

# ENCEPHALARTOS

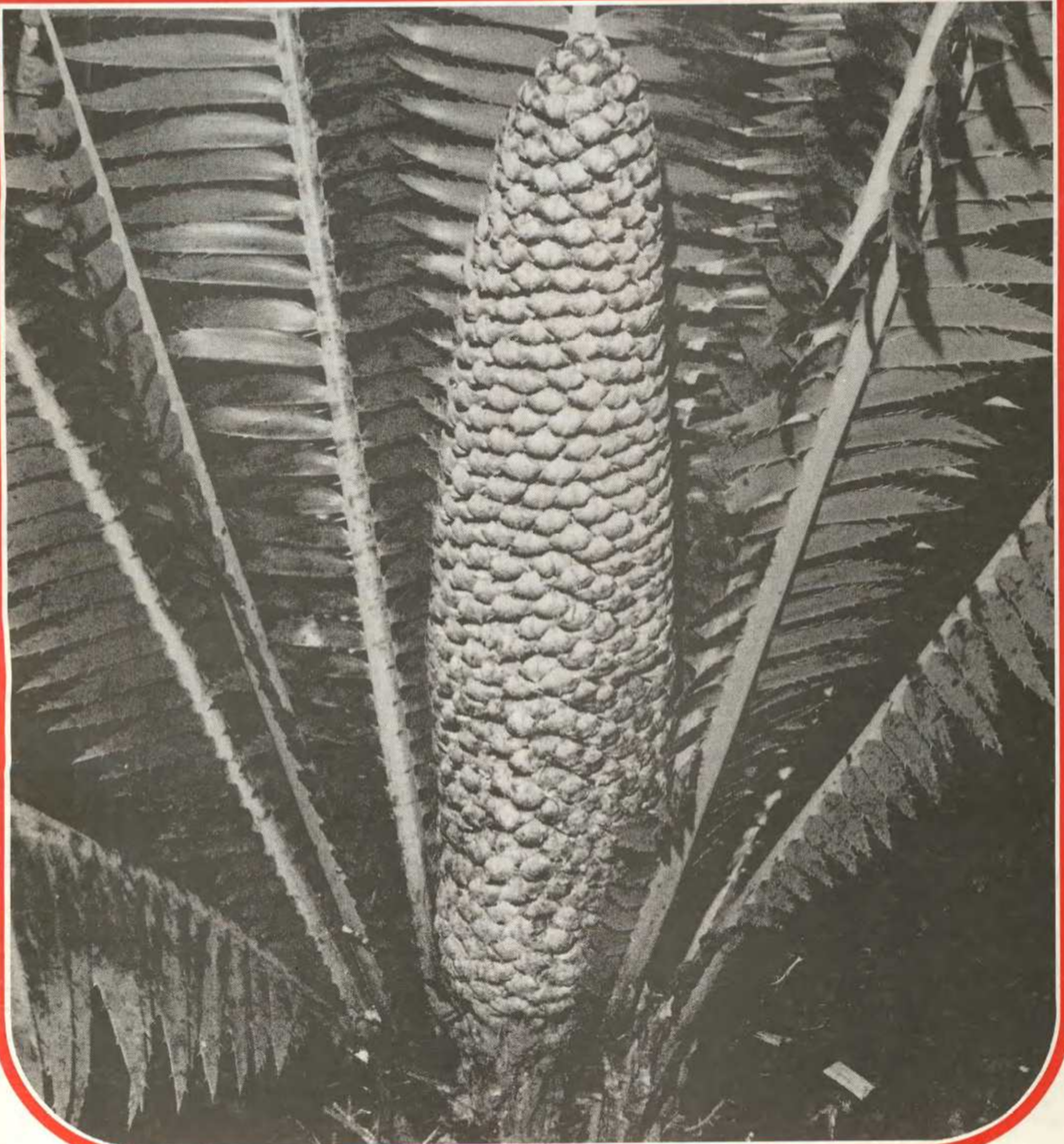
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SOUTH AFRICA

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BROODBOOM VERENIGING  
VAN SUID-AFRIKA

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**COVER / VOORBLAD :** *Dioon spinulosum*

Male cone, approximately 400 mm long, on a plant coning for the first time.

Photo: Piet Vorster

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## FROM THE PRESIDENT

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You have just received this issue, No. 50, of "Encephalartos" and with the rest of the members of our Society, has reached a milestone in the history of the journal. To celebrate this momentous occasion, we wanted to enclose, for your convenience, an index to all the articles and notes that appeared in the previous issues, as well as those of No. 50. Although the index was compiled, it is not in a shape to be published as yet, and will be published in No. 51. This index will help members to track articles of interest in issues that they might not have. One of our members also compiled an "in-depth" index that is available either on hardcopy (paper printout) or on 1.44 Mb "stiffy" disk. He has made this index available to the Society as a small fundraising project and if you are interested you can contact me. The latter index will also be regularly updated. A brief description of this index is supplied elsewhere in this issue (see p. 26).

Also included in this issue is a list of members of the Society, with their membership numbers and addresses. Please check your own details and let us know if anything is wrong or missing. Since the foundation of the Society, member numbers were allocated in numerical order, starting with 1 and we have just reached number 2176. Unfortunately members come and go at a tremendous rate and only about 700 names are included in the present list. Over 200 of the members whose names appeared in the previous list (*Encephalartos* 45: 27-43, March 1996), have not renewed their membership for 1996 and we were forced to remove their names from the new list. A similar trend is repeating itself this year, since another 200 members have not renewed their membership for 1997. These names are still on the present list, but due to financial reasons, they will not receive this issue of the journal and will not do so until they are fully paid up. Could any of the members make any suggestions as to how we could persuade members to keep up their membership?

Together with No. 49 of "Encephalartos", some of the overseas members received a letter informing them that the amount they had paid for renewal of their membership did not cover airmailing of the journal. Lately we were not stating the exact amounts of membership fees in foreign currencies and this might explain why members were not quite sure how much to pay. In future the exact amounts for membership fees in American, Australian and British currencies will be supplied on renewal forms as well as forms for new membership.

Hannes Robbertse

## VAN DIE PRESIDENT

---

U het pas hierdie uitgawe, nr 50, van "Encephalartos" ontvang en het saam met die res van die lede van die Vereniging 'n mylpaal in die geskiedenis van die tydskrif bereik. Om hierdie gedenkwaardige gebeurtenis te vier, wou ons vir u gerief 'n volledige indeks insluit van al die artikels en berigte wat in vorige uitgawes sowel as in nr 50 verskyn het. Alhoewel die indeks reeds voltooi is, is dit nog nie gereed om gepubliseer te word nie, en sal dit in nr 51 verskyn. Hierdie indeks behoort u te help om vorige artikels maklik op te spoor; veral as u nie self 'n bepaalde uitgawe besit nie. Een van ons lede het self ook 'n volledige indeks opgestel wat as 'n drukstuk en op 'n 1.44 Mb "stiffie" vir gebruik in u rekenaar beskikbaar is. Hy het die indeks aan die Vereniging beskikbaar gestel om daarmee bietjie fondse in te samel en indien u belangstel kan u my kontak. Genoemde indeks sal ook gereeld opgedateer word. 'n Kort beskrywing van die indeks verskyn elders in hierdie uitgawe van die tydskrif (kyk p. 26).

'n Lys van die name en adresse van die lede van die Vereniging word ook in hierdie uitgawe ingesluit en u word versoek om u eie gegewens te kontroleer en ons te laat weet indien iets ontbreek of as daar foute is. Sedert die stigting van die Vereniging is daar by nommer 1 begin en aan elke nuwe lid 'n volgnummer toegeken en ons het reeds nr 2176 bereik. Ongelukkig kom en gaan lede teen 'n geweldige tempo en slegs ongeveer 700 name verskyn op die huidige lys. Meer as 200 name moes van die vorige lys (*Encephalartos* 45: 27-43, Maart 1996) verwyder word omdat die lede laas in 1995 betaal het. 'n Soortgelyke tendens word hierdie jaar herhaal in die sin dat 'n verdere 200 lede nog nie hul ledegeld vir 1997 betaal het nie. Die name van hierdie lede is nog op die huidige lys, maar as gevolg van finansiële oorwegings sal hulle nie hierdie uitgawe van die tydskrif ontvang nie, tot tyd en wyl hulle hul ledegeld betaal het. Is daar enige van die lede wat 'n voorstel het oor hoe ons lede kan aanmoedig om hul ledegeld gereeld te betaal?

Tesame met nr 49 van "Encephalartos" het sekere buitelandse lede 'n brief ontvang waarin hulle in kennis gestel is dat die bedrag wat hulle vir ledegeld betaal het, nie die koste van lugposversending van die tydskrif dek nie. Ons het wel in die laaste tyd nie meer die presiese bedrae wat lede aan buitelandse geld vir lidmaatskap moes betaal in die tydskrif verstrek nie. In die toekoms sal die bedrae in Amerikaanse, Australiese en Britse geldeenheide in die hernuwingsvorm asook in die vorm vir aansoek om nuwe lidmaatskap aangedui word.

Hannes Robbertse

# FOCUS ON ...

# FOKUS OP ...

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

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

## *DIOON SPINULOSUM* Dyer

William Tang

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

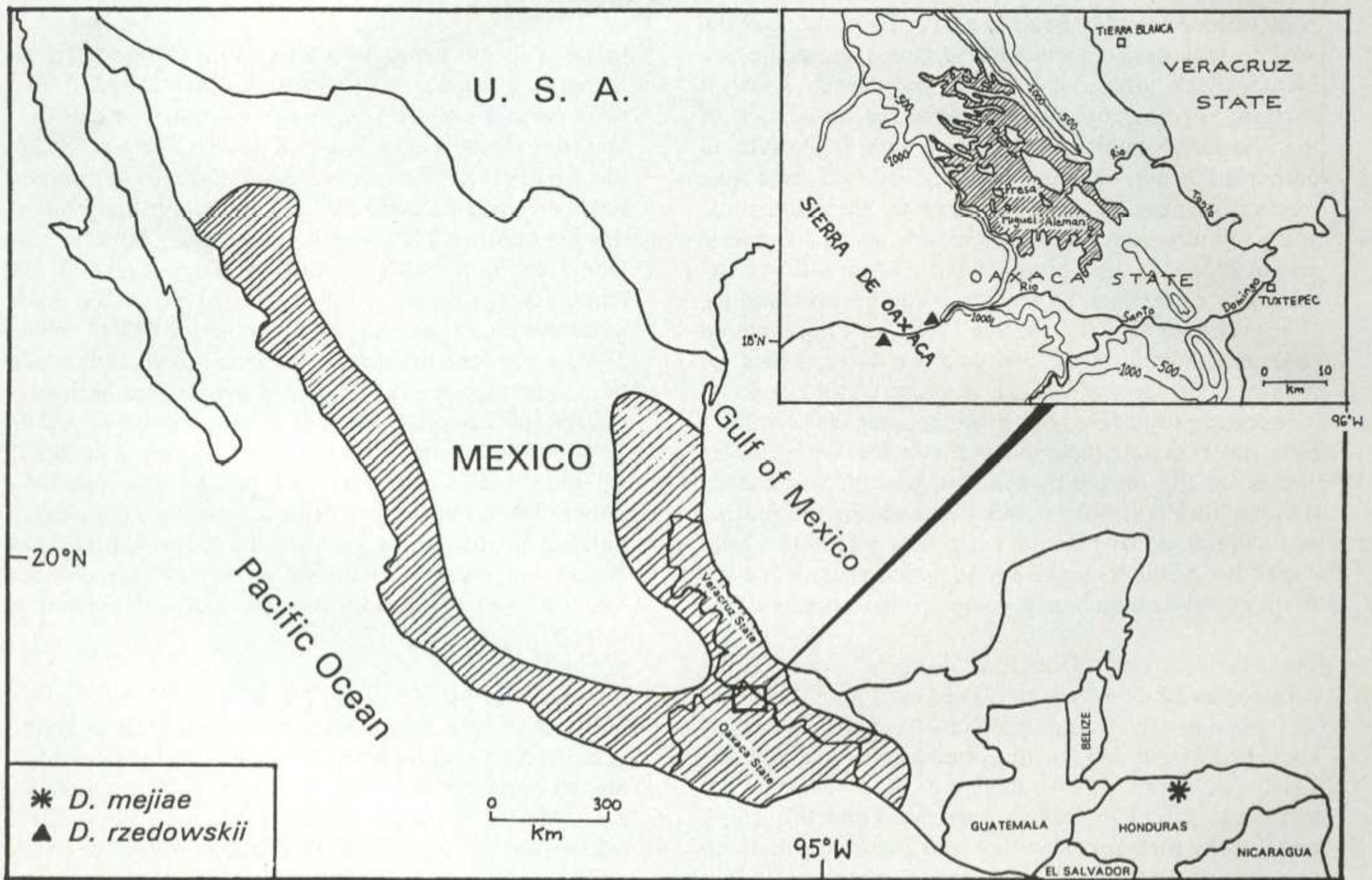


Figure 1 Map of Mexico and northern Central America showing the distribution of *Dioon* in Mexico (indicated by shaded area). One species, *D. mejiae*, occurs in Honduras (indicated by the star). *Dioon spinulosum* occurs in southern Mexico within the rectangle, which is magnified and shown in detail in the upper right corner. *Dioon spinulosum* originally extended from near Tierra Blanca to the south of Tuxtepec at elevations below 1000 ft (300 m) indicated by elevation lines on the map. Much of this habitat was drowned by the construction of the dam "Presa Miguel Aleman". Maps based on Moretti *et al.* (1993) and De Luca *et al.* (1980).



Figure 2 *Dioon spinulosum* in habitat in Oaxaca, Mexico.

## INTRODUCTION

*Dioon* is a cycad genus of the New World. It has a relatively limited distribution within the countries of Mexico and Honduras (Figure 1). Fossils of *Dioon*, however, are known from the Oligocene and Miocene periods, 20-35 million years ago, in California, Oregon and southern Alaska (Hollick 1932; M. Blumler, H. Meyer *pers. comm.*). These fossils indicate that this genus once had a wider range in North America when warm moist climatic conditions extended further north. Drier colder climates in more recent epochs appear to have shrunk the geographic range of *Dioon* to that of the present day.

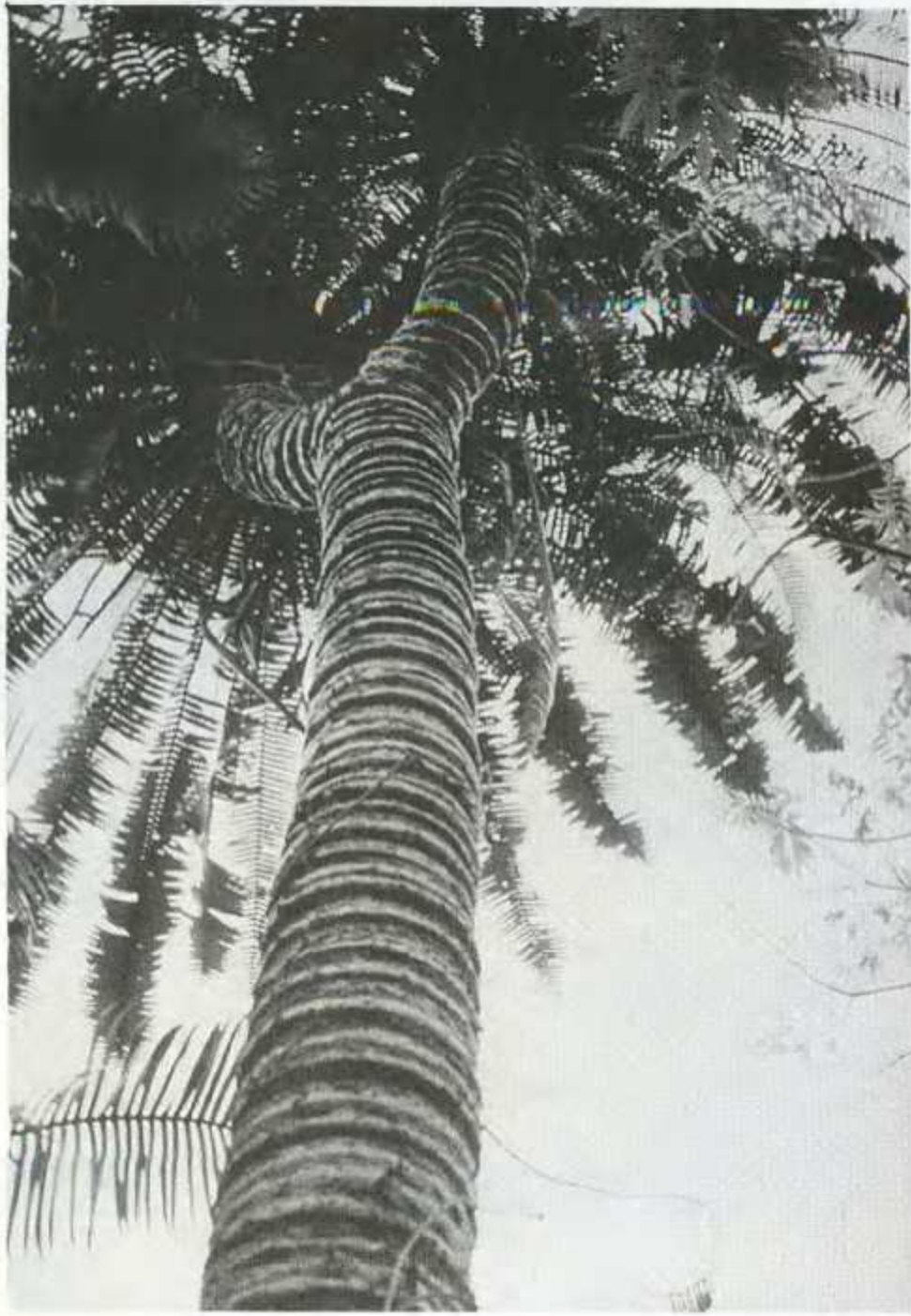
Dioons are small to large cycads with tough, spiny foliage and aerial trunks (Sabato & De Luca 1985). They are found from moist lowland forest habitats to high desert. One of the most ornamental species of this genus is *Dioon spinulosum* Dyer (see Figures 2, 3), a tall-trunked species with relatively wide leaflets. This species was first described in 1883 by the English botanist W.T. Thistleton Dyer, based on trunks and small leaves of plants grown in an European conservatory, that originated from Mexico (Eichler 1883, Dyer 1883). The description of this species was further elaborated on by the famous American cycadologist

Charles Chamberlain in 1909, based on field studies in Mexico and examination of cones.

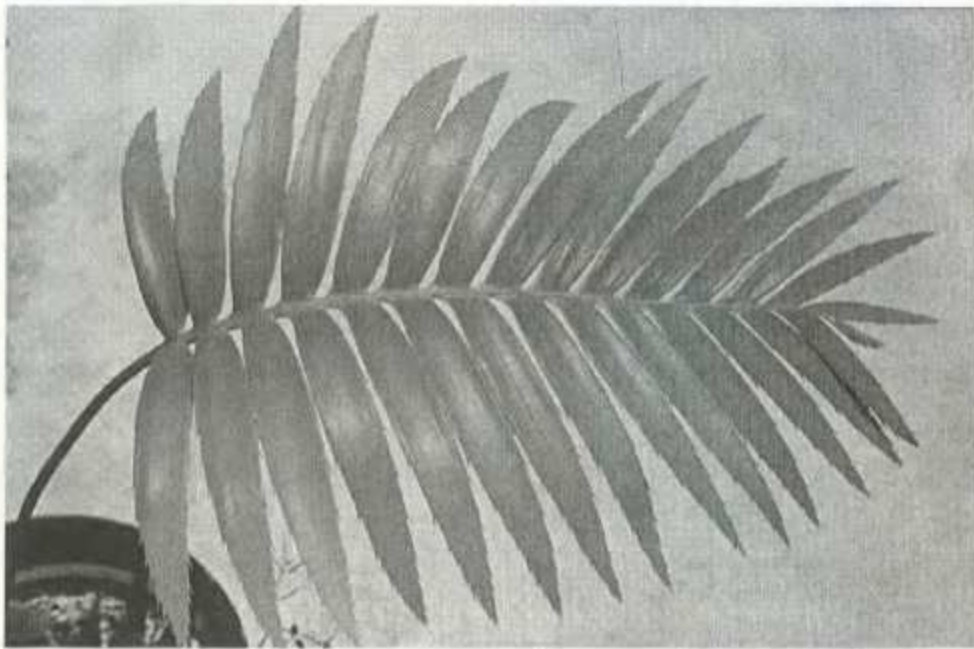
## DESCRIPTION

### 1. LEAVES

Upon emergence the unexpanded leaves of *Dioon spinulosum* are covered with sparse silvery hair. Fully expanded, the seedling and adult leaves differ in the length and armature of the petiole. The young plant has long unarmed petioles, which help to raise the leaves toward light, and the transition from unarmed petiole to leaflet is abrupt (Figure 4). As a young plant of *D. spinulosum* grows larger and more than one leaf is produced per leaf flush, the petiole changes. At this stage and throughout adulthood the leaf essentially has no petiole; the spiny leaflets gradually reduce in size to multi-pointed prickles almost all the way down to the leaf's point of attachment to the stem (Figures 9-11). Newly emerged leaves have a bloom which give them a bluish cast. At maturity the leaves may range from about 1.5 to 2.2 metres long, depending on the robustness of the specimen. The dark green leaves arch and have a thick hard texture and a waxy coating which gives them an almost plastic appearance. A crown may



**Figure 3** An unusual branched specimen of *Dioon spinulosum* in habitat, Oaxaca, Mexico.



**Figure 4** A seedling of *Dioon spinulosum* in cultivation showing the shape of the juvenile leaf.

hold three or more flushes of leaves with 20-30 or more leaves, giving it a full round appearance. A leaf may have 80-177 pairs of subopposite leaflets, 140-200 mm long and 10-20 mm wide, with 5-8 sharp spines on each margin of leaflets on a large leaf. Occasionally there are specimens with no spines on the margin of the leaflets. The leaves are quite durable and may remain green and

fresh-looking for a week or more after being removed from the plant.



**Figure 5** A seedling of *Dioon spinulosum* growing in a limestone crevice in habitat in Oaxaca, Mexico.



**Figure 6** The lower stem of an old plant showing a smooth texture, in the garden of Loran Whitelock, Los Angeles, California.

## 2. STEM

Like most cycads with aerial trunks the stem is covered by leafbases (Figures 8, 14). In older specimens the leafbase pattern becomes obscured and the trunks



Figure 7 A large plant growing on exposed limestone, in habitat, Oaxaca, Mexico.

have a somewhat smooth appearance (Figures 3, 6). The apex is covered by a layer of greyish hairy scale leaves (Figures 9-11). This is the tallest cycad in the western hemisphere and one of the tallest growing of all cycads, with trunks in the wild reported at over 16 metres in height (Chamberlain 1909). It is a relatively fast growing species - in cultivation trunks may grow 140 mm between yearly leaf flushes (Tang 1991). Trunks rarely branch (Figure 3), but may occasionally produce suckers, especially if the trunk is leaning. I have found the trunks of this cycad to be one of the easiest to reroor. A 700 mm section of trunk of a male plant broken off during a hurricane at Fairchild Tropical Garden in 1992, reroored quickly in sharp sand after lying in partial shade for a month (see Figure 8). Sixty millimetre sections cut from this trunk also reroored, each producing several suckers.

### 3. ROOTS

*Dioon spinulosum* grows in the wild on limestone substrates. Its root system is extensive and vigorous, enabling it to reach moisture deep in rock crevices (Figure 7). Chamberlain (1909) writes about plants in

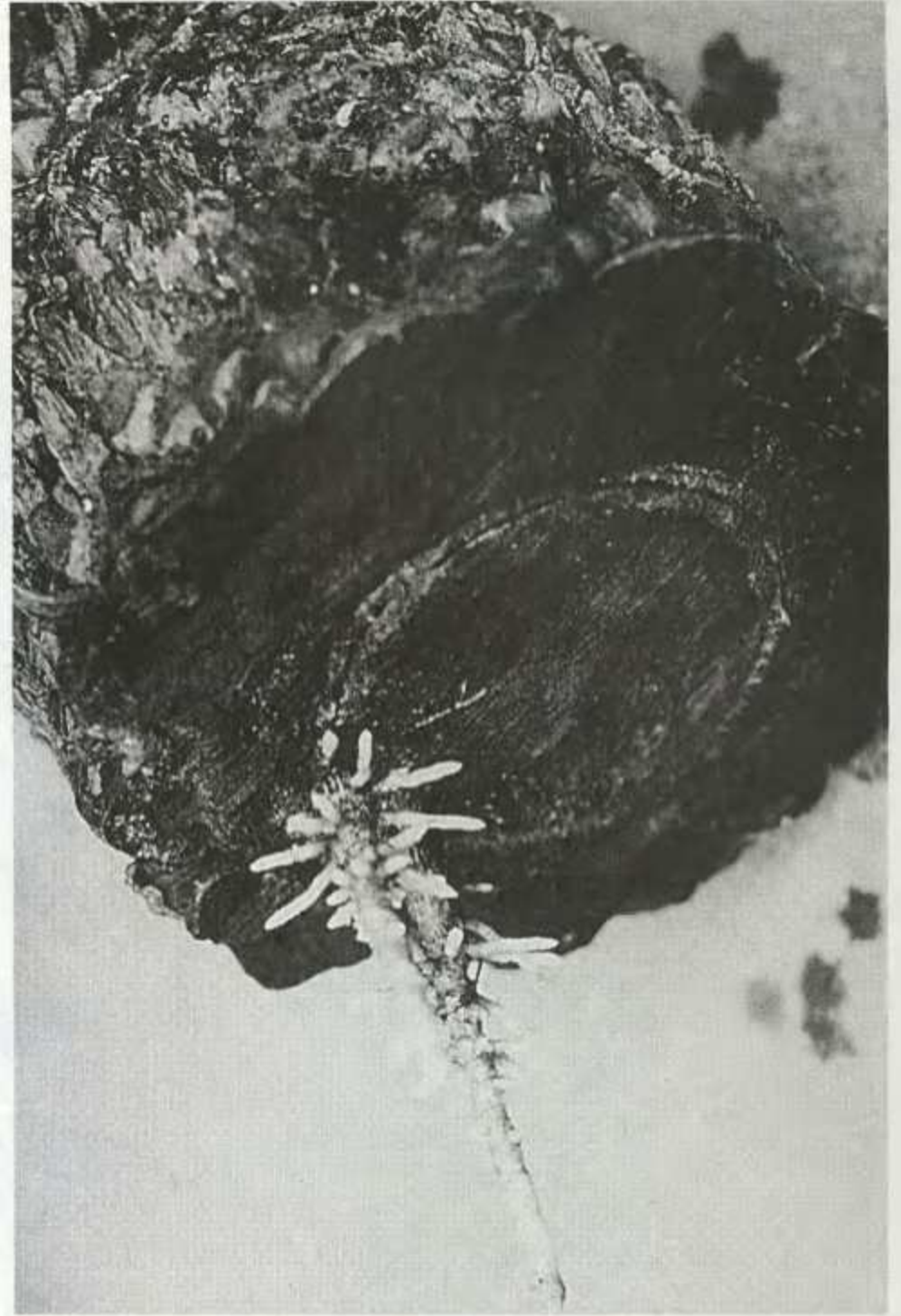


Figure 8 A cut stem of *D. spinulosum* with new roots emerging from the vascular ring.

the wild: "The roots are often exposed for considerable distances, especially in precipitous places, where a root may hang down along the surface of a rock. One root hanging down this way was exposed for a distance of more than 12 m and was 50 mm in diameter where it again entered the soil."

This is a species which responds well to ample watering and young plants require regular watering as well as warmth to establish themselves. Once established, it can endure periods of dry weather, but will suffer during droughts.

### 4. CONES

The cones of both male (Figures 9, 10) and female (Figure 11) are covered with dense silvery grey hairs. Male cones are 105-120 mm wide and elongate rapidly when they are shedding pollen (Figure 10), lengthening 10-20% per day. During their pollination phase, which occurs in July and August in south Florida, both male and female cones produce heat in a daily cycle (Tang 1987, see Figure 12) and release an unpleasant odour. Both heat and odour are believed to play a role in insect

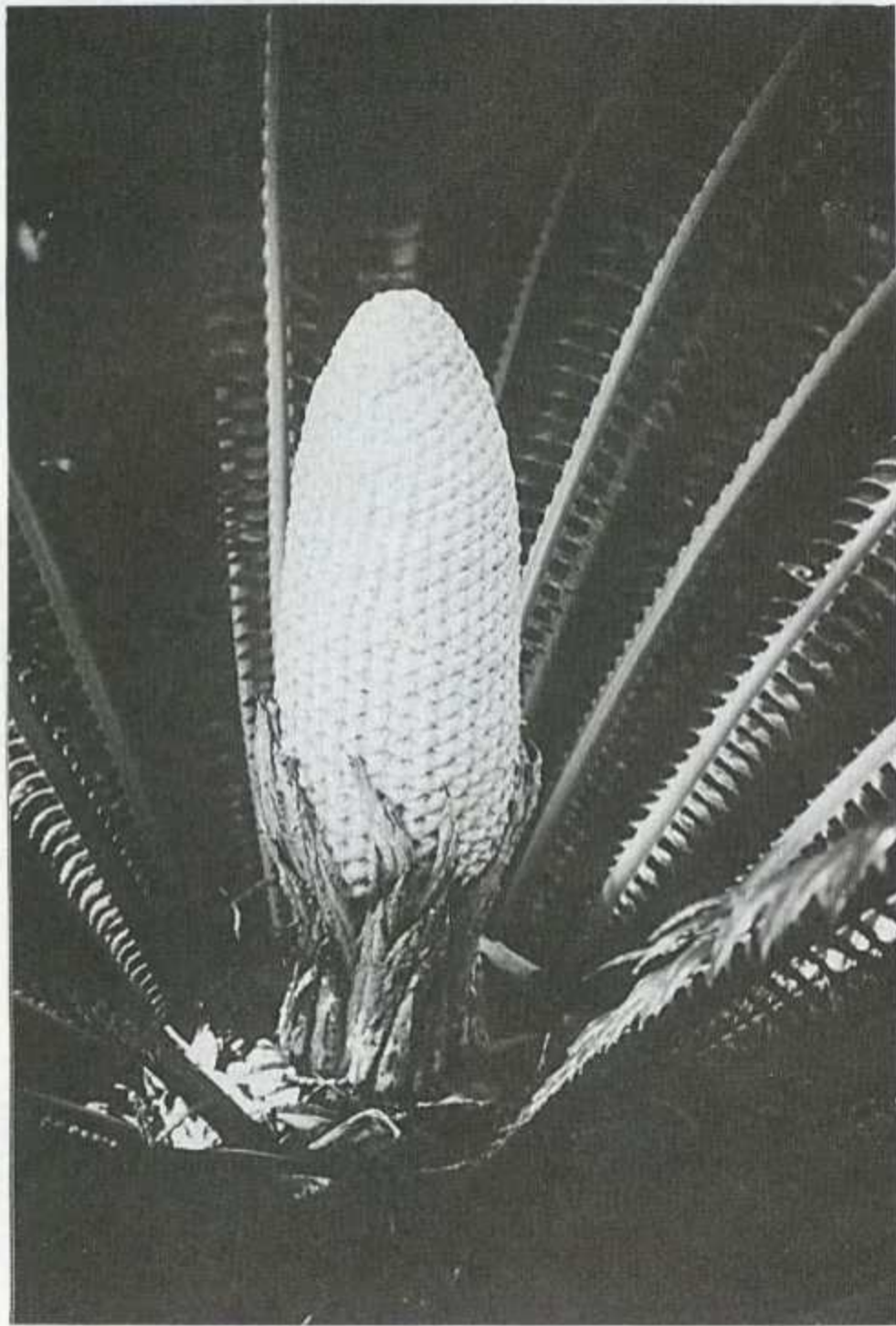


Figure 9 The stem apex of a male plant with an immature cone, showing the shape and texture of the scale leaves.

pollination. Female cones of *Dioon* are unique in the family Zamiaceae in that the sporophylls (scales) are leaf-like and hairy and the tips overlap one another, except at the base adjacent to the stalk, where the scales are small. Niklas and Norstog (1984) noted that these small scales at the junction with the stalk open for receptivity to pollination. Apparently, weevils of the genus *Rhopalotria* (family Belidae, subfamily Oxycoryninae, tribe Allocorynini, see Oberprieler 1995) acts as pollinators. I have found weevils of this genus in wild male cones and inside cultivated female cones in the spaces between the cone axis and ovules (see Figure 13). After pollination the female cone grows considerably and hangs down from the crown on its long stalk (Figures 11, 14, 15), measuring up to 500 mm long and 270 mm wide and weighing as much as 15 kg. This is among the largest for cycad cones. After pollination the female cone will remain intact for 15-16 months before releasing the seeds. The seeds are large and consist of a yellow fleshy outer layer which rots quickly after the release of the seeds from the cone. With the fleshy coat removed the seed may be 21-27 cc in volume. The seeds germinate rapidly, some even before falling from the cone. In the wild the seeds may be dispersed

by mammals, such as peccaries which feed on the fleshy outer coat. A large seedling will emerge from the seed and a first-year seedling may be approximately the size of a 2-3 year old seedling of many South African *Encephalartos*.

#### AFFINITIES AND DIAGNOSTIC FEATURES

Based on leaf and cone characters as well as DNA analysis (Moretti *et al.* 1993), the closest relative of *Dioon spinulosum* is *D. rzedowskii*. *Dioon rzedowskii* occurs in close geographic proximity to *D. spinulosum* in the mountains of the Sierra de Oaxaca (see Figure 1) at altitudes of 650-850 m in relatively more open forest than *D. spinulosum*. It differs from *D. spinulosum* in that the leaflets in mature leaves are entire and without spines. Also, the emerging leaves of *D. rzedowskii* are densely hairy instead of sparsely hairy as in *D. spinulosum*. Some consider the two to be forms of a single species. The only other described species of *Dioon* which is closely related is *D. mejiae* of Honduras (Figure 1). This is also a tall forest species. It can be distinguished from *D. spinulosum* in that its leaflets have only a few spines on the margins or none at all and the leaves are stiff and straight instead of arching. Its female cones differ also, in that their stalks are much shorter and the cones do not hang from the crown as in *D. spinulosum*.

#### GEOGRAPHIC DISTRIBUTION AND HABITAT

*Dioon spinulosum* occurs naturally in a seasonally moist area of southern Mexico at elevations of 0-300 m in lowlands and hills at the foot of the Sierra de Oaxaca (Figure 1). It once occurred in southern Veracruz state near Lake Catemaco, where clearing of forest and removal of plants from habitat has caused its virtual extinction in that region. It is still to be found in the adjoining area of Oaxaca state from around the town of Ciudad Aleman south down through Tuxtepec and west as far as Ojitlan. Around Tuxtepec it was once said to be so common that in some places it is almost the only large plant, forming something like a "*Dioon* forest" (Chamberlain 1919). In the area of Ciudad Aleman it was also once very abundant, however, a large section of this habitat was drowned by the construction of the dam "Presa Miguel Aleman" in the 1960's. *Dioon spinulosum* is still to be found along the shores of the lake created by this dam and thousands may still occur on the islands that protrude from this lake. The habitat of *D. spinulosum* is a seasonally dry tropical moist forest. This cycad grows as an understory plant and occasionally as a canopy emergent. During the dry season some of the trees in this forest become deciduous, however, in the wet season it is hot and wet and considerable rainfall may occur. The substrate of the area is predominantly limestone (see Figures 5, 7). Other cycads are found in

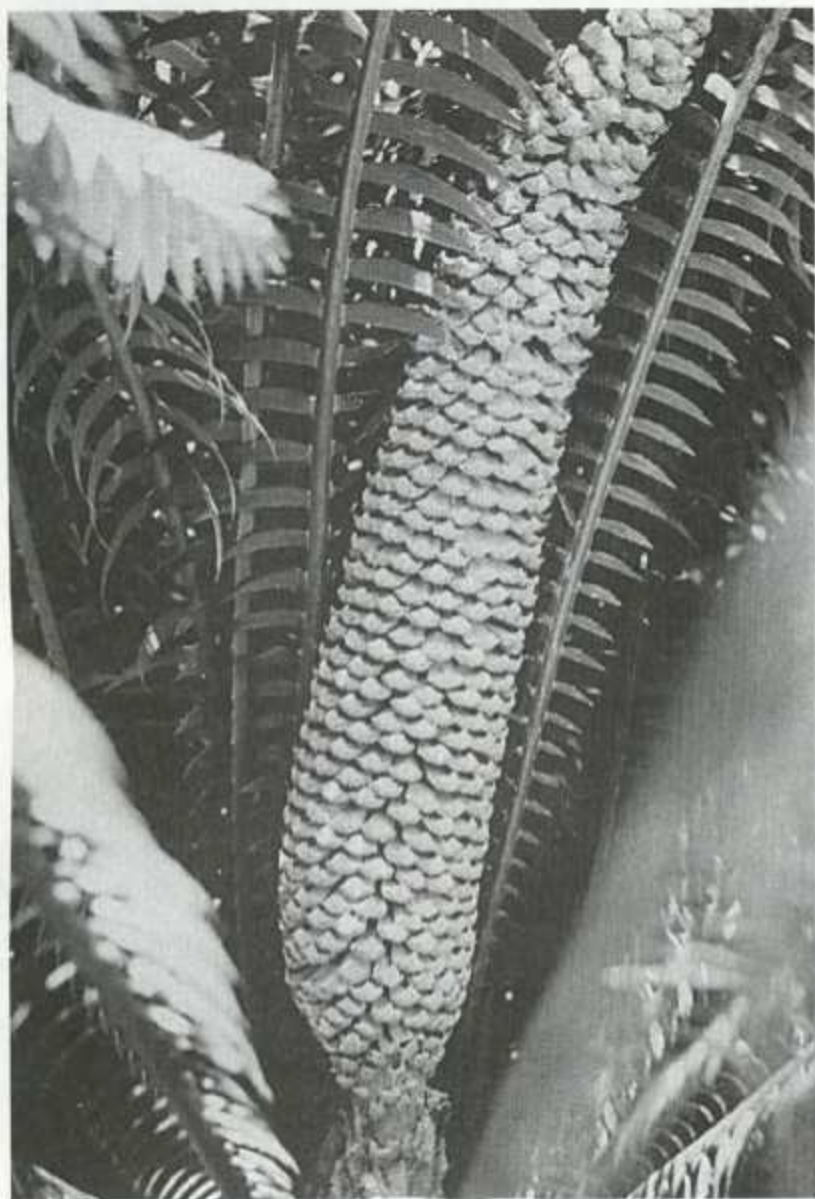


Figure 10 A male cone during pollen shedding.



Figure 11 A female with one maturing cone hanging from the crown and another receptive to pollination at the apex. Note the openings on the younger cone where the cone meets the cone stalk. It is through these openings that pollinating beetles enter.

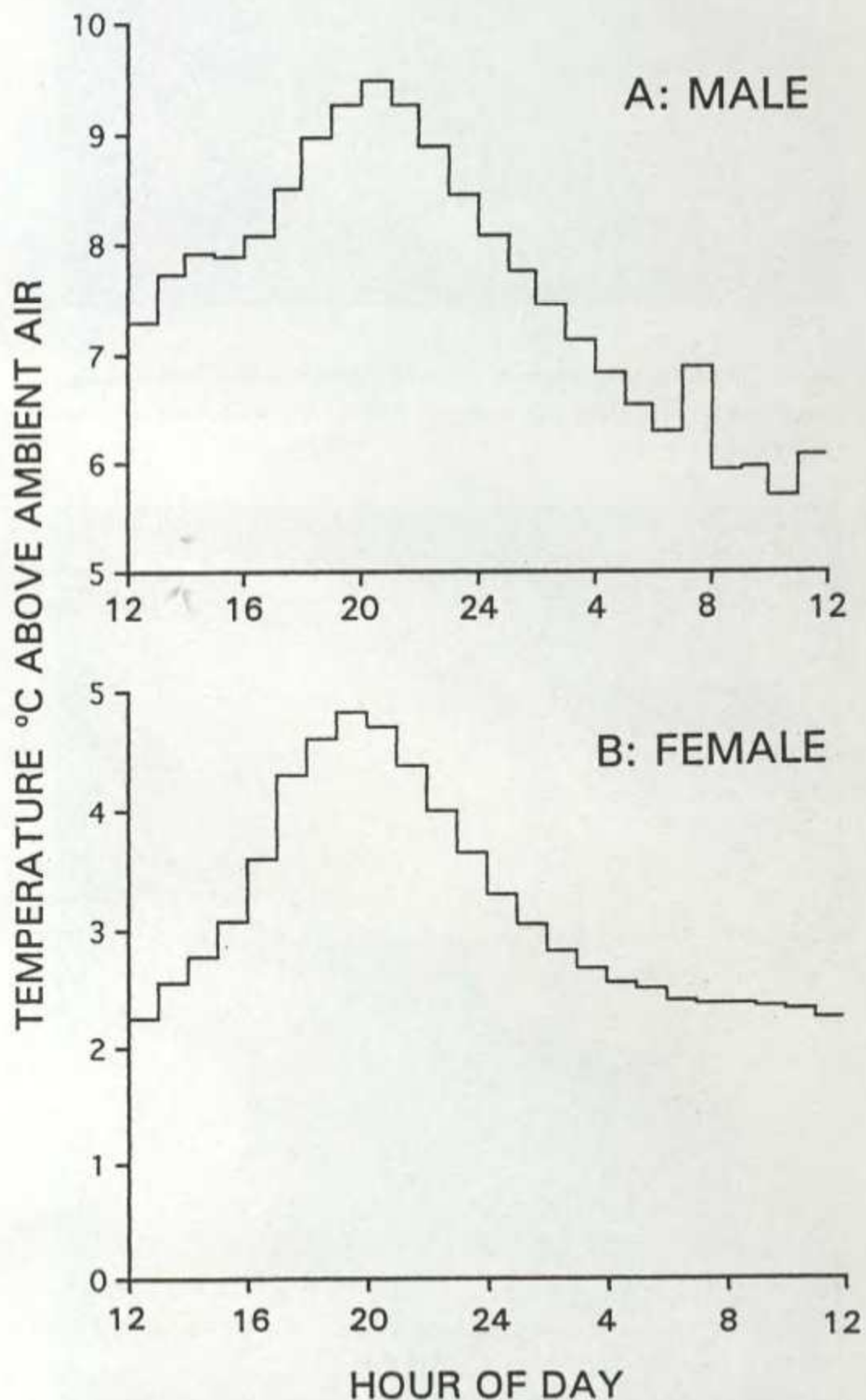


Figure 12 Temperature of *Dioon spinulosum* cones above that of the ambient air over a 24 hour period for: A) a male cone during pollen shedding and B) a female cone during receptivity to pollination. Cones were removed from plants and brought indoors, where ambient air temperature was maintained at  $24 \pm 0.5^\circ\text{C}$ .

the near vicinity of *D. spinulosum*, including *Zamia loddigesii* and a form of *Ceratozamia robusta*.

#### CULTIVATION

*Dioon spinulosum* can grow under a wide range of light, soil and climatic conditions. It grows best in conditions similar to its native habitat - humid tropical to

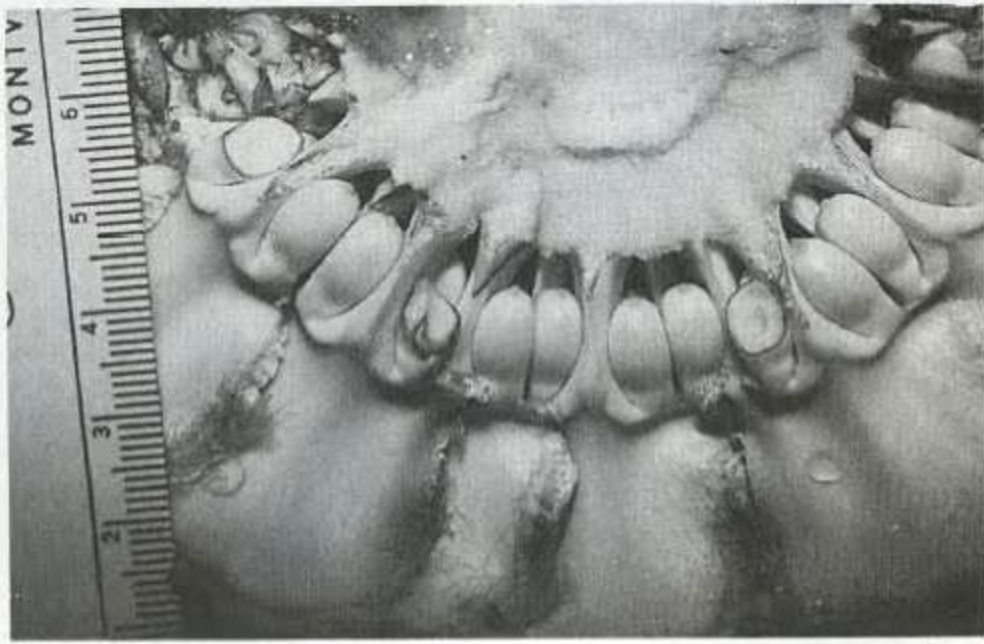


Figure 13 A female cone of *D. spinulosum* at pollination, cut transversely, showing the space between the axis and ovules. Scale: mm.



Figure 14 A ripe female cone breaking apart, at Fairchild Tropical Garden.

subtropical climate with plenty of rainfall, its vigorous root system allows it to grow well in porous soils such as limestone as well as sandy soils. When planting, loosening of soil and the addition of humus are recommended. It can grow in low light situations, making it suitable for shady spots in the garden or as a

houseplant. It can also grow in full sun, but does best with some afternoon shade. It likes heat and humidity and its growth rate can be rapid for a cycad if sufficient fertilizer and water are provided. In the mainland U.S. it shows its most luxuriant growth in the moist subtropical climate of south Florida, but also does well in southern Texas and Louisiana. In California it can be cultivated outdoors from San Diego and Los Angeles to as far north as the San Francisco Bay Area. In South Africa it is best suited for the coast of Natal, but will grow from the Cape to lower elevations of the Northern Province. In Australia it grows well in the tropical zones from the Northern Territory down the Queensland coast into northern New South Wales. It prefers conditions similar to *Encephalartos villosus* or *Lepidozamia hopei*. Large healthy specimens can withstand mild frosts, but the leaves of *D. spinulosum* will be killed by temperatures below  $-7^{\circ}\text{C}$  ( $20^{\circ}\text{F}$ ) (Whitelock 1994).



Figure 15 A disintegrating female cone, with no fertile seeds, at Fairchild Tropical Garden.

#### HUMAN USE AND CONSERVATION STATUS

*Dioon spinulosum* has been much reduced from its original numbers, particularly by dam construction and land clearing in the last four decades. In the most

recent survey approximately 5 000 plants are estimated to remain in the wild (Osborne 1995) and it is categorized as "rare". In some Indian communities within its range, seeds of *D. spinulosum* are used as an ingredient in tamales and in sweet snacks. The main use of this plant is, however, as an ornamental, both domestically and abroad. In the 1960's lots of 30 000 plants were available for sale for as little as six pesos per stem (Vovides *et al.* 1992). Importation records from the United States indicate that the last large shipment of wild-collected plants of this species was exported from Mexico to the U.S. in 1987. Undoubtedly plants continue to fall as its forest habitat continues to be cleared. It remains a popular ornamental in Mexico and plants probably continue to be removed from the wild for local markets.

#### ACKNOWLEDGEMENTS

I thank Loran Whitelock for his assistance and Andrew Vovides for showing me these plants in habitat in 1987.

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## ARTICLES / ARTIKELS

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### GROEIPATRONE VAN *ENCEPHALARTOS MANIKENSIS* BLARE

Erik Rouwenhorst

Posbus 620, 2940 Newcastle

Ontvang 3 Februarie 1997

'n Mens is altyd opgewonde as jou broodbome nuwe blare spruit na die periode van rus in die winter. By die meeste plante vind dit jaarliks plaas, maar by ander kan dit 'n gebeurtenis wees wat net elke 2-3 jaar plaasvind. Dit kan aangedui word deur wol in die kroon by sommige spesies terwyl 'n algemene vergroting in die kroon ook 'n kenmerk is. Daarna vergeet mens weer daarvan en let nie werklik op hoe die blare presies groei nie.

Ek het dus besluit om dieper na groei te kyk en het probeer uitvind watter faktore groei sal bepaal. In my eksperiment het ek van twee *E. manikensis*-plante gebruik gemaak. Dit was jong plante met 'n stamdeursnee van sowat 160 mm wat op 'n beskutte plek in die koelte gestaan het. Die vorige seisoen het albei plante sowat vier blare per plant gespruit en hierdie blare is deur my verwyder net na die winter. Die eerste nuwe blare het gou hul verskyning in die kroon gemaak

en het gegroei teen 1 mm elke 120 minute. Daar was nie 'n baie groot verskil in die nag nie want groei het slegs verminder na 1 mm elke 150 minute. Die rede hiervoor kan moontlik toegeskryf word aan laer temperature in die nag. Organiese voedsel vir groei word verkry vanuit die stam en is vroeër gesintetiseer tydens fotosintese. Fotosintese het op hierdie stadium minimaal plaasgevind omdat die blare klein was en die vorige seisoen se blare reeds verwyder was deur my. Na 'n week het ek weer na die plante gekyk en teen hierdie tyd was die blare sowat 150 mm lank. Groei het teen 9-25 mm elke 120 minute plaasgevind en het verskil by van die blare. In die nag het 'n groot verskil voorgekom en het groei slegs plaasgevind teen 5-9 mm elke 120 minute. Dit moes beteken dat die blare teen hierdie tyd reeds kon fotosintetiseer en groei het vinniger plaasgevind. Die blare het op hierdie stadium van mekaar geskei en uitwaarts geneig. Oor 'n tydperk van 24 uur het ek die blare ondersoek en deur van bo-af na die plant te kyk het ek gesien dat die blare soos 'n spiraal gelyk het. Party het links geneig en ander regs en na 30 minute het elke blaar sy rigting verander en in die teenoorgestelde rigting geneig. Daar was ook beweging inwaarts en uitwaarts.

Na sowat 12 dae was die blare omtrent 'n meter lank en het groei en beweging stadig begin verminder. Op hierdie stadium het die pinnas (blaartjies) begin krul en heeltemal tot teen die ragis opgekrul (hulle het na agter beweeg sodat die ragis bo was). Na sowat twee dae het hulle stadig begin terugrol en slegs in 'n mindere mate in die teenoorgestelde rigting gekrul, maar dit was egter baie gering. Daarna het die blare begin verhard en die pinnas het in hierdie tyd die meeste gegroei.

Die tweede plant het twee weke na die eerste begin spruit en in plaas van 7 blare soos by die eerste plant het die tweede 11 blare gespruit. Daar kan dus aanvaar word dat die vertraagde groei by die tweede plant veroorsaak was deurdat meer blare meer energie benodig en dit langer neem vir die maak daarvan. Die feit dat beide meer blare gelewer het as die vorige seisoen is nie net omdat die plante groter geword het nie. Die sneeu wat ons in die winterr gehad het kon ook stikstof voorsien het saam met gereelde voeding, daarby het ek ook die stamme intensief bespuit met blaarvoeding. Dit is dus nie nodig om voeding in die winter te staak nie. Dit is net belangrik om te besef dat plante meer geneig is om beskadig te word, omdat die grond droër sal wees. Op hierdie manier kan die plant reserwes opbou vir wanneer meer energie in die somer benodig word.

Die bogenoemde inligting is slegs een geval gewees hoe die blare van *E. manikensis* groei en soortgelyke groei kan verskil by ander plante. Daar mag ook interessante feite ontdek word as inligting van ander versamelaars ontvang word.

[Baie interessant en Erik, 'n skoolgaande lid van die Broodboom Vereniging van S.A., moet geluk gewens word vir sy inisiatief en waarnemingsvermoë. Hy moet egter versigtiger wees met sy afleidings. Vir betroubare afleidings moet 'n proef altyd 'n kontrole-behandeling bevat en behoort elke behandeling verkieslik verskeie plante in te sluit. So bv. as mens wil aantoon dat lig deur middel van fotosintese groei bevorder het, behoort party plante (of blare) verdonker te gewees het terwyl alle ander toestande (dus ook temperatuur) vir almal dieselfde gehou is. Waar mens wil aantoon dat voeding die groei beïnvloed, moes die kontrole plante nie die addisionele voeding ontvang het nie. Dit is verder dikwels moeilik om groeiverskynsels noukeurig in woorde te beskryf. Sketse help baie om die saak te verduidelik. - Resensent.]

### Summary

#### Growth patterns of *Encephalartos manikensis* leaves

The appearance of leaves on cycads once every one to more years is an exciting event.

Observing two young *E. manikensis* plants (stem diameter 160 mm), each produced four leaves that were removed just after winter. New leaves appeared shortly thereafter and elongation was at a rate of 1 mm per 120 minutes during the day and 1 mm per 150 minutes during the night. Reserves must have come from the stem since the leaves were still immature. After a week, when the leaves were 150 mm long, growth rate was 9-25 mm per 120 minutes during the day and 5-9 mm per 120 minutes during the night.

Observing the leaves over a period of 24 hours from the top of the plant sideways (left to right) as well as inward and outward movements of the growing leaves were noticed, changing every 30 minutes.

After 12 days the leaves were about 1 m long and movements slowed down.

The one plant had seven new leaves and the second plant had 11. In the rest of the article the author speculates on the role of nutrition on leaf production and growth.

[Very interesting and Erik, a school-going member of the Cycad Society of S.A., should be congratulated on his initiative and perceptivity. However, he should be more cautious in arriving at conclusions. Conclusions can only be credible when control-experiments were carried out as well, and each treatment should preferably include several plants. - Reviewer.]

# ENCEPHALARTOS MACROSTROBILUS (ZAMIACEAE), A NEW CYCAD SPECIES FROM NORTHERN UGANDA

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Received 24 February 1997; accepted 10 March 1997

**Abstract:** *Encephalartos macrostrobilus* Jones & Wynants, a new species from north-western Uganda, is described. It is compared with *E. septentrionalis* Schweinfurth from which it differs by its arborescent, larger, and more luxuriant habit, its much larger megastrobili, its yellow to ochre instead of red seed sarcotesta, and its less and differently dentate seedling leaflets.

*Encephalartos macrostrobilus* Jones & Wynants, species nova:

*Encephalartos septentrionalis* Schweinfurth propter caulem singulum affinis, sed cauli erecto et majori, foliis majoribus pluribusque, macrostrobilis majoribus et seminibus ochracei differt.

**TYPE:** NORTH-WESTERN UGANDA. - Madi area (3°35'N, 31°40'E), 900-1400 m, on sandy lithosols in degraded woodland along riverbeds, in light shade, S. Jones & J. Wynants 01 (BR, holo.).

Plant arborescent with usually a single *trunk*, unbranched but occasionally with basal offsets, becoming somewhat procumbent with age, in exposed sites covered with persistent leaf bases but in more shady locations with only a few remaining leaf bases evident, up to 2.5 m tall and 300-450 mm thick. *Leaves* 35-60, spreading-erect, rigid and straight but somewhat recurved near apices, very dark green, in sheltered locations 1.9-2.2 m long and 390-590 mm wide but in exposed places 1.4-2.0 m long, petiolate with petiole 120-150 mm long, basal leaflets abruptly reduced to 1-3 pairs of bifid spines, base strongly bulbous, rachis with longitudinal groove along its entire length; leaflets paired and opposite, at almost 90° with rachis, falcate with margins slightly revolute, stiff, glabrous, with 21 longitudinal veins (counted on 12 different specimens) which are not raised on either ab- or adaxial surfaces, upper margin with 6-8 teeth each 2-6 mm long but not further than 60-80 mm from rachis, lower margin with 2-4 teeth each 2-5 mm long in area 30-80 mm from rachis, leaflets 190-250 mm wide. *Cones* of both sexes emerging simultaneously, glabrous, deep green maturing to olive green, exposed faces of

sporophylls rhombic and smooth to slightly crenulate; *male cones* (*microstrobili*) 6-14, erect, stalked on peduncles 80-90 mm long, cone narrowly ovoid, 180-200 mm long and 45-50 mm across; *female cones* (*megastrobili*) 3, erect on emergence but angled or even drooping at maturity, stalked on peduncles 120-140 mm long, cone up to 800 mm long and 300 mm across, seeds about 300 per cone, 35-40 mm long and 25 mm across including sarcotesta and 32-36 mm long by 19-22 mm across with sarcotesta removed, sarcotesta yellow to deep ochre and turning orange when ripening.

(Figures 1 & 2).

## Diagnostic features

*Encephalartos macrostrobilus* occurs within 50 km of at least one population of *E. septentrionalis* Schweinfurth; and in view of the poorly known nature of *E. septentrionalis*, is likely to be confused with it. However, *E. macrostrobilus* is readily distinguished by its well developed and erect rather than very short and procumbent or even underground trunk, its densely foliated crown compared to the often tattered dozen or two leaves of *E. septentrionalis*, its much larger female cones (about 800 mm long as opposed to 270-360 mm long) which at maturity are olive green with yellow to ochre seeds compared to manila brown cones with bright red seeds, and its remarkably slender male cones. Even the seedlings are distinct: in *E. macrostrobilus* the first leaf has 6 pairs of leaflets with none or only a few teeth along the upper margin near the apex of each leaflet (Figure 2E), while in *E. septentrionalis* the first leaf consists of 4 to 5 pairs of leaflets with significantly more teeth on the upper margins from close to the base or from at least halfway to the apices (Figure 2D).

## Reproduction

The sex ratios of mature plants appear to be skewed in favour of females.

By day baboons and hornbills were seen removing ripe seed. At night other animals, presumed to be rodents, continued dispersal.

Seeds start germinating immediately once they have been shed.

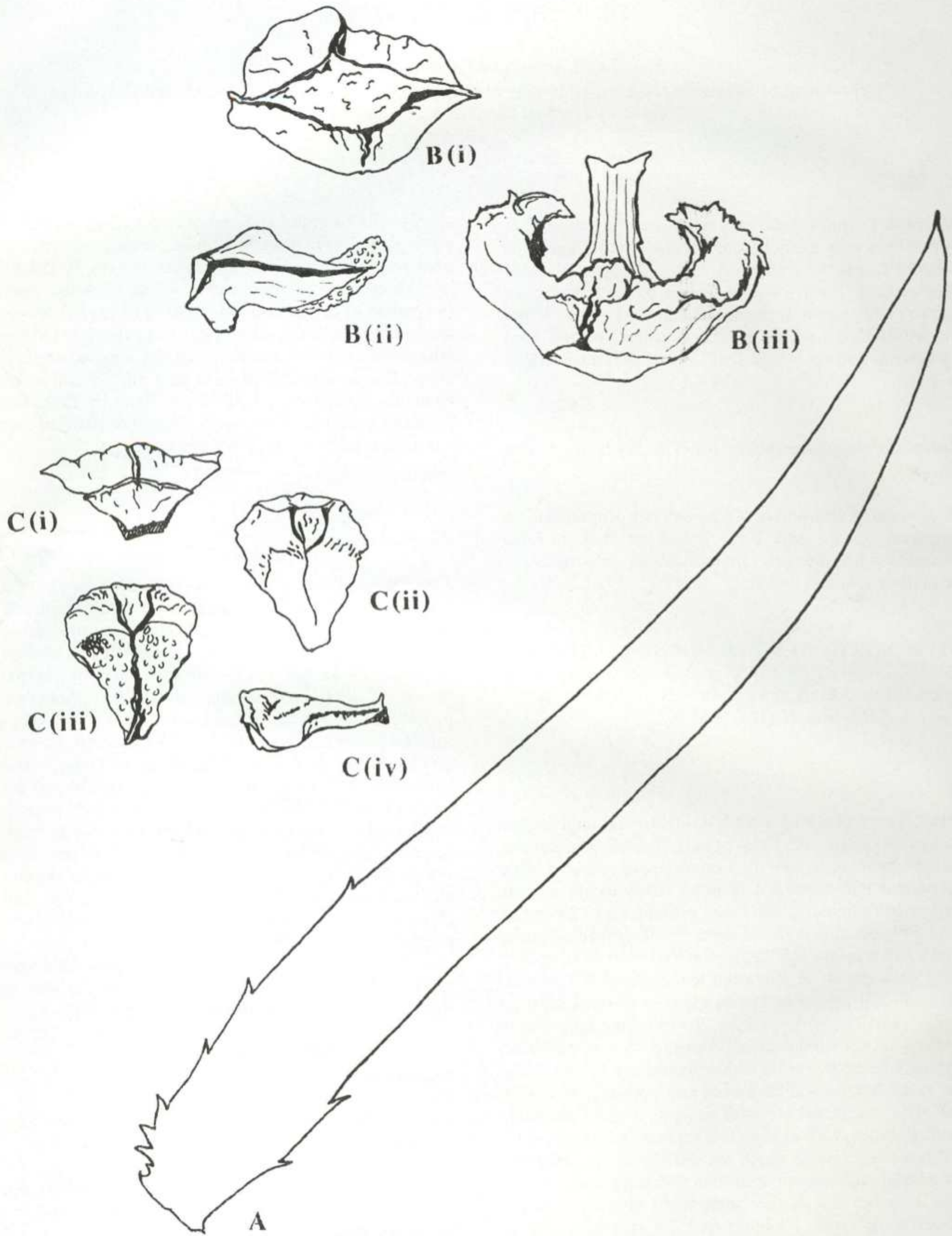


Figure 1 *Encephalartos macrostrobilus*: A, median leaflet; B, median megasporophyll in (i) frontal, (ii) lateral, and (iii) adaxial view; C, median microsporophyll in (i) frontal, (ii) adaxial, (iii) abaxial, and (iv) lateral view. Scale: life size.

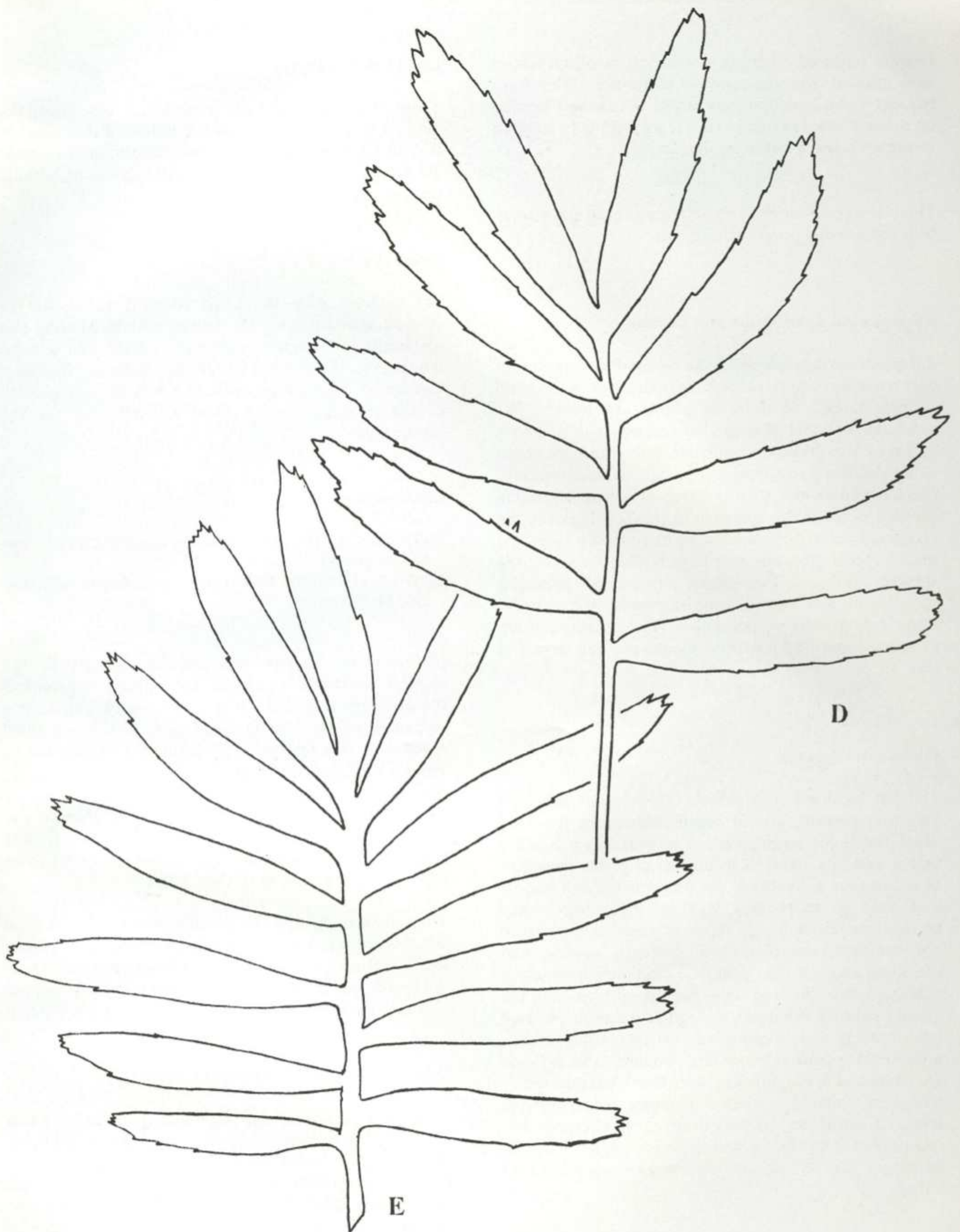


Figure 2 First seedling leaves of *Encephalartos septentrionalis* (D) and *E. macrostrobilus* (E) respectively. Scale: life size.

Despite repeated attempts, no weevils or other beetles were isolated from the cones of either sex. What were thought to be lepidopterous larvae were found feeding on the sarcotesta in one cone, but we were not equipped to preserve and identify the larvae.

There is a good range of age classes at each site visited, with consistently good recruitment.

#### Geographical distribution and habitat

*Encephalartos macrostrobilus* is a recent discovery, known only from north-western Uganda in the area of the Madi people, at 900 to 1400 m above sea level. The vegetation consists of degraded savanna with a canopy height of 5 to 20 m, on sandy lithosols with rock slopes along seasonal watercourses. *E. macrostrobilus* is usually encountered in the slightly more luxuriant vegetation within 100 m of the drainage channels. Typically the plants are about 50% shaded by surrounding trees and shrubs. Most grow amongst large boulders marking the stream course. Two main populations surveyed, occurred on a 10° slope facing eastwards, and a similar slope facing west respectively. The smallest group surveyed comprised 4 mature plants, and the largest at least 13.

#### Conservation status

The few localities from which *E. macrostrobilus* are known at present, are all heavily utilized by the local Madi people for grazing cattle and goats, as well as for timber and fuel. The total number of plants known to us is less than a hundred, but access is difficult and by foot only so there may well be more unrecorded populations. Even though apparently neither widespread nor common, the plants are currently seeding and recruiting successfully. Still, contemporary land use is exacting a toll: the tree cover has deteriorated, and the ground stratum is subject to regular burns to produce fresh grazing and improved access for cattle. It was noticed that plants amongst large boulders and in shade are larger and apparently healthier than ones exposed by felling of sheltering trees. Exposed plants survive repeated burns as evidenced by stem charring, but recruitment may be adversely affected by frequent burning. The cycads themselves are not subject to felling.

Sudanese refugee camps, associated insurgents, and in particular the local cultist "Lord's Resistance Army", make *E. macrostrobilus* relatively safe from all but the suicidal plant collector.

#### Local cultural aspects

These plants are called *Ci-cia*, meaning "resembling the date palm" (*Phoenix*). A few seeds are collected for use to "chase bad omens". When land is cleared, the cycads are not felled, possibly for religious reasons or because they are not suitable for fuel.

#### Acknowledgements

The authors wish to thank Richard Matthews for valuable introductions, Mr. Herbert Alule-Amudra and his family for practical assistance. They also wish to thank Prof. E. Robbrecht of the National Botanical Garden of Belgium for assistance with the compilation of the description, and Lynn Chamberlain for the illustrations.

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[A reference to this new species appears in the unpublished manuscript titled "Georg Schweinfurth and the discovery of *Encephalartos septentrionalis* - with some comments on the present distribution of this and allied species" by Roy Osborne (submitted for publication to *The Cycad Newsletter*, U.S.A.).

According to Osborne, *Encephalartos septentrionalis* has become somewhat more common than it was a decade ago because of recent seed collections that shed more light on the distribution of this cycad.

To shed more light on the distribution of *Encephalartos macrostrobilus* part of the map, showing the approximate localities for *Encephalartos septentrionalis* and allied taxa in Uganda and Sudan, is reproduced (Figure 3) and the following passage from Osborne's manuscript is quoted:

#### "Seed collections from the present decade

During the past few years there have been at least two major seed collections in the northern Uganda-southern Sudan areas. The first of these was a collection of seed from the Moyo locality in northern Uganda, distributed fairly widely during 1995 under the name *Encephalartos septentrionalis*. At more-or-less the same time, a crop of seed was obtained from a cycad population in the southern Sudan's Didinga Hills, some 100 km to the northeast of the Imatong Mountains. This cycad has been referred to under the name of "*Encephalartos* sp. Sudan". Interestingly, about 100 km to the south of this

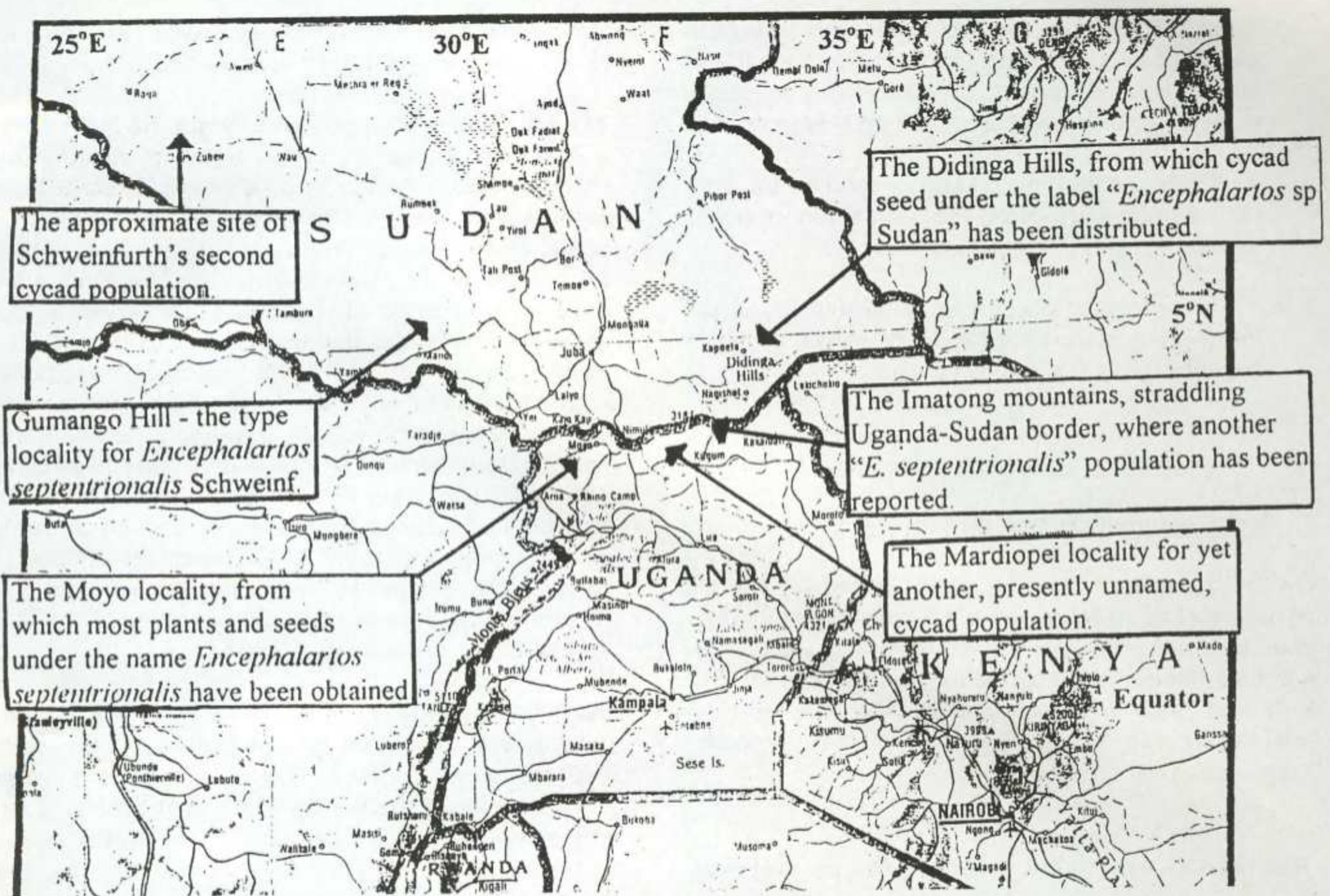


Figure 3 Map showing the approximate localities for *Encephalartos septentrionalis* and allied taxa in Uganda and Sudan.

locality, across the border into northern Uganda near the village of Mardiopei, there is word of yet another population of a cycad which appears to constitute a different species, and the name *Encephalartos "macrostrobila"* has been mentioned. There thus seem to be three cycads in the general area

of the Imatong Mountains, one of which may be allied to *Encephalartos septentrionalis*."

When Osborne's article has been printed in *The Cycad Newsletter* it will be summarized under "New scientific reports" in a future issue of our journal. - Editor.]

## NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar  
Posbus 15357, 0039 Lynn-oos

Ontvang 14 April 1997

### Toekomstige aktiwiteite

**5 Julie 1997:** 'n Besoek aan 'n *Encephalartos transvenosus*-kolonie in die Happy Rest Natuureservaat naby Louis Trichardt is gereël. Deelnemers moet om 08h00 by die Schoemansdal Veldskool in die reservaat bymekaar kom (Louis Trichardt - Vivo pad). Verblyf kan in die koshuis van die Schoemansdal Veldskool gereël word.

Koste is R40.00 per persoon, met 2 of 3 persone per kamer. Slegs beddegoed word voorsien, maar 'n kombuis toegerus met 'n stoof en yskas sal tot ons beskikking gestel word. Indien u hiervan gebruik wil maak, is dit noodsaaklik dat u vir Hanneke (Tel. 012 8080995) so gou as moontlik laat weet en die volle bedrag van R40.00 per persoon betaal.

**6 Sept. 1997:** 14h00 by hoofgebou van die Nasionale

Botaniese Instituut, Pretoria. Mnr John Baker van die Gautengse Afdeling Natuurbewaring sal ons inlig oor die nuutste verwickelinge aangaande wetgewing oor broodbome - ook op Nasionale vlak.

1 Nov. 1997: Afsluitingsfunksie - spreker sal later aangekondig word maar praatjie sal nie meer oor broodboomwetgewing handel nie.

L.W. Ons probeer steeds om 'n uitstappie na die *Encephalartos inopinus*-lokaliteit gereël te kry - hopelik vir Mei/Julie volgende jaar.

#### Verslae oor onlangse aktiwiteite

##### Dr Rolf Oberprieler se praatjie oor snuitkewers

Op 18 Januarie 1997 het dr Rolf Oberprieler van die Biosistematiese Afdeling van die Navorsingsinstituut vir Plantbeskerming vir ons 'n deskundige praatjie gelewer oor die snuitkewers wat met broodbome ge-assosieerd is. Rolf het ons verder vriendelik van die Engelse samevatting van sy praatjie voorsien wat hieronder aangebied word:

#### **The weevils associated with cycads - an overview**

**Rolf Oberprieler**

Weevils (superfamily Curculionoidea) represent the largest and evolutionarily most advanced group of beetles. Their evolutionary success is largely due to their endophytic habits, i.e. their larvae generally develop inside plant tissues, where they are relatively safe from predators, parasites and adverse climatic conditions. The most conspicuous structural adaptation of weevils related to this habit is the development of an elongated snout, or rostrum, particularly in the female, as it is with this organ that she drills a fine hole into the plant tissue to insert her ovipositor for laying eggs. In the more primitive weevils the snout can only be inserted up to the insertion of the antennae on the sides of the rostrum, but in the more advanced forms the basal antennal segment is also elongated and folds back into a lateral furrow on the snout, permitting the rostrum to be inserted further to reach deeper-lying tissues such as protected kernels.

The weevil lineage originated in Jurassic times but diversified dramatically in the Cretaceous period, largely in parallel with the radiation of angiosperm plants in the same epoch. However, several weevil groups are also associated with the more primitive gymnosperms, reflecting either very ancient associations but also more recent shifts from earlier angiosperm hosts. Of particular interest among the gymnosperm associations of weevils are those with cycads, as these plants are

much older than the weevils and were most probably always colonized by weevils secondarily.

The associations of weevils with cycads are quite diverse and display varying degrees of intimacy, ranging from only casual development in rotting cycad tissues to highly sophisticated ones in live tissues of the reproductive organs of the plants. While some of these associations are harmful to the plants (such as seed feeding), others are directly or indirectly beneficial and in several cases involve pollination, so that the cycads are often evidently highly dependent on their specific weevils for reproduction and survival. As currently known, seven different lineages of weevils, classified in four different families, have evolved true and obligatory associations with cycads, involving 15 genera and about 100 species. Viewing these associations in a sequence of increasing intimacy allows not only a reconstruction of how the colonization of cycads by weevils might have taken place in general, but also sketches a chronology of the likely ages of these various associations.

The least intimate, and probably most recent, colonization of cycads is represented by the South African genus *Phaenocorynes*, a rather typical dryophthorine (rhynchophorine) weevil belonging to a group well known for its larval development in soft-stemmed plants such as palms, cacti and bananas. *Phaenocorynes* tunnels in dying and dead cycad stems only and displays some host specificity among its three smaller species, combined with a wide host range in the larger *P. sommeri* (Burmeister). The latter usually coexists with one of the smaller species in the same cycad trunk, and some careful resource partitioning is then observable between these congeneric species.

A similar trunk-boring habit is practised by the Australian genera *Melanotranes* and *Domyrsus*, with 3 and 1 known species respectively, while the related *Tranes* (with 6 known species) and *Miltotranes* (2 species) appear to have switched from this habit to that of developing in the sporophylls of the male cones, the former genus on *Macrozamia* and *Lepidozamia*, the latter on *Bowenia*. The precise life-histories of all these species needs further study, as does the apparent involvement of *Tranes* and *Miltotranes* in the pollination of their hosts.

Larval development in male and female cycad sporophylls is also practised by another South African genus of cycad weevils, *Apinotropis*. This belongs to the rather primitive weevil family Anthribidae, whose members are predominantly feeders of xylariaceous wood rotting fungi. The strict association of *Apinotropis* with cycads is remarkable since it appears to represent the ancestral life style of the family rather than a secondary shift in diet, unless a cycad-specific fungus is involved. The most primitive species of *Apinotropis* apparently develops in the old leaf bases of the cycad

trunk rather than in sporophylls, indicating this to be the original habitat of the genus.

In Central America a completely unrelated group of primitive weevils has also developed a sophisticated association with cycads. Two closely related genera, *Rhopalotria* and *Parallocorynus*, currently classified in a tribe Allocorynini of the family Belidae, develop in the male sporophylls of *Zamia* and *Dioon*, respectively (although one species of *Rhopalotria* occurs on a *Dioon*, too). The life-history of *Rhopalotria* has been well studied and its role in the pollination of its hosts proved conclusively, and this association with cycads is likely to be a very old one. All species of Allocorynini appear to be host specific.

The most primitive extant genus of cycads, *Cycas*, has recently been shown to harbour some specific weevils in its male cones as well. Belonging to a Pacific lineage of true weevils (family Curculionidae), the genus *Tychiodes* displays a perplexing species diversity on *Cycas* in South-East Asia (specifically Thailand and Vietnam). It seems that this colonization has occurred from the more primitive *C. rumphii* section of the Pacific islands onto the *C. pectinata* and *C. siamensis* groups on the mainland and has resulted in the diversification of three different species groups of weevils. These now inhabit largely the same hosts but show some remarkable congruence with the diversity and also the relationships of their hosts. *Tychiodes* also develops in the axes and sporophylls of male cones and is indicated to be involved in the pollination of its hosts.

Again in southern Africa, another group of true weevils has colonized the cones of *Encephalartos*. Three genera, grouped in a tribe Amorphocerini and seemingly related to South American and perhaps other forms associated with palms, have developed striking specializations to inhabit both the male and the female cones of the African cycads. From a primitive genus and species developing in old leaf stalks, *Amorphocerus* has evolved an increasingly strong body and burrowing legs to be able to tunnel into the firm female cones, where its larvae develop in the axis and sporophylls as the cone disintegrates, while *Porthetes* has remained more delicate of build, corresponding to the softer, loose male sporophylls in which its larvae occur. The most striking adaptation of *Porthetes*, however, is the development of an olfactory globule in its antenna. This globule is largest in species occurring in areas harbouring more than one species of cycad and appears to enable the weevils to distinguish between the cone odours of different cycad species. *Porthetes* is correspondingly highly host-specific, nearly all of its 16 presently known species occurring on a single species of *Encephalartos* only, and the species groups of weevils and cycads are congruent to a large degree.

The highest degree of intimacy of association with

cycads, finally, occurs in the African cycad weevils of the tribe Antliarhinini. Being relatively primitive weevils again, the two genera of this group are related to wood-boring weevils of the family Brentidae. *Platymerus* is a genus of stocky weevils inhabiting the growing female cones of the woolly-coned species of *Encephalartos* around the Drakensberg, and its larvae develop predominantly in the sporophylls in an individual fashion but show incipient seed feeding in some species. *Antliarhinus* consists of two species groups, a more primitive one comprising 5 known species developing in the axes of growing female cones from eastern to southern Africa, while the more advanced group contains three South African species. *Antliarhinus peglerae* develops individually in live female sporophylls (sometimes also in male ones), but the larvae of *A. zamiae* and *A. signatus* feed in a communal fashion on the ovules of a large variety of *Encephalartos* species. This last type of larval development represents the most intimate of all weevil-cycad associations known and involves striking morphological adaptations (extremely elongated female rostrum) as well as unusual behavioural traits (communal larval development), and it is indicated to represent a very old association between weevils and cycads.

It is evident from this overview that weevils have colonized cycads at least seven times independently, in accordance with the diversity and distribution of the plants present at the times of colonization. In doing so, the different groups of weevils faced largely similar physical and chemical obstacles in their prospective hosts and have often overcome these in similar ways. The general evolutionary trend of all these associations is one from less specific affiliations with vegetative tissues (trunks and leaf bases) to more specific ones with reproductive organs (sporophylls and ultimately seeds), and it seems likely that the currently less specific (and presumably younger) associations will also evolve in the same direction as the more intimate and evidently older ones. Especially in the more complex and intimate associations (of Antliarhinini, Amorphocerini, *Tychiodes* and Allocorynini) there is evidence that originally these associations arose through colonization by the weevils of then existing cycad species, but that the finer specificity of both weevils and cycads on the current species level came about largely through vicariance (fragmentation of former species) and resulting cospeciation.

The various weevils occurring on cycads have thus not only been associated with these plants for very long times, but they have become an integral part of the ecology and biology of these plants (especially as regards pollination), and the survival of the latter now clearly depends in no small measure on that of their associated weevils. From a horticultural point of view, only a very small minority of species (two in fact) are "evil weevils" and really harmful to cycads, and growers and conservationists of cycads should take these beetles, as

other cycad insects, into much closer consideration in their efforts to conserve these relict plants.

### Die Marble Hall - Groblersdal uitstappie

Op 9 Maart 1997 het sowat 20 lede van die Strektak by Marble Hall vergader vanwaar 'n besoek aan die broodboomversameling van Hugo Duvenhage op 'n nabygeleë plaas gebring is. Die versameling bevat volwasse eksemplare van meeste van die beskrewe inheemse broodboomsoorte. Die interessantste eksemplaar is 'n manlike *Encephalartos middelburgensis* wat jare gelede deur Hugo se oorlede vader in die Avontuurgebied oos van Loskodam uit die veld verwyder is. In teenstelling met die beskrywing van die spesie, bevat hierdie eksemplaar se blare feitlik geen petiool nie. Soos by *E. dyerianus* word die pinnas van die basale gedeelte van die blaar al hoe kleiner hoe nader hul aan die blaarvoet geleë is (kyk Figuur 1).

'n Besoek is ook aan die versameling van Wolf Wolmarans tussen Marble Hall en Groblersdal gebring. 'n Groot verskeidenheid volwasse inheemse broodbome was hier te sien. Die kleur van verskeie plante het aanvanklik die kykers dronkgeslaan. Daar is egter later vasgestel dat die ongewone kleur deur die sprinkelbesproeiing van die plante met kalkryke water veroorsaak word.

Die hoogtepunt van die uitstappie was die besoek aan John Kloppers se versameling op 'n plaas aangrensend aan Groblersdal. Die groot versameling volwasse plante sluit feitlik al die inheemse soorte sowel as verskeie uitheemse soorte in (Figuur 2). Die eksemplare is in groepies volgens spesies in 'n groot boomryke tuin met wye grasperke smaakvol aangeplant en elke broodboomgroepie is van 'n netjiese etiket voorsien waarop die spesienaam in afgekorte vorm verskyn. Na die besigtiging van hul tuin het John en Maryna hul baie besondere onthaalgeriewe tot ons beskikking gestel waar daar met groot geesdrif vleis gebraai en geëet is terwyl talle outydse gereedskapstukke bewonder is. 'n Broodboomsuier is deur John as afskeidspresent aan elke gas aangebied.

Ons wil weer eens baie dankie sê aan die drie gashere vir die besonder genotvolle besoek aan hul tuine.

### Summary

#### The Marble Hall - Groblersdal excursion

On March 9, 1997, about 20 members of the Transvaal Regional Branch of the Society paid a visit to cycad gardens on three farms in the Marble Hall - Groblersdal area.

The cycad collection of Hugo Duvenhage, near Marble Hall, consists of mature plants of most of the described indigenous species. The most interesting specimen is a male *Encephalartos middelburgensis* of which the leaves are nearly without petioles (Figure 1).



**Figuur 1** Suier van die *Encephalartos middelburgensis* wat uit die veld naby Loskopdam gehaal is. Let op die gebrek aan 'n duidelike petiool by die blare. / **Figure 1** *Encephalartos middelburgensis*, originally a sucker that was removed from the wild near Loskop Dam years ago. Note the absence of a distinct petiole in the leaves.

The cycad collection of Wolf Wolmarans, between Marble Hall and Groblersdal, consists of a large variety of mature indigenous plants. The unusual leaf colour of the plants is due to spray-irrigation with water rich in lime.

The culmination of the excursion was visiting John Kloppers' cycad collection on his farm bordering on Groblersdal. In his large wooded garden with expansive lawns, the cycads are tastefully planted in small groups according to species. His large collection of mature plants consists of specimens of nearly all indigenous species as well as exotic species (Figure 2). After looking at the plants, a barbecue was held, making use of John and Maryna's exceptional entertainment facilities.



**Figuur 2** John en Maryna Kloppers langs 'n majestueuse eksemplaar van *Encephalartos middelburgensis* in hul uitgestrekte tuin net buite Groblersdal. / **Figure 2** John and Maryna Kloppers standing next to a majestic specimen of *Encephalartos middelburgensis* in their extensive garden just out of Groblersdal.

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## SHORT COMMUNICATIONS / KORT MEDEDELINGS

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### LEAF PRODUCTION IN *DIOON SPINULOSUM*

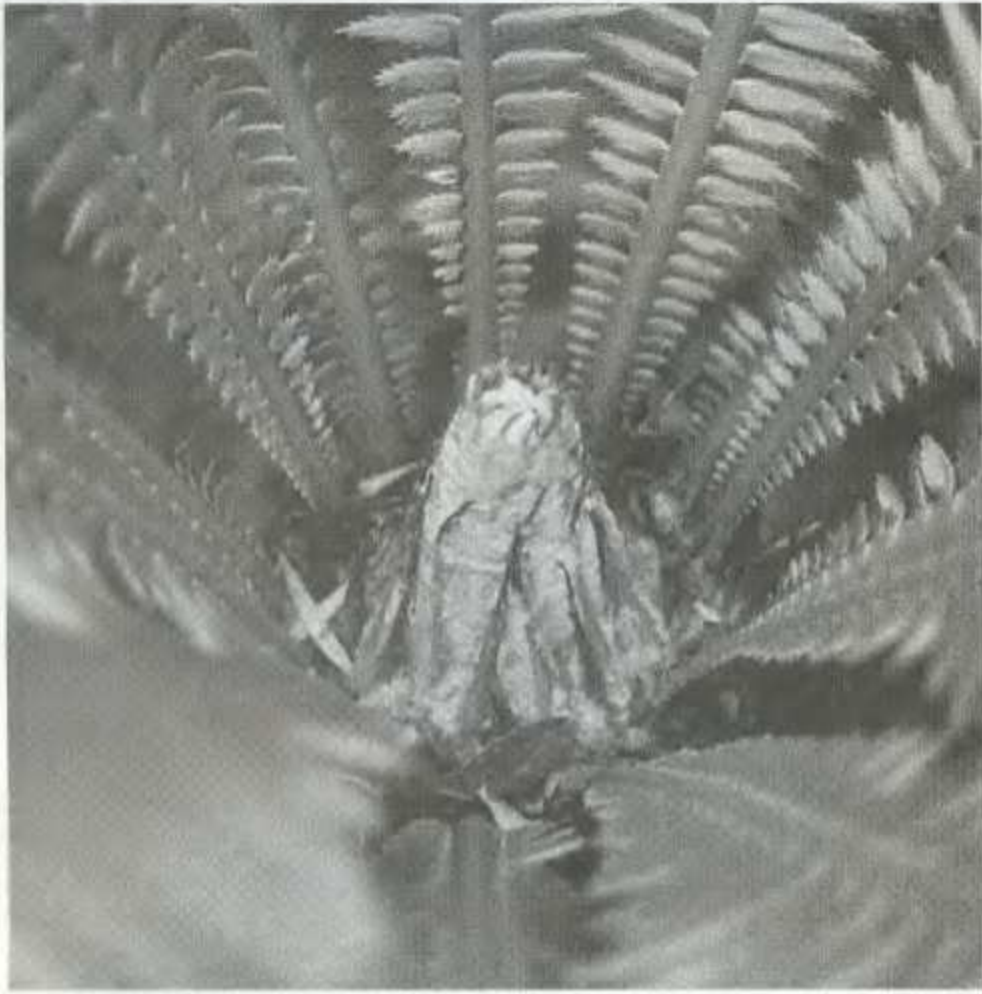
**William Tang**

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

*Received 14 January 1997*

In many cycads, particularly the larger species, leaves are produced in one spectacular flush. This is a dramatic event in nature and the garden. *Dioon spinulosum* is an example of such a species. **Figure 1** documents the leaf

flush of this species in the author's garden in Miami, Florida. This is a 13 year-old plant producing 12 leaves. Leaf expansion occurred over a 20-day period, with leaf hardening continuing thereafter.



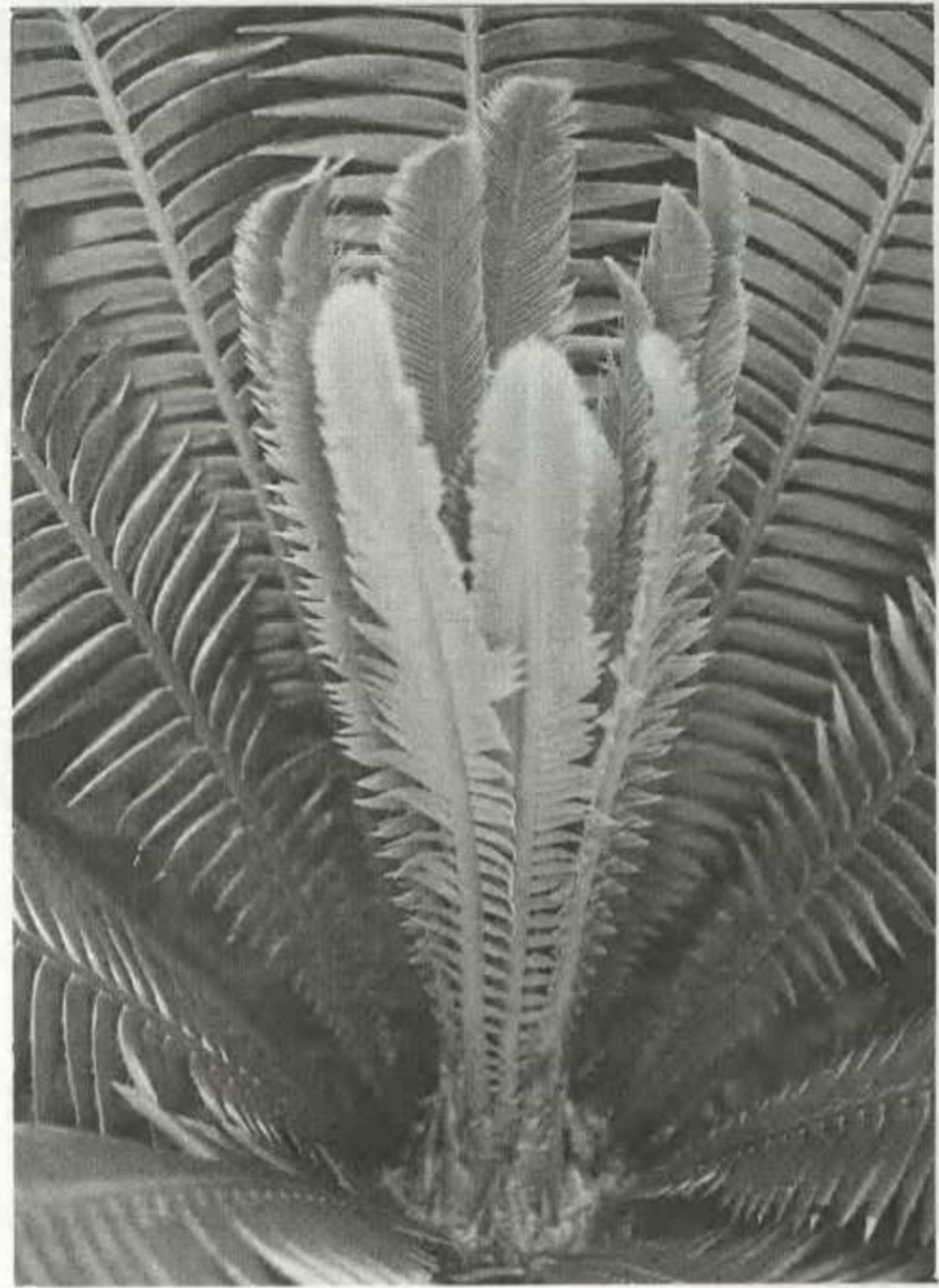
Day 1



Day 3



Day 5



Day 7



Figure 1 New leaves in *Dioon spinulosum* on day 1, 3, 5, 7, 9, & 15 of emergence. Notice that the lower leaflets expand first and the ones at the leaf apex develop last.

← Day 9



Figure 2 A *Dioon spinulosum* at Fairchild Tropical Garden holding leaves from 8 distinct flushes.

Figure 2 shows a specimen of *D. spinulosum* at Fairchild Tropical Garden, holding leaves from eight separate flushes. This plant was growing in partial shade with ample irrigation - a situation in which it experienced little or no drought stress.

← Day 15

## AMORPHOCERUS BROADENS ITS HORIZONS

Piet Vorster

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

Received 12 March 1997

In the Proceedings of the Third International Conference on Cycad Biology, pages 367-378 (1995), I had a paper on the occurrence of cycad-associated beetles of the genus *Amorphocerus* on different cycad species in a garden environment.

These beetles are apparently intimately and exclusively associated with cycads and no other plant species. In nature they are very restricted in their choice of host species (see Rolf Oberprieler in the same publication, page 33), but in a garden environment this selectiveness breaks down so that the beetles are found on a wide variety of *Encephalartos* species and even on other genera. However, two species on which I had not found any beetles, were *Ceratozamia mexicana* and *Cycas thouarsii*.

The exact nature of this beetle-cycad relationship is not yet entirely understood. The beetles were only evident when the plants were in cone. They appeared in the male cone where they apparently feed on pollen but not on any other part of the cone, and leave the cone once it starts shrivelling. They then apparently migrate to the female cones where they can be found when the female cone falls apart. They burrow and breed in the axis and sporophylls of the female cone. Once coning is over, they vanish until the next coning event. The question is: "Where are the beetles when there are no cones, and what do they do during that period (which can be several years in duration)?" Are the beetles dormant in the soil at the base of the plant, do they sleep hidden amongst the scales covering the stem, or are they active inside the stem?

During the 1996/1997 season these beetles did things which I haven't noticed before in my garden in Stellenbosch.

Firstly, I found them in a male cone of *Ceratozamia mexicana*, where previously I failed to find any.

Secondly, I found them in an emerging female cone of *Cycas thouarsii*, where they burrowed in and devoured the female sporophylls.

Thirdly, new leaves emerged shrivelled and black, just like those described by Maans Kemp in *Encephalartos* 48: 27-29 (December 1996). Affected species were grey-leaved ones, namely *E. arenarius*, *E. longifolius*, *E. princeps*, and *E. trispinosus* x *E. altensteinii*. On cutting off these damaged leaves, I found adult beetles inside the rachis. I would guess that climatic conditions led to this behaviour of the beetles.

In view of the leaf-destroying habits now exhibited by these beetles, I am afraid that I can no longer tolerate the beetles on my plants, even though there is still a lot to be learnt about them. I cannot help wondering whether they spend part of their lives burrowing in the stems, and under abnormal conditions are responsible or co-responsible for the sudden and strange deaths of cycads in gardens. Accordingly I have declared war on them, and pour poisons such as Carbapray into both male and female cones, as well as into the crowns of my plants when new leaves emerge and the poison can gain access to the deeper parts of the stem crown.

## WILD HARVESTED SEEDS AND THEIR DISTRIBUTION

Mike Michaelsen

The U.S. Cycad Society Seed Bank, 1417 Hilgard Ave., Simi Valley, California 93065, U.S.A.

Received 15 April 1997

**Author's note:** Although I have written this article for the U.S. Society Newsletter, and the content is geared to the members of the U.S. Cycad Society, I feel that it may be of interest to members of the Cycad Society of South Africa as well.

The main purpose of The U.S. Cycad Society Seed Bank is to aggressively secure and distribute various species of cycad seeds to its members. Securing seeds is governed by the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES). The seed bank vigorously disagrees with certain regulations pertaining to the export of wild-harvested seeds, especially the *Encephalartos* species from Africa. We have expressed our dissatisfaction to the Conservation Authorities in South Africa, but our pleas to change or relax these regulations have fallen on deaf ears.

The harvesting and regulated distribution of wild seeds is by far the most efficient way to preserve any species of plant. Harvesting seeds does no harm to the plant and will, in some cases, relieve the pressure of poaching. It should be one of the governing authority's top priorities to harvest and distribute seeds in an equitable manner that will satisfy all concerned. Placing seeds in the hands of many, and in varied localities, can do nothing but insure plant survival.

To provide income for the exporting countries, the harvested seeds could be sold to botanical gardens, seed banks, and to certain growers. One equitable solution would be to sell one-fourth of the seed to botanical gardens, one-half to seed banks, and the remainder used to propagate plants to be replaced in the wild in fifteen to twenty years. Botanical gardens would have access to seeds unobtainable before, seed banks could put seeds in many hands that would give them tender, loving care, and Mother Nature could get back tenfold what she gave up to begin with. No one loses.

Many published sources state that seeds left in the wild suffer high mortality rates. When one takes into consideration that many cycad species are near or next to extinction, common sense should dictate that Mother Nature could use some help. Seeds left in the wild are subject to destruction by rodents, fire, and drought. Mother Nature in all her infinite wisdom has been very kind to some species, but extremely cruel to others. When a cycad cone of 100 seeds drops, and less than 10 of them will survive to an age of five years, Mother Nature is definitely asking for HELP. She is making a very loud statement: "harvest the seeds, give them optimum growing conditions, and you will no longer have an endangered species." She also may be saying: "I have provided you with plants, but you have destroyed them by urban sprawl, dams, agriculture, greed, and ignorance. If you want the plants to survive, then do something about it. I've done my part, now you take the initiative."

Past president of the U.S. Cycad Society and well-respected cycad enthusiast William (Willie) Tang shared his thoughts on the subject in our newsletter of September 1992. I would like to quote from his article: "For most cycad species the collection of seeds from wild

plants is an inefficient process that does little harm to wild populations. Because of the sporadic nature of coning and the remoteness and rough terrain of most of their habitats, the majority of seeds produced probably escape detection by the would-be seed collectors. Those that do find their way to cultivation probably have a higher rate of germination and survival than they would have in the wild. In cultivation, where they can be given better irrigation and fertilization, cycads cone with greater frequency than in the wild."

Even Loran Whitelock, the world-respected cycad grower and conservationist, made remarks regarding wild seed collection. His comments are taken in part from the South African Cycad Society publication, "Proceedings of the Third International Conference on Cycad Biology", published in 1995: "In recent times a great deal has been written regarding the negative aspects of seed collection from wild populations of endangered cycads. A closer examination of the populations and reproductive biology of these cycads would suggest that, on the contrary, avid seed collection from wild populations should in fact be the recommended course of action for their preservation. Cycads have a very long life span and their populations do not require a high replacement rate. A very low replacement rate is sufficient not only to maintain the population's numbers, but also to allow for their expansion. When studying wild populations of cycads, one is amazed at how few immature plants are seen. This scarcity of small plants is caused by the inability of the majority of the seed or seedlings to survive. The low survival rate is generally due to the hazards of weather, predators, and fire. This is nature's way of insuring against overpopulation and aiding in the survival of the strongest individuals."

The credibility of Tang and Whitelock is impeccable in the world of cycads. With their voices added to the majority of cycad enthusiasts that argue that wild seeds should be harvested, one can only surmise that the Authorities in Africa are indeed over-zealous in their application of the word "conservation". In correspondence with world-renowned Cynthia Giddy, the first lady of cycads, she was adamant about not harvesting wild seeds. As we shared opposing views, we never agreed on the harvesting of wild seeds. She did concede that she had no problem with garden-grown seeds being exported. But, the South African authorities reject the exportation even of garden seeds, one reason being that they have no way knowing if seeds are garden grown or wild collected. Mrs. Giddy did mention that garden seeds are much more likely to be hybridized than those from the wild.

The sharing of seeds with others is the backbone of the U.S. Cycad Society Seed Bank. If all the seeds we purchased were to go to one person, I would definitely have a problem with that. However, the seeds we obtain

are shared with over 125 society members. We know we have done our part to help insure the future of cycads. We have members and individuals in the U.S. that have cone producing plants. For the most part, all of these persons are very generous with their seeds, and for their generosity, I want to publicly thank them. If it were not for their kindness and generosity, many members would not be able to acquire seeds of the types shared with us.

To the few members that have some rare *Encephalartos* plants and do not acknowledge our requests for seeds, shame on you. Even with our assurance of confidentiality, you have not responded to our pleas. You have no idea how much pleasure you could bring to someone with the seeds you have. If you call yourself a conservationist, consider that by sharing seeds, you might possibly help prevent poaching of wild plants.

## BRIEF DESCRIPTION OF CYDEX - A COMPREHENSIVE INDEX TO "ENCEPHALARTOS" JOURNAL

### Glossary of INDEX acronyms

Ads.	Advertisements
Art.	Article
B.P.	Bits and Pieces
B.R.	Book Review
C.A.	Cycads of Australia
C.i.C.	Cycads in Containers
Const.	Constitution
D.R.	Donations Received
Edit.	Editorial
F.C.	From the Chairman
F.O.	Focus On
F.P.	From the President
F.R.	Financial Report
F.S.	Financial Statements
G.T.	Give and Take
Let.	Letters
Membr.	Membership listing
Misc.	Miscellaneous
M.L.	Membership List
N.C.	Newspaper Clipping
N.N.	Nursery News
N.S.R.	New Scientific Reports
P.E.	Pollen Exchange
R.N.	Regional News
S.B.	Seed Bank
S.C.	Short Communication
S.S.	Swop Shop

### description heading, viz.:

- (i) Subject
- (ii) Author(s)
- (iii) Type of article, e.g. "Focus On", etc.
- (iv) Journal number
- (v) First page of article
- (vi) Last page of article

- 1) CYDEX is a comprehensive Index of ALL entries in all "Encephalartos" journals from No. 1 through to the latest No. 48
- 2) Each entry in CYDEX is listed under a 6 field

- 3) CYDEX is written using the powerful AmiPro 3.01 word-processing software package and runs under a Micro Soft Windows 3.1 environment.
- 4) The AmiPro Sort routine allows for 3 levels of sorting the data (in ascending or descending order) and operating on any of the 6 field descriptions.
- 5) The Index is currently written in Aerial 10 point font. AmiPro, however, allows a whole range of font types and sizes.
- 6) The CYDEX file is currently 306 149 bytes. It runs quite satisfactory in terms of speed on a 486 PC.
- 7) In hardcopy printout, CYDEX is currently 39 (A4) pages long. It is printed in a landscape orientation, but again, AmiPro allows a variety of options.
- 8) AmiPro files can easily be stored in a variety of other formats, e.g. ASCII, Manuscript, WordPerfect 5x and 4.2, WordStar, WS2000 ver 1.0 and 3.0, etc.



Geagte Redaktrise

## KOMMENTAAR OOR ARTIKEL "BROOdBOME FLOREER OOK IN KOUER DELE"

Ek wil graag kommentaar lewer oor bogenoemde artikel wat verskyn het in die "Landbouweekblad" van 31 Januarie 1997 (kyk bl. -- in hierdie uitgawe). Ek weet dat daar soms in "Encephalartos" onder die afdeling koerantuitknipsels sulke artikels verskyn. Ek sal graag wil weet of sulke materiaal gekeur word en of dit geplaas word soos dit ontvang word?

In bogenoemde artikel het daar egter verskillende foute verskyn wat ek voel noodsaaklik is om uit te wys. Ek glo dat die foute ontstaan het toe die artikel geskryf is en dat die versamelaar nie die oorsaak daarvan is nie. By een van die foto's word daar verwys na 500 spesies, dit kan heel moontlik die hoeveelheid plante wees. Ook word beweer dat plante suiers maak van balletjies op wortels. Suiers word teen die stam gevorm, ek het nog nie gehoor dat suiers op wortels gevorm word nie. Daar is ook spelfoute in die benaming van spesies, maar ek voel dit is nie 'n ernstige probleem nie. Die geslag van die kewer wat eiers lê word bestempel as manlik wat nie moontlik kan wees nie. Ook word verwys na wurms en larwes wat in hierdie geval dieselfde moet wees. Die "vingertjies" kan moontlik die vrugskubbe wees en die saad wat met water gemeng word die stuifmeel. "Volgens mnr Alers is die skaarsste spesie in Suid-Afrika die *woodii*, waarvan net twee mannetjies oor is - een in Pretoria en een in Durban." Dit is beslis nie moontlik nie, daar is baie meer en selfs in Durban is daar sowat sewe plante wat ek met 'n vorige besoek gesien het. Volgens 'n koerantuitknipsel ("Rare plant") in *Encephalartos* 43: 42 (September 1995) is daar 38 plante oor.

Erik Rouwenhorst, Posbus 620, 2940 Newcastle.

Ontvang 10 Februarie 1997

[Koerant-/tydskrifuitknipsels wat as nuuswaardig beskou word, word op die betrokke bladsy(e) in ons tydskrif geplak en geen veranderinge word aangebring nie. Sulke artikels word gewoonlik deur verslaggewers geskryf wat leke op die gebied van broodbome/plantkunde is en hulle skryf wat die persoon met wie die onderhoud gevoer word hulle meedeel, en soms is die inligting nie heeltemal korrek nie. Ek wil dus 'n versoek tot broodboomversamelaars rig om, wanneer hulle onderhoude oor broodbome voer, slegs korrekte inligting aan verslaggewers te verstrek. Baie plantversamelaars (en selfs sommige plantkundiges) gebruik dikwels net die

epiteton wanneer daar van 'n spesie gepraat word, byvoorbeeld "*woodii, revoluta*", ens. Ek onthou nog dat daar jare gelede 'n kort artikel oor die "woody eye" in die Botaniese Tuin in Pretoria in 'n uitgawe van die "Pretoria News" verskyn het (die regte spelling van "*woodii*" is blykbaar nie aan die verslaggewer verstrekte nie). Die gebruik van slegs die spesifieke epiteton as naam van 'n spesie is nie plantkundig korrek nie aangesien die naam van enige plantspesie uit 'n kombinasie van die betrokke genusnaam plus die spesifieke epiteton bestaan. Die korrekte name van die twee spesies wat ek as voorbeelde gebruik het, is dus *Encephalartos woodii* en *Cycas revoluta* onderskeidelik.

Slegs een eksemplaar (bestaande uit vier stamme en 'n paar kleiner suiers) van *Encephalartos woodii* is ooit in die natuur gevind. Plante van hierdie spesie produseer egter vrylik suiers en dus kom eksemplare van die spesie al wêreldwyd in botaniese tuine asook in privaatversamelings voor. Ek glo nie daar is al 'n opname gemaak van hoeveel plante werklik bestaan nie. Lesers kan gerus die interessante geskiedenis oor die ontdekking van die enkele *E. woodii*-eksemplaar deur die plantkundige John Medley Wood in 1895 en die latere lotgevalle daarvan in Roy Osborne se "Fokus op ...."-artikel van die spesie lees (*Encephalartos* 5: 4-6, Maart 1986). - Redaktrise.]

### Addisionele kommentaar

Dit is jammer dat 'n artikel, soos die een waarna hierbo verwys word, deur 'n joernalis wat duidelik nie oor die nodige wetenskaplike agtergrond beskik nie, skynbaar sondermeer in 'n toonaangewende weekblad opgeneem word. Afgesien van die foute in die artikel wat hierbo deur een van ons skoolgaande lede en die redaktrise uitgewys is, kan daar ook nog op die volgende gewys word:

1. Daar word in die byskrif van een van die foto's gesê: "Die deursnee van die boom se blare is byna 3 m." Die 3 m verwys skynbaar na die blaarkroon en nie na die blare nie.
2. "Revolita" behoort *Cycas revoluta* te wees.
3. Dit is belaglik om sondermeer te beweer dat die *Encephalartos longifolius* wat in die een foto uitgebeeld word, sowat 2000 jaar oud is en om verder te beweer dat die inheemse broodbome slegs sowat 10 mm per jaar groei. Die "groeï" verwys skynbaar na die lengtegroei van die stam.
4. Daar is 38 en nie 34 inheemse broodboomspeesies in

die RSA nie.

5. Daar kom verskeie broodboomsoorte in die Noordelike Provinsie voor, nie net in Mpumalanga, Oos-Kaap en Natal nie.
6. Dit sal interessant wees om te verneem waarom vloedbesproeiing meer voordelig as sprinkelbesproeiing is.
7. *E. ferox* en *E. villosus* kom in die natuur in warm dele van ons land voor. Hulle floreer trouens in warm gebiede. Hulle gedy egter nie in sterk lig nie en is skaduliewende spesies.
8. Die langsnuitkewer (*Antliarhinus zamiae*) broei slegs in ontwikkelende broodboomsade en die larwes vreet nie broodbome van binne af dood nie.
9. Sade of saadpitte wat in water sink is nie noodwendig suksesvol bestuif of bevrug nie.
10. Die "vingertjies" van 'n broodboom se vroulike keël is die keël se steriele sporofille of skubbe.
11. Die 9:1 verhouding van manlike tot vroulike individue in 'n natuurlike broodboombevolking is ook heeltemal onwaar. Waar die saak wetenskaplik ondersoek is, is daar altyd 'n verhouding van feitlik 1:1 verkry.
12. Daar is geen wetenskaplike ondersteuning vir die bewering dat dit voordelig is om 'n broodboom tydens oorplanting presies te oriënteer soos wat dit vroeër was nie. Die "takke" waarna daar verwys word is skynbaar die plant se blare want broodbome vorm selde bogrondse takke.
13. Benatting van onder af sal seker afwaartse wortelgroei bevorder maar dit is seker nie noodsaaklik nie. In vogtige grond groei meeste wortelsoorte afwaarts onder die invloed van swaartekrag.
14. Dit sal meer as twee of drie opeenvolgende kruisings verg om 'n suiwer *Encephalartos woodii*-wyfie te skep.

Nat Grobbelaar, Posbus 15357, 0039 Lynn-oos.

### Summary

#### Comments on the magazine clipping "Cycads also flourish in cool areas" (see pp. --).

Erik Rouwenhorst, who sent in the clipping, comments on the article that appeared in a South African Agricultural magazine, "Landbouweekblad", on 31 January 1997. He wants to know whether such articles

are evaluated before printing in "Encephalartos" or are printed just as they are received.

He points out several errors that appear in the article, such as: plants produce suckers from nodules on the roots; misspelling of species names; the gender of the egg-laying insect is given as male; "larvae and worms" are names with the same meaning; the "small fingers" are probably megasporophylls; the mixing of "seed" with water to pollinate a female cone must refer to pollen, and according to Mr. Alers, the owner of the collection, the rarest species is *woodii* of which only two male plants are left, one in Pretoria and one in Durban. In this connection Erik refers readers to a newspaper clipping, "Rare plant", in *Encephalartos* 43: 42 (September 1995) according to which there are 38 plants existing.

The editor replies that newspaper/magazine clippings are pasted on the relative page(s) just as they are. Such articles are usually written by reporters who do not have the necessary scientific background, and they only convey what they were told by the person(s) they have interviewed. She urges cycad collectors to furnish only authentic information when being interviewed. She also points out that plant collectors (and even some botanists) often use only the epithet when speaking of a species, for example, "*woodii*, *revoluta*", etc. She remembers that years ago a short article on the "woody eye" in the Botanical Garden in Pretoria appeared in an issue of the "Pretoria News". Using the epithet without the generic name is wrong. It should be *Encephalartos woodii* and *Cycas revoluta*. With regard to *Encephalartos woodii* she points out that plants of this species suckers freely and thus specimens can be found all over the world in botanical gardens and private collections. She refers readers to the "Focus on ..." article on *E. woodii* by Roy Osborne (*Encephalartos* 5: 4-6, March 1986) where one can read about the interesting history of this species.

In the "Additional comments", Nat Grobbelaar writes that it is unfortunate that such an article was published in a leading weekly without first being submitted to a scientific reviewer. He points out the following: In the caption of one of the photos "the diameter of the tree's leaves is nearly 3 m" should be "the diameter of the leaf crown"; "revolita" should be *Cycas revoluta*; it is ridiculous to allege that the *E. longifolius* in one of the photos is about 2000 years old and that indigenous cycads only grow about 10 mm per year; there are 38 indigenous cycad species in South Africa, not 34; several *Encephalartos* species occur in nature in the Northern Province as well; why is irrigation by flooding more advantageous than spray-irrigation?; *E. ferox* and *E. villosus* flourish in warm areas but they are shade-loving species; the long-snouted beetle (*Antliarhinus zamiae*) breeds in developing cycad seed and does not occur inside the stem causing the death of the plant; seeds or seedkernels sinking in water are not necessarily

successfully pollinated or fertilized; the "small fingers" of the female cone of a cycad are sterile sporophylls or scales; the 9:1 ratio of male to female individuals in a natural cycad population is incorrect, scientific research confirmed the ratio to be nearly 1:1; no scientific support exists that cycads when being transplanted should be orientated exactly as they were previously, and the "branches" that are referred to are probably the leaves of the plant as cycads seldom produce aerial branches; in nature plants are usually wetted from above by means of rainfall and it is thus not necessary to wet the root system directly through a pipe inserted when transplanting the plant, and it will require more than three or four successive cross-breedings to produce a pure-bred *E. woodii* female.

Geagte prof. Robbertse

#### NUWE INTERIM REËLING VIR SEKERE HANDELINGE IN SPESIAAL BESKERMDE PLANTE BINNE DIE GAUTENG PROVINSIE

In afwagting op die deregulering van provinsiale wetgewing, word besitpermitte vir broodbome nie meer uitgereik of opgedateer in die Gauteng Provinsie nie. Persone wat in besit is van broodbome word aangeraai om enige dokumentasie vir die wetlike besit daarvan te bewaar. Plante mag voortaan besit, afgestaan en vervoer word sonder permitte binne die Gauteng Provinsie. Wanneer eienaarskap van die plante verander, moet die skenker 'n skenkingsbrief aan die ontvanger voorsien.

Die in- of uitvoer en verkoop van broodbome is nog onderhewig aan permitte. Hierdie permitte word deur hierdie kantoor uitgereik op skriftelike aansoek.

U is welkom om my te kontak indien ek van enige verdere hulp kan wees.

*J.K. Baker, Seksiehoof, vir Direkteur Generaal: Gauteng Provinsiale Regering. Adres: Die Hoof Natuurbewaarder, Distrikdienste: Gauteng, Privaatsak X 209, 0001 Pretoria.*

Ontvang 10 Februarie 1997

#### Summary

#### New interim regulations on certain proceedings regarding specially protected plants within the Gauteng Province

Pending the final settlement on deregulation of provincial legislation, ownership permits for cycads are no longer issued or updated in the Gauteng Province. People possessing cycads are advised to keep all documents proving legal right of ownership. Henceforth,

plants may be owned, donated and transported without permits within the boundaries of the Gauteng Province. When ownership of plants change the previous owner must provide the new owner with a letter of donation. However, permits are needed for the import/export and sale of cycads. The Nature Conservation authorities issue these permits on receipt of requests in writing.

Dear Editor

#### NOTES ON COLD-HARDINESS

I saw Piet Vorster's inquiry concerning the cold tolerance of *Cycas revoluta* in *Encephalartos* 48: 34 (December 1996). I thought that I would respond and supply some of my personal knowledge and what has been reported to me concerning *C. revoluta* and several other species.

In northern Florida, we get some horrendous freezes. Our record minimums have plummeted as low as 10°F (-12°C). Fortunately, these are record freezes that come every 50-100 years but unfortunately many came in the 1980's. These freeze events come as arctic air masses from Canada with hard blowing gail force winds. Our average annual minimums are 20-30°F (-6° to -1°C) with perhaps 2-14 days when we have frosts. We get cool weather from October to April which allows some cool loving plants to prosper. Except for the freeze events, the climate is almost tropical with lots of warm weather and sunshine. This allows the cultivation of many tropical plants that are vigorous enough to survive freezes. If they are sufficiently protected during the few hours of severe freezes then they can even prosper and cone in this climate.

*Cycas revoluta* has survived all these freezes and there are plants almost a century old in the city. Similarly, *C. taitungensis* has survived freezes in 1989 of 16°F (-9°C) with 3 days below freezing.

I am growing a few South African species that are cold hardy. *Encephalartos lehmannii* has promise. My plants were unbothered by frosts to -6°C. I also grow *E. ferox* and other species with broader leaflets. *E. ferox* will tolerate freezes to -3°C without damage to foliage. The plants rebound from colder temperatures and a correspondent in Baton Rouge reports their survival from the 1983 freezes. Mature plants of *E. ferox* exist in the late Dent Smith's garden (Daytona Beach) and have survived freezes down to 20°F (-6°C).

Relative to *E. natalensis*, mature plants exist in the late Dent Smith's garden that have survived all the freezes without care and protection.

It is noteworthy that foliage damage occurs in Central

Florida (200 km south) from freeze events (Roy Works has published accounts of this), but they do not get the cooler weather before a freeze event and damage occurs.

Some Australian species demonstrate cold tolerance. *Lepidozamia peroffskyana* will tolerate severe freezes down to  $-8^{\circ}\text{C}$ , and perhaps lower, without caudex damage. However, late season flushes of leaves will be burned. *Macrozamia moorei*, *M. communis* and *M. spiralis* are very cold hardy.

Mexican species are very cold hardy, *Dioon edule* being the most cold hardy. From personal experience I know they are cold hardy down to  $-6^{\circ}\text{C}$  and I have heard plants surviving in Baton Rouge from the freezes of 1983 and 1985 (in the negative teens centigrade). *Ceratozamia mexicana* and many species of *Zamia* are similarly cold tolerant. There are mature plants of *Dioon* and *Ceratozamia* in Gainesville (northern Florida) that survived many freezes and some recently severe freezes.

Ed Brown, 10712 Lippizan Dr., Jacksonville, Florida 32257, U.S.A.

Received 14 February 1997

Dear Editor

#### HAROLD JOHNSON NATURE RESERVE

Member Erik Rouwenhorst's contribution, "Broodbome by Harold Johnson Natuurreservaat" (*Encephalartos* 49: 19-21) made my hair stood on end.

A nature reserve is an ecosystem or a piece of one which is preserved as it is, as far as this is humanly possible. Man cannot improve a natural ecosystem, and with our present knowledge we cannot really repair damage. As soon as a natural ecosystem is modified by man through the addition of species which did not previously form part of the system, it becomes a wildflower garden.

As yet we know practically nothing about the genetical constitution of populations of wild plants, but we do know that it differs in different populations. One of the main aims of nature reserves is to preserve that genetical integrity, evolved over long periods of time to allow the species to adapt to local conditions and constraints. For this reason it is absolute taboo to introduce any "foreign" genetical material into a nature reserve. In the Western Cape, for instance, if illegally possessed tortoises are confiscated, these are never released into natural veld unless it can be established beyond any doubt where they originally came from. The reason is to protect the genetical integrity of wild tortoise populations. The same applies to cycads.

It is most unwise to introduce into nature reserves cycad specimens of the same species as which already occur naturally in the reserve, because the act is likely to compromise the genetical integrity of the natural population.

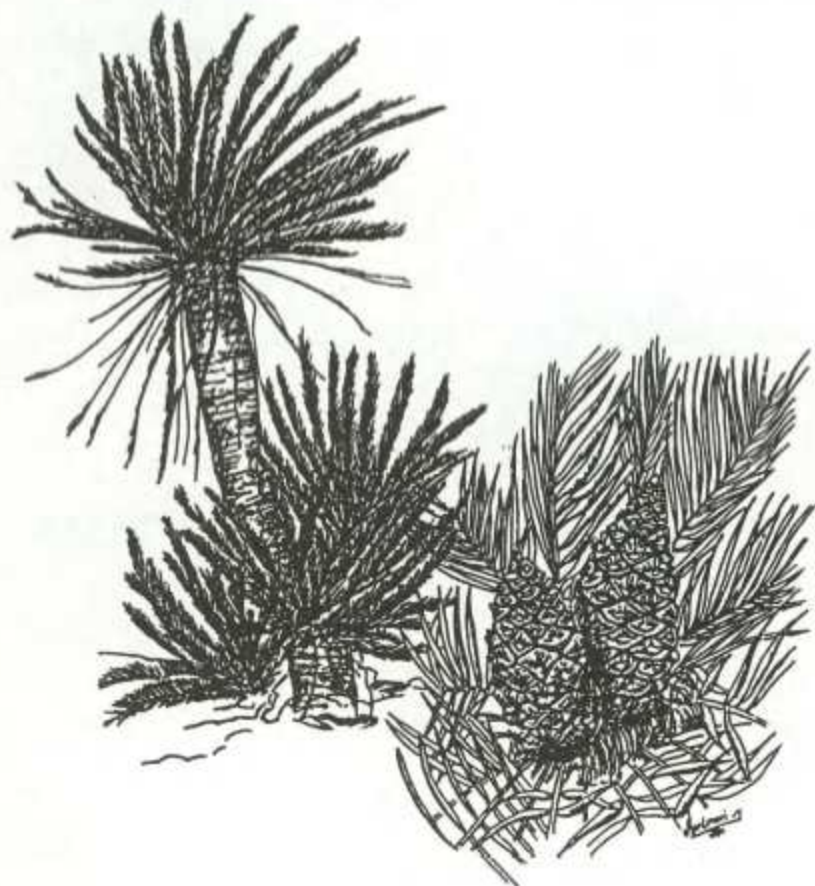
It is also unwise to introduce cycads into a reserve which looks as if there should be cycads, but where none occur naturally, because this act is sure to upset the ecosystem.

It is totally unwise to introduce into a nature reserve, additional to cycad species occurring naturally, species from elsewhere "to increase biodiversity". Under natural conditions most cycad species seem to have their own species-specific pollinating insects, but under disturbed conditions these insects are known to move to other cycad species as well, giving rise to hybrids and totally compromising the genetical integrity of all cycad species concerned.

I am surprised that the Natal Parks Board fell into this trap of trying to enrich their nature reserve, and implore them to get rid of the foreign cycads without delay.

Piet Vorster, Botany Department, University of Stellenbosch, Private Bag XI, 7602 Matieland.

Received 7 April 1997



## CYCADS IN CONTAINERS IN CALCUTTA

Shri Dhar

20 Ballygunge Park Road, Calcutta 700019, India

Received 20 March 1997

In the December 1996 issue of "Encephalartos" on page 37, there was an item regarding "Cycads in Containers". As I grow most of my cycads in containers (Figures 1-4), I have varied experiences. *Encephalartos* and *Dioon* species generally grow well in wooden containers which I specially get made, whereas *Cycas* and *Zamia* species do not grow as rapidly. I wonder whether it has something to do with these genera.



Figure 1 *Encephalartos villosus* in a 3 ft. diameter wooden pot.



Figure 2 A variegated form of *Zamia furfuracea*.

In reply to your various questions, I give my answers below:

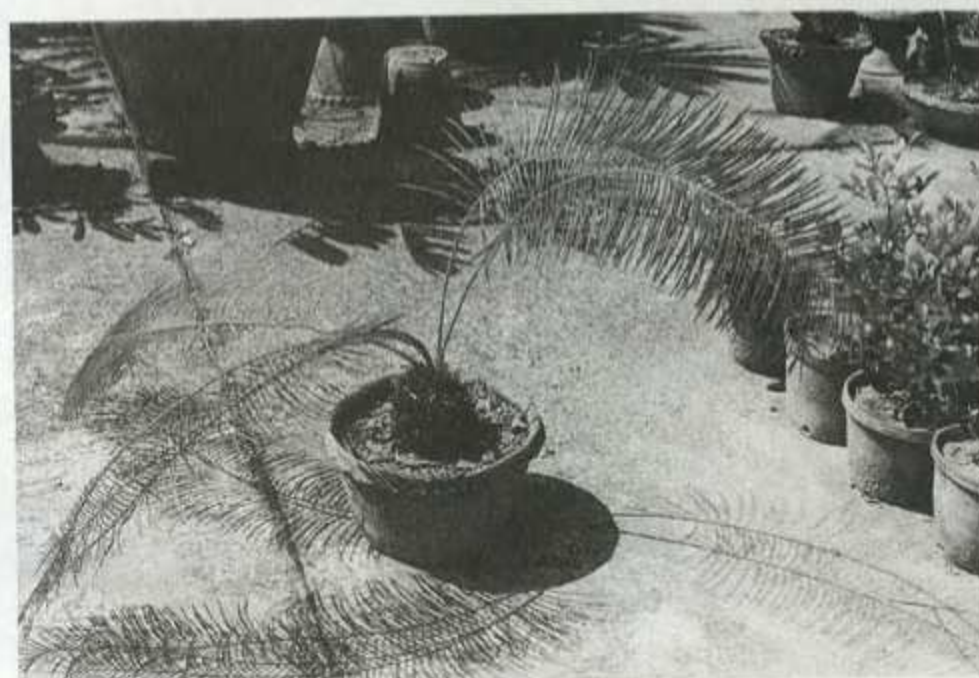


Figure 3 *Cycas beddomei*.

- Q. Best type of container (clay, asbestos, other?).  
A. I use mainly specially made wooden containers, photographs enclosed. I also use clay containers. In India we do not have asbestos containers.
- Q. Container size in relation to size of cycad trunk.  
A. Some of the pictures enclosed show the size of the containers in relation to the size of the plants.
- Q. Best soil mix or other growing-medium.  
A. I have been experimenting with different soil compositions in which I use mainly  $\frac{1}{4}$  leaf mold,  $\frac{1}{4}$  cowdung manure,  $\frac{1}{4}$  coarse sand and  $\frac{1}{4}$  ordinary alluvial soil. In this mixture, I use only bonemeal as fertilizer.
- Q. Fertilization.  
A. As we do not get dependable chemical fertilizers, I do not use them. From time to time, I apply powdered mastered oilcake and bonemeal.
- Q. Watering - how often and how much.  
A. The frequency of watering very much depends on the season. During summer, we water every day, whereas in winter, maybe once in 2-3 days. In the rainy season, we don't water at all.



Figure 4 *Cycas rumphii*. It was in the ground before it was taken out and planted in the pot.

- Q. Exposure to full sun versus protection from hot sun.
- A. I have experienced that all cycads need full sun. I have my *Cycas siamensis* in a location which provides sun only in the first half of the morning and I find it is not good. I am tinkering with the idea of moving it to another location where it will get full sun throughout the day. However, as it is not too healthy at the moment, I am waiting till it regains full health before shifting it. In any case, some of my *Zamia furfuracea* plants have been kept on the top floor of my house where they get full sun throughout the day and they are doing quite well.

[It would have been useful to know how long ago the plants depicted in Figures 1-4 have been transplanted into the containers, and also if their growth could have been compared with that of similar plants of the same age grown in open ground over the same period. - Editor.]




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## NEW SCIENTIFIC REPORTS

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Bonzi, L.M.\*, Bonatti, P.M., Paoletti, C., Pazzagli, L., Cappugi, G., Pancani, M.A. & Cardini, F. 1996. Occurrence of a mixture of ketocarotenoids in chloroplast plastoglobules of young leaflets of a cycad. *Journal of Plant Physiology* 149(6): 663-668.

[An investigation was carried out on chloroplast plastoglobules in young leaflets of "forma fuscoviridis" of *Ceratozamia mexicana* Brongn., a cycad characterized by a transitory red-brown colour in the first stages of developing leaves. Plastoglobules were isolated by several ultracentrifugations and the contents of the different "rings" were compared on silica gel layers with natural standards obtained in our laboratory from fully ripe fruits of *Murraya exotica* L. and of *Triphasia trifolia* (Burm. f.) P. Wilson (the two very rare semi-beta-carotenone and triphasiaxanthin) and from the leaflets of the same "forma fuscoviridis" (the novel

ceratoxanthin). The results pointed out that the red-brown colouration is due to the presence of a mixture of eight ketocarotenoids in the plastoglobules densely packed around the prolamellar body of young chloroplasts.]

\*First author's address: Dip. Biologia Vegetale, Lab. Citologia, V. La Pira 4, 50121 Firenze, Italy.

Chaw, S-M.\*, Zharkikh, A., Sung, H-M., Lau, T-C. & Li, W-H. 1997. Molecular phylogeny of extant gymnosperms and seed plant evolution: Analysis of nuclear 18S rRNA sequences. *Molecular Biology and Evolution* 14(1): 56-68.

[To study the evolutionary relationships among the four living gymnosperm orders and the interfamilial relationships in each order, a set of 65 nuclear 18S

rRNA sequences from ferns, gymnosperms, and angiosperms was analyzed using the neighbor-joining and maximum-parsimony methods. With *Selaginella* as the outgroup, the analysis strongly indicates that the seed plants form a monophyletic group with the fern as a sister group. Within the seed plants the angiosperms are clearly a monophyletic group. Although the bootstrap support for monophyly of the gymnosperm clade is moderate, the monophyly is further supported by its lack of angiosperm-specific indels. Within the gymnosperms there appear to be three monophyletic clades: Cycadales-Ginkgoales, Gnetales and Coniferales. The cycad-ginkgo clade is the earliest gymnosperm lineage. Given the strong support for the sister group relationship between Gnetales and Coniferales, it is unlikely that Gnetales is a sister group of the angiosperms, contrary to the view of many plant taxonomists. Within Coniferales, Pinaceae is monophyletic and basal to the remaining conifer families, among which there are three monophyletic clades: Phyllocladaceae-Podocarpaceae, Araucariaceae, and Sciadopityaceae-Taxaceae-Cephalotaxaceae-Taxodiaceae-Cupressaceae. Within the latter clade, Sciadopityaceae may be an outgroup to the other four families. Among the angiosperms, no significant cluster at the level of subclass was found, but there was evidence that Nymphaeaceae branched off first. Within the remaining angiosperms, the monocots included in this study was nested and form a monophyletic group. This study attests to the utility of nuclear 18S rRNA sequences in addressing relationships among living gymnosperms. Considerable variation in substitution was observed among the ferns and seed plants.]

\*First author's address: Inst. Bot., Academia Sinica, Taipei 11529, Taiwan.

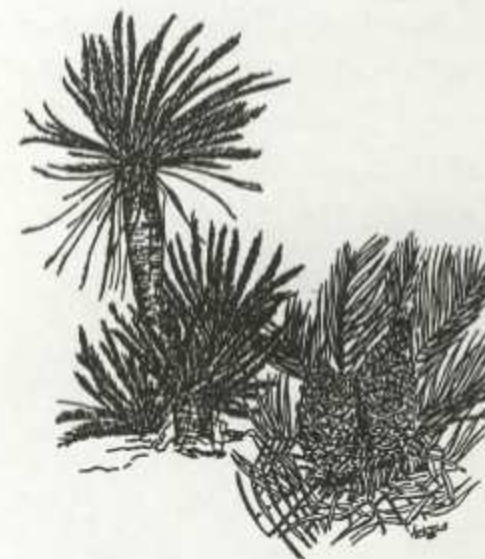
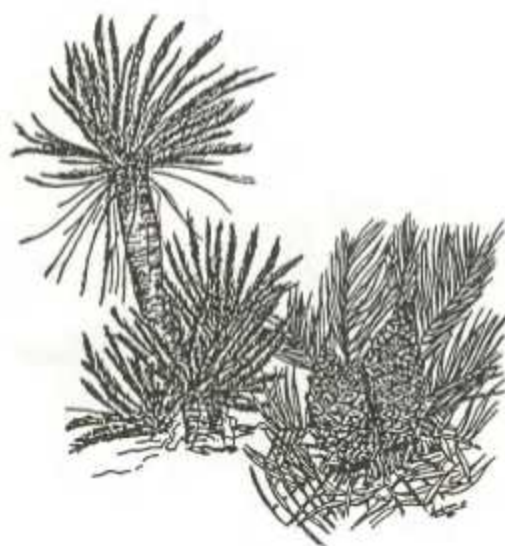
Czier, Z. 1996. *Banatozamites* Czier, gen. nov. (Cycadeoidales) from the lower Liassic of Romania. *Review of Palaeobotany and Palynology* 94(3-4): 345-356. [Fossil plant material originating from the lower Liassic of Anina, the Banat region, Romania, has been studied. However, because it cannot be assigned to the

cycadeoidalean genera so far known, although it undoubtedly belongs to this order, the new genus *Banatozamites* Czier, with its type species *B. chlamydostomus* Czier, has been created. Whereas the compared relevant genera *Zamites*, *Ischnophyton*, *Otozamites*, *Ptilophyllum*, *Dictyozamites*, *Pterophyllum* and *Sinoctenis* all possess simply pinnate leaves, *Banatozamites* most probably has a bipinnate leaf habit. The other bipinnate genera *Coreanophyllum* and *Nipponoptilophyllum* do not possess a cuticle. Therefore, the present material could not be assigned to either of these genera. The new cycadeoidalean genus *Banatozamites* Czier represents a new element in the European autochthonous palaeoflora, and a new element in the lower Liassic *Clathropteris meniscioides* zone.]

Author's address: Tarii Crisurilor Mus., B-dul Dacia 1-3, 3700 Oradea, Romania.

Hill, K.D. 1996. A taxonomic revision of the genus *Cycas* (Cycadaceae) in Australia. *Telopea* 7(1): 1-64. [A taxonomic revision of the genus *Cycas* in Australia is presented, with a key to all the species and maps of distribution illustrated. Twenty-seven species are recognized, six of them described here as new (*C. badensis*, *C. maconochiei*, *C. semota*, *C. tuckeri*, *C. xipholepis* and *C. yorkiana*). Six new subspecies are recognized (*C. arnhemica* subsp. *natja* and *muninga*, *C. maconochiei* subsp. *lanata* and *viridis*, and *C. media* subsp. *ensata* and *banksii*), and *C. lane-polei* is reinstated from synonymy. All Australian species are placed in section *Cycas* subsection *Endemicae*, with seven series recognized and described, five of them new.]  
Author's address: Natl. Herbarium New South Wales, Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia.

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



## AMENDMENT OF THE CONSTITUTION OF THE CYCAD SOCIETY OF SOUTH AFRICA

### ALTERATION OF ITEM 5.1.2 OF THE CONSTITUTION (See item 7 of the Constitution)

1997-04-16

Item 5 of the Constitution provides for the appointment of "A Back Copies Officer". At the moment the latter resides in Durban while the Secretary-treasurer resides in Pretoria. Requests for back copies of "Encephalartos" plus enclosed payment are often sent to the Secretary-treasurer who then has to transfer the request to the Back Copies Officer for attention. This procedure is cumbersome and expensive. A person joining the Society later during the year is also entitled to receive the back copies of the current year in which case the same detour is followed in that the Secretary-treasurer receives the membership fees and thereafter notifies the Back Copies Officer to supply the new member with the back copies.

To get rid of this cumbersome procedure, Council decided to ask members for their consent to alter the Constitution so that item 5.1.2 would read as follows:

"The duties of the President may be combined with that of the Secretary or the Treasurer. The duties of the Secretary-treasurer may also be combined with that of the Back Copies Officer." (The underlined part is the proposed alteration and is to be added.)

We require a two-thirds majority of members casting their votes to make this alteration. Will you please cast your vote in the ballot paper appearing on one of the coloured pages in this issue of the journal and return it before 1 September 1997.



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

### WYSIGING VAN ITEM 5.1.2. VAN DIE GRONDWET (Kyk item 7 van die Grondwet)

1997-04-16

Item 5 van die Grondwet maak voorsiening vir die aanstelling van 'n "Beampte vir vorige uitgawes". Op die oomblik woon die beampte in Durban, terwyl die Sekretaris-tesourier in Pretoria woon. Versoeke vir vorige uitgawes van "Encephalartos" tesame met die betaling word dikwels aan die Sekretaris-tesourier gestuur wat dan die inligting aan die beampte vir vorige uitgawes moet stuur vir afhandeling. Die prosedure is omslagtig en duur. 'n Persoon wat later in die jaar by die Vereniging aansluit is ook geregtig op al die vorige uitgawes van die jaar. Ook hier moet dieselfde ompad gevolg word, naamlik dat die Sekretaris-tesourier die ledegeld ontvang en dan die beampte vir vorige uitgawes in kennis moet stel om die vorige uitgawes aan die nuwe lid te stuur.

Om hierdie omslagtigheid uit te skakel, het die Raad besluit om lede se toestemming te vra om die Grondwet te verander sodat item 5.1.2 soos volg sal lees:

"Die pligte van die President mag met dié van die Sekretaris of Tesourier gekombineer word. Die pligte van die Sekretaris-tesourier kan ook met dié van die Beampte vir vorige uitgawes gekombineer word." (Die onderstreepte gedeelte is die voorstel vir die wysiging en moet bygevoeg word.)

Ons benodig 'n tweederde meerderheid van daardie lede wat stem om die wysiging aan te bring. Sal u asseblief die stembrief, wat op een van die gekleurde bladsye in hierdie uitgawe verskyn, voltooi en dit voor 1 September 1997 terugstuur.



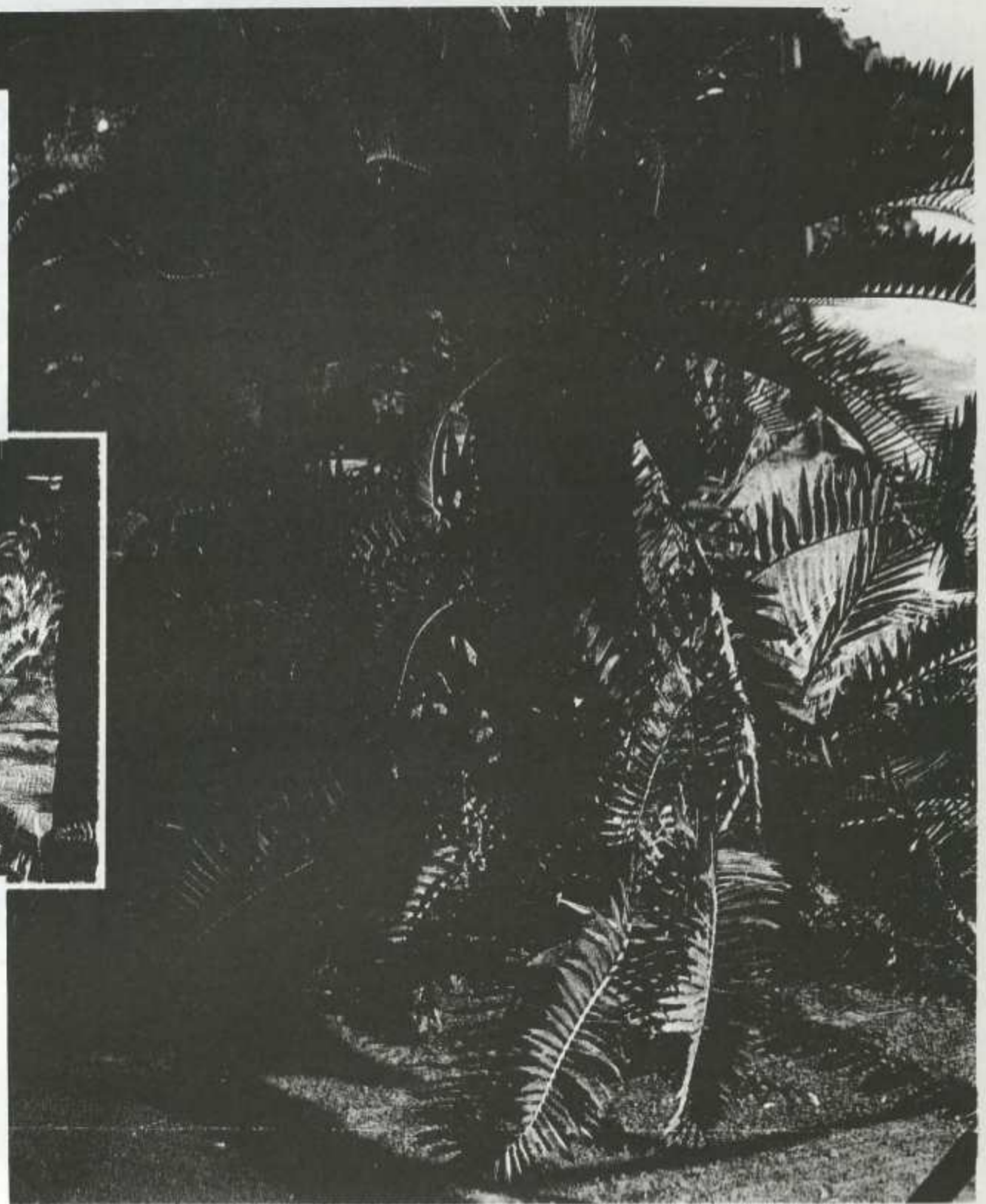
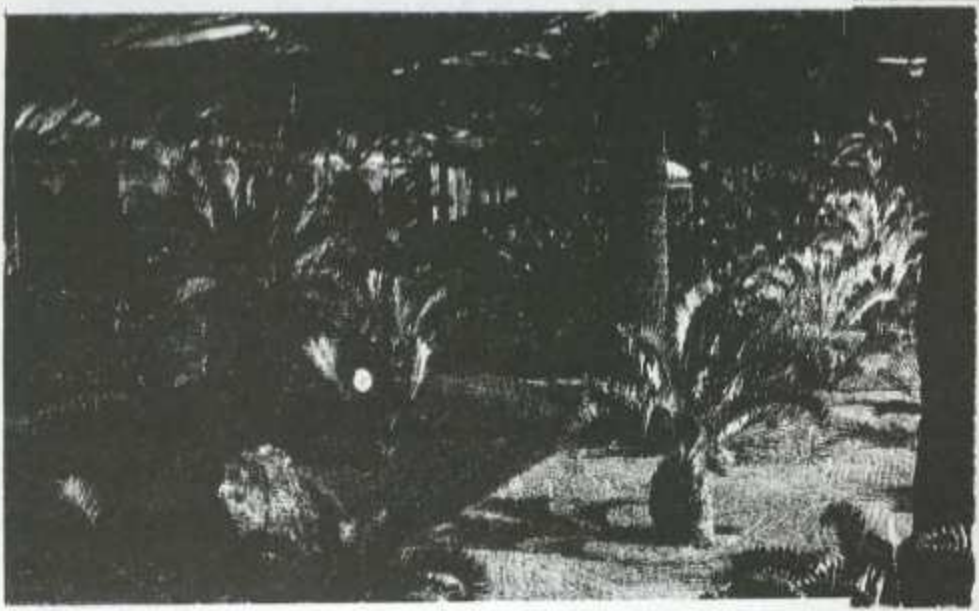
**TUIN**

► **HIERDIE boom wat suiers maak van balletjies wat aan die wortels vorm, is 'n longifolius.**

[This tree, producing suckers from small ball-shaped structures on the roots, is a *longifolius*.]

▼ 'n **BLIK op die broodbomeversameling van byna 500 verskillende spesies.**

[A view on the cycad collection of nearly 500 different species.]



Broodbome kan met welslae in die kouer dele van Suid-Afrika gekweek word. Een van die grootste versamelings van dié plante in die land, kom dan ook in die hartjie van die Vrystaat voor. Die kweker gee wenke oor hoe hy dit doen.

# Broodbome floreer ook in kouer dele

■ deur CHRIS JOOSTE

Reproduced with permission from the author, who is the Regional Editor for "Landbouweekblad" in the Free State.

'n **V**ERSAMELING van sowat 500 broodbome, waarvan sommige tot so oud as 2 000 jaar is, is in die Vrystaat te sien, 'n gebied waar broodbome nie natuurlik voorkom nie. Dit is te danke aan 'n ywerige versamelaar wat dié plante daar gevestig het.

Mnr. Jan Alers, eienaar van die Goudveld-wynkelder naby Wel-

Landbouweekblad, 31 Januarie 1997

kom, is die geesdriftige versamelaar en kweker van hierdie broodbome. Van die 34 bekende spesies in Suid-Afrika, word 30 in sy versameling aangetref. Die skaars spesies het hy bekom deur met ander versamelaars uit te ruil. Hy is daarom net die man wat belangstellendes alles oor broodbome kan vertel.

► **DIE keël van 'n wyfie-broodboom – in hierdie geval 'n *cycadifolius*.**

**[The cone of a female cycad - in this case a *cycadifolius*.]**

Broodbome kom nie in die Vrystaat in die natuur voor nie. Die plante se natuurlike omgewing – Mpumalanga, Oos-Kaap en Natal – het normaalweg nie uiterste koue nie, daarom beskerm mnr. Alers sy broodbome teen die Vrystaatse ryp.

Sommige spesies, soos *villosus*, *caffer*, *transvenosus* en *altensteinii* – is meer gevoelig vir ryp as ander. Die area waar sy broodbome staan, word deur 'n muur aan die ooste-, noorde- en suidekant beskerm, met skadunet bo-oor en aan die westekant. Wanneer die temperatuur tot  $-3^{\circ}\text{C}$  of  $-4^{\circ}\text{C}$  daal, word as bykomende voorsorgsmaatregel steenkoolvure in konkas gemaak en tussen die bome geplaas vir hitte. Rypskade kom dus selde voor, maar hael en sneeu het al die skadunette geskeur en skade aan die blare van die plante aangerig. Die bome self is nog nie deur koue beskadig nie.

'n Japanse spesie, *revolita*, wat vinniger groei as die sowat 250 mm in 25 jaar van die inheemse spesies, is baie gehard en kan enige plek in die Vrystaat geplant word. Omdat dit nie 'n inheemse plant is nie, word 'n permit nie vereis nie.

Broodbome is nie baie vatbaar vir droogte nie. Die plante moet egter water kry wanneer dit droog is, soos wanneer 'n mens jou tuin natlei. As die bome te veel water kry, kan dit verrot. Vloedbesproeiing, en nie sprinkelbesproeiing nie, is die beste manier van natlei.

Sekere spesies, soos *villosus* en *ferox* is gevoelig vir hitte, wat vlekke op die blare kan veroorsaak. Daarom moet die meeste broodbome in halfskadu geplant word. Daarvoor is skadunet geskik.

Wat plaë betref, is die langsnuitkewer broodbome se grootste vyand. Dié kewer maak gaatjies in die boom waarin hy sy eiers lê. Die larwes en wurms vreet die boom dan van binne af sodat dit uiteindelik vrek. Broodbome is ook gevoelig vir dop- en koringluise wat die sagte blare uitsuig. Die gewone spuitmiddels om dié plaë te bekamp, kan op broodbome gebruik word.



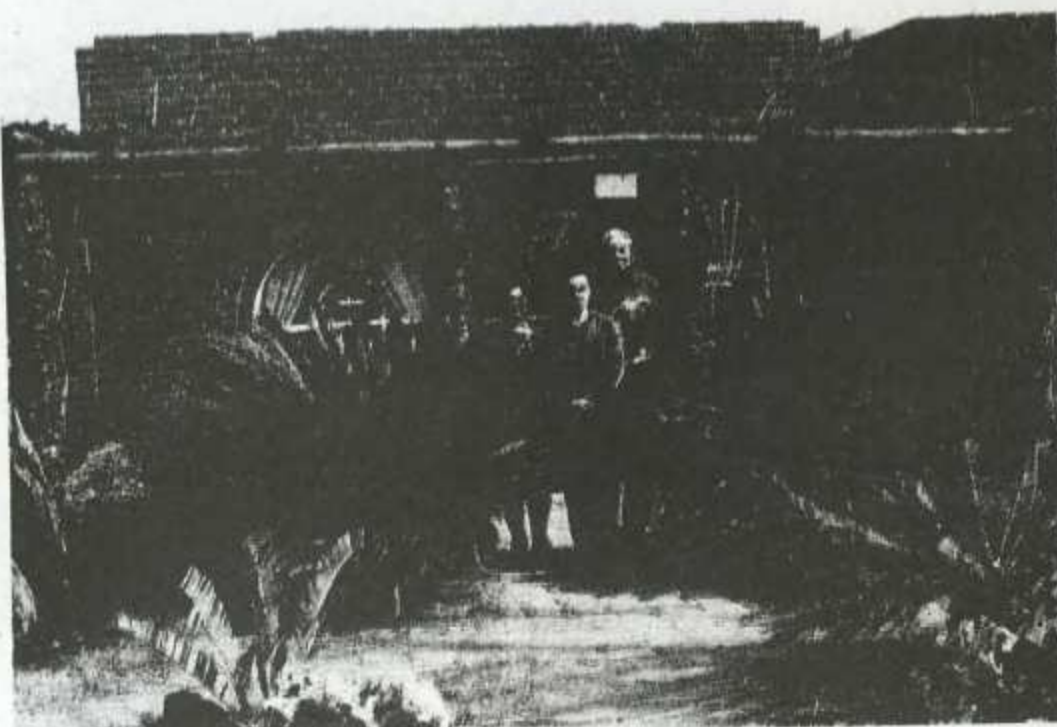
◄ **DIE manlike keël van 'n *lehmannii*.**

**[The male cone of a *lehmannii*.]**



▲ **MNR. ALERS by 'n *longifolius* met besonder lang blare. Die deursnee van die boom se blare is byna 3 m.**

**[Mr. Alers standing next to a *longifolius* with exceptionally long leaves. The diameter of the tree's leaves is nearly 3 m.]**



▲ **BY broodbome van die Japanse spesie *revolita*, 'n geharde plant wat nie deur koue of ryp beskadig word nie, staan van links mev. Gerrie Alers, Rolien Selzer en mnr. Jan Alers, geesdriftige versamelaar van broodbome.**

**[Standing next to cycads of the Japanese species *revolita*, a hardy plant not damaged by cold or frost, are Mmes. Gerrie Alers, Rolien Selzer and Mr. Jan Alers, enthusiastic collector of cycads.]**



▲ **'n BAIE skaars broodbome-spesie is die *inopinus*.**

**[A very rare cycad species is the *inopinus*.]**



◄ **HIERDIE *longifolius* is sowat 2 000 jaar oud en kom oorspronklik van die omgewing van die Addo-olifantpark. Broodbome se ouderdom word deur toetse in 'n laboratorium bepaal. Plantkundiges kan dit ook bepaal deur na die hoogte en die spesie te kyk.**

**[This *longifolius* is about 2000 years old and originally came from the vicinity of the Addo Elephant Park. The age of cycads is determined by means of laboratory tests. Botanists can also determine the age by looking at the height and the species.]**

Mnr. Alers verkoop klein broodboompies wat hy kweek van saad wat hy van sy bome oes. Hy los die sade aan die stronk tot dit self afval. Die sade word om die plant gelos tot die "vleis" sag is. Dit kan dan afge-vryf word.

#### **Bestuif**

Nadat die sade skoongemaak is, word dit in water geplaas om te sien of dit bestuif is of nie. Die sade wat sink, is bestuif en dié wat dryf, nie. Die geoesde sade word van ses maande tot 'n jaar gelaat om droog te word. Elke maand word die sade vir sowat vir ses uur in water geplaas. Wanneer die

sade droog is, word dit halflyf in riviersand geplant sodat dit makliker oorgeplant kan word.

Broodbome kan normaalweg net sowat agt dae per jaar bestuif word. Kwekers kan die bome ook self bestuif. Die vroulike keël is gereed om bestuif te word wanneer die "vingertjies" aan die keël oopgaan. Die plant kan dan bestuif word deur die stuifmeel van die mannetjie-plant met 'n kwassie by die vroulike keël in te werk of deur een van die "vingertjies" af te breek, die saad met water aan te maak en dit by die gaatjie in te gooi. Ná die twaalfde dag maak die "vingertjies" weer toe en kan die boom nie verder bestuif word nie. In die natuur is die verhouding mannetjies tot wyfies 9 tot 1.

Wanneer broodbome oorgeplant word, is dit belangrik om die volgende riglyne te volg: Een van die belangrikstes is dat die boom presies op dieselfde manier en net so diep geplant moet

word as wat dit voorheen gegroei het. Dieselfde takke moet dus, byvoorbeeld, in 'n noordelike rigting wys.

#### **Wortelstelsel**

Grawe 'n gat van 'n meter in deursnee en 'n meter diep. Die bo- en ondergrond moet apart gehou en die bogrond en 'n deel van die ondergrond met goeie kompos gemeng word. Gooi 'n laag van sowat 100 mm gruis onder in die gat en plaas 'n plastiekpyp skuins tot in die middel van die gat onder die gruis.

Gooi die mengsel van grond en kompos in die gat. Plant die boom daarin op dieselfde diepte as wat hy voorheen geplant was. Lei die boom dan soos gewoonlik nat.

Ná sowat 'n jaar moet die plant nie meer water van bo af kry nie. Die water moet dan by die pyp ingegooi word sodat die vog regstreeks by die wortelstelsel kan kom. 'n Ligte toediening van vloeibare kunsmis kan ook

deur die pyp gegee word.

Om te bepaal watter soort kunsmis broodbome nodig het, is dit die beste om 'n grondmonster te laat ontleed. 'n Goeie aanbeveling is 2:3:4.

Volgens mnr. Alers is die skaarsste spesie in Suid-Afrika die woodii, waarvan net twee mannetjies oor is – een in Pretoria en een in Durban. Kruisings is wel beskikbaar waar van die woodii se stuifmeel op natalensis-wyfies gebruik is. Ná twee tot drie kruisings kan 'n suiwer woodii-wyfie dalk weer geteel word.

In sy versameling kom broodbome van al drie die habitat-provinsies voor. Hy het permitte vir elkeen en sy versameling word gereed deur beamptes van die Departement Natuurbewaring besoek. Van sy bome is al deur die departement met mikroskopies gemerk sodat dit uitgeken kan word sou dit gesteel word. **L**

#### **Abstract**

### **Cycads also flourish in cool areas**

Mr. Jan Alers, owner of the Goldfields Wine-cellar near Welkom in the Free State Province, owns a collection of about 500 cycads. Of the 34 known South African species 30 are represented in the collection. No cycad species occur in the wild in the Free State where winters are extremely cold (in terms of South African standards). Therefore Mr. Alers protects his cycads against the Free State's frosts. The area in which his cycads are planted is protected by walls on the eastern, northern and

southern sides, with shade-net right over and on the western side. When temperatures drop to  $-3^{\circ}\text{C}$  or  $-4^{\circ}\text{C}$  drums, in which coal fires are lighted, are placed among the trees to provide heat. Thus damage by frost seldom occurs. However, when hail and snow cause rents in the overhead shade-net the leaves of the plants can be damaged. [For more details see the summary of comments on this article on p. 28-29. Editor.]

## Mikroskyfies stel plantdiewe aan die kaak

Johan de Meyer

Mikroskyfies het gehelp om ses broodbome van die skaars spesie *Encephalartos laevifolius* wat in Mpumalanga gesteel is, terug te vind.

Volgens mnr. Gary Sutter, woordvoerder van die Mpumalanga-Parkeraad (MPR), het lede van dié raad saam met lede van die Natalse Parkeraad Vrydag huise in twee Durbanse voorstede deurgesoek.

Beslag is gelê op die ses broodbome by die huise in Waterfall Park en Winston Park.

Volgens die mikroskyfies is die broodbome by Starvation Creek, na-

by Ngodwana in Mpumalanga, gