulletin of the Siamese Society* 24: 163-175). In no small measure this is the result of the exploration instigated by Society member Kampon Tansacha, and the expertise of Ken Hill. Sadly, a number of these newly discovered species appear to be very restricted in their geographical distribution, so that their continued survival in nature is definitely at risk.

Not far from Bangkok lies Pattya, famous for its tropical beaches, and situated close by is the spectacular Nong Nooch Tropical Garden, a private enterprise of Kampon Tansacha's. This garden contains a splendid living collection of cycads and palms, amongst other plant groups, from all over the world. In addition to collating and caring for this enormous collection, Kampon is playing an increasingly important role in shouldering the burden of *ex situ* conservation and stimulating dissemination of information by publication. This book is one of the fruits of the latter initiative, and was published on occasion of the 1998 International Palm Society Biennial Convention hosted by the Nong Nooch Tropical Garden.

The section on *Cycas* comprises six pages of text plus six plates consisting of 27 individual colour photographs. Ten species are treated, of which *Cycas chamaoensis*, *C. clivicola*, *C. littoralis*, *C. nongnoochiae* and *C. tansachana* are to be described as new by Hill, and *C. pranburiensis* by Yang, Tang, and Vatcharakorn. *C. clivicola* consists of two subspecies which, in view of their wide geographical separation, may well eventually prove to warrant separate specific status.

The *introduction* is mercifully brief, stating the position of *Cycas* in the plant kingdom, and providing a generalised description of the genus. For those of us who think that the Thai *Cycas* species grow in lush, steaming jungle, the generalised description of their habitats will be illuminating:

"Cycads are distributed throughout Thailand, usually in more open, exposed, and often drier situations. Thailand has numerous isolated, limestone or granite mountains, and several, often endemic species are confined to these rocky monoliths. There they cling tenaciously to inaccessible cliffs and steep, rocky slopes. The plants are conspicuous and often the only vegetation in such instances, and their trunks are frequently prostrate, creeping, pendulous, or even saxophone-shaped. Such species include *Cycas clivicola* and the local endemics *C. tansachana*, *C.*

pranburiensis, *C. nongnoochiae*, and *C. chamaoensis*. Since many of these rocky monoliths are poorly explored, more careful and methodical searching may turn up additional species. Another species, *C. siamensis*, is widespread in the flatter plains separating these mountains. Three species, *C. pectinata*, *C. simplicipinna*, and *C. macrocarpa*, occur in the understorey of moist or wet forest."

These very words apply equally well to *Encephalartos* in Africa, and the good news for collectors is firstly that the Thai *Cycas* species are morphologically considerably more diverse than the Australian species on which most of our experience of the genus was hitherto based, and secondly that preliminary results indicate that they are far easier to grow under a range of conditions than the exasperatingly difficult Australian species.

There is an *identification* key based on both vegetative and sexual characteristics.

The treatment of individual species consists of a brief but apparently adequate *description*, a paragraph on *distribution* and *ecology*, *notes* which consist mainly of a comparison with other species with which it could be confused, and one or more excellent and well-reproduced coloured *photographs* of plants in habitat and usually male and female cones. There are no distribution maps.

Readers who already have TANG, YANG & VATCHARAKORN's little book, *Cycads of Thailand* (reviewed in *Encephalartos* 53: 33-35, March 1998) would want to know whether they should buy this book as well, especially since TANG *et al.* costs R20, and the new book R435. Both cover the same geographical area and the same species. The latest book is authoritative in the sense that HILL is the most knowledgeable expert on *Cycas* in the world, and this

book really comprises a user-friendly and illustrated extract of his definitive taxonomic treatment. TANG *et al.*'s booklet was written before the nomenclature of the new species was formalised, with the result that some of their names were spelled incorrectly: *Cycas nongnoochii* should be *C. nongnoochiae*, and *C. tansacha* should be *C. tansachana*. *C. macrocarpa* subsp. *brevidens* ascribed to Hill by TANG *et al.*, is not mentioned at all by HILL. Unlike Hill, Tang and his collaborators are not professional taxonomists, but they saw all the Thai species in nature, and Tang has some experience of growing them at the Fairchild Tropical Garden in Miami. Surprisingly TANG *et al.* have a better photographic coverage than HILL, their maps are a bonus, and their illustrations are scattered through the text instead of grouped into plates which are close to but not opposite the relevant text. Unlike TANG *et al.*, HILL has a short but quite essential bibliography of the titles. To my mind TANG *et al.* is a better designed effort and more pleasant to use, and readers may find that it is unnecessarily expensive to buy HILL's book if they are not interested in palms as well. It may well pay the publisher to separate the palm and cycad sections as two separate publications.

It seems likely that Kampon Tansacha and the Nong Nooch Tropical Garden will host the *Sixth International Conference on Cycad Biology* (CYCAD 2002) in three year's time, and this book will certainly be a most handy companion to take along to that illustrious occasion. Closer to home, I can recommend this as a useful albeit expensive source of the most recent information on the cycads of a very rich part of the range of *Cycas*.

Piet Vorster

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NEW CYCAD PUBLICATIONS

DOBRUSKINA, I.A. 1998. **Lunz flora in the Austrian Alps: A standard for Carnian floras.** *Palaeogeography Palaeoclimatology Palaeoecology* 143(4): 307-345.

[The Lunz flora of Niederösterreichische Alpen is the most famous and for a long time was the best known flora of the Carnian Stage (Upper Triassic). It occurs in marine deposits with marine invertebrates, so that its geological age is exactly known, so it provides a standard by which to correlate terrestrial floras of Carnian age to the marine Triassic time-scale. Fossil plants from the

Lunz beds were collected from more than ten localities in the Northern Limestone Alps not far from Lunz, where they are confined to the so-called "Lunzer Sandstein", which is part of the "Lunzer Schichten". The flora, reviewed and analysed here in detail, consists of numerous sterile leaves of Cycadophyta, of abundant ferns and Sphenopsida and of rare Ginkgophyta and Coniferophyta.]

Author's address: Hebrew Univ., Jerusalem, Inst. Earth Sci., Jerusalem 97904, Israel.

DE LAUBENFELS, D.J. & ADEMA, F. 1998. A taxonomic revision of the genera *Cycas* and *Epicycas* gen. nov. (Cycadaceae). *Blumea* 43(2): 351–400.

[The genus *Cycas* L. is divided into four subgenera, all new, and thirty species are described, of which two are new. A new Asian genus, *Epicycas* de Laub., is recognized for several *Cycas* species and one undescribed species with a subterranean bulbous stem base. Keys to the subgenera of *Cycas* and their species, and to the genus *Epicycas* are given.]

First author's address: Syracuse Univ., Dep. Geography, Syracuse, NY 13244, U.S.A.

HASEBE, M. 1997. Molecular phylogeny of *Ginkgo biloba*: close relationship between *Ginkgo biloba* and cycads. In Hori, T., Ridge, R.W., Tulecke, W., Tredici, P. del., Tremouillaux Guiller, J. & Tobe, H. (eds.) *Ginkgo biloba*: a global treasure. From biology to medicine. Tokyo: Springer-Verlag, pp.173–181. ISBN 44311702040.

HORI, T. & MIYAMURA, S.I. 1997. Contribution to the knowledge of fertilization of gymnosperms with flagellated sperm cells: *Ginkgo biloba* and *Cycas revoluta*. In Hori, T., Ridge, R.W., Tredici, P. del., Tremouillaux Guiller, J., & Tobe, H. (eds.) *Ginkgo biloba*: a global treasure. From biology to medicine. Tokyo: Springer-Verlag, pp.67–84. ISBN 44311702040.

OSBORNE, R. 1998. An update on cycad sex changes. *Cycad Newsletter* 21(2): 3–5.

[A summary is provided of all 20 the documented cases of cycad sex changes which are considered scientifically credible. He also records the sex change of three of 12 male *Cycas taitungensis* specimens following their transplantation during 1997.]

Author's address: Cycad Connections, P.O. Box 244, Burpengary, Queensland 4505, Australia.

SHARMA, I.K., JONES, D.L. & FORSTER, P.I. 1998. Contribution of isozymic analysis in differentiating *Macrozamia moorei* D.L. Jones and K.D. Hill from *M. johnsonii* F. Muell. (Zamiaceae). *Austrobaileya* 5(2):

363–365.

[*Macrozamia johnsonii* D.L. Jones & K.D. Hill was recently segregated from *M. moorei* F. Muell. (Jones & Hill 1992) based on morphological characters, in particular, differences in the seedlings and plant habit. Populations of the two species are also disjunct, being separated geographically by a distance of 800 km. The results obtained in the present paper provide supportive evidence for distinguishing *M. moorei* and *M. johnsonii* as distinct species.]

First author's address: Plant Biodiversity Research, GPO Box 1600, Canberra, ACT 2601, Australia.

STEVENSON, D.W., MORETTI, A. & GAUDIO, L. 1995–1996. A new species of *Zamia* (Zamiaceae) from Belize and the Yucatan Peninsula of Mexico. *Delpinoa*, n.s. 37–38: 3–8.

[A new species, *Zamia polymorpha* D. Stevenson, Moretti & Vazques Torres from the Yucatan Peninsula and Belize, is described. It appears to be related to but cytologically, morphologically, geographically, and climatically separated from *Zamia loddigesii* Miq.. Chromosome number varies from $2n = 17$ to $2n = 22–28$.]

First author's address: New York Bot. Garden, Bronx, NY 10458, U.S.A.

STEVENSON, D.W., SABATO, S., MORETTI A. & DE LUCA, P. 1995–1996. What is *Zamia fischeri* Miquel? *Delpinoa*, n.s. 37–38: 9–17.

[Most specimens and plants in cultivation of *Zamia fischeri* Miquel, a Mexican cycad belonging to the Zamiaceae, do not conform to the description and illustrations provided by Miquel. These plants have more leaves, larger leaves, a different leaflet shape and texture, and $2n = 18$ instead of $2n = 16$ found in *Zamia fischeri*. Accordingly, the disparate element commonly called *Z. fischeri* is referred to a new species, *Z. vazquesii* D. Stevenson, S. Sabato & P. De Luca.]

First author's address: New York Bot. Garden, Bronx, NY 10458, U.S.A.

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

Nominations for new Council: 2000 to 2002

Prof. Frederick de Jager, present president of our Society, announced that he will not be available as president for the next term of two years. We invite members to submit (to the present president) nominations for Council members (president, secretary-treasurer, editor and regional officers) for the next two-year term, not later than 31 August 1999. Each nomination must be signed by the nominee to confirm his/her acceptance of the nomination.

Sunday Tribune, 7 February 1999

Most noble plant of them all

MYRTLE RYAN

When Rosemary Ladlau saw the lovely picture of a cycad by Durban artist Douglas Goode she knew she had found the perfect prize to award at the World Flower Show.

Douglas Goode loves cycads. They touch his spirit and stimulate his artistic talents. So he was delighted when he was commissioned to produce two studies of these ancient plants as prizes for the winners of the Horticultural Perfection category.

He chose to draw the *Encephalartos woodii* as he believed it would have been seen in the Ngoya Forest north-east of Mtunzini – primeval and proud on a hillside, with its colours etched against a sparse backdrop of trees.

The other study – the one he confesses is his favourite because it embodies the spirit of the cycad – is a close-up of leaves and a cone.

"The cycad is the Rolls-Royce of the plant kingdom," he said. "The orchid takes only second place."

But Douglas and Greg Hayes of Stepping Stones (who handle the printing and framing of all Doug-



CYCAD BOFFIN: Douglas Goode (left) and Greg Hayes

las's work) wanted the winner to take home more than just a work of art. So they chose repulped cycad fibre for the "canvas". Greg insisted they use old leaves.

Douglas's love affair with cycads has taken him all over Africa. "I spent 20 years researching my book *Cycads of Africa*," he said. "I started in 1964, planning only to depict the South African species. But my friend Ian Sinclair per-

suaded me to cover all the African cycads. At that time there were 56 known species in Africa, 27 of which were in southern Africa. Now there are 13 additional species and I intend capturing these in a new edition," he said.

Those who would like to see more of Douglas's work can visit the Exhibition of Botanical Art which opens at the NSA Galleries this afternoon at 4pm.

Nominasies vir 'n nuwe Raad: 2000 tot 2002

Prof. Frederick de Jager, die huidige president van ons Vereniging, het te kenne gegee dat hy nie vir die volgende termyn van twee jaar beskikbaar sal wees nie. Ons versoek lede om voor 31 Augustus 1999 nominasies in te stuur (aan die huidige president) vir Raadslede (president, sekretaris-tesourier, redakteur en streeksverteenvoerders) vir die volgende termyn van twee jaar. Elke nominasie moet deur die genomineerde onderteken word om sy/haar aanvaarding daarvan te bevestig.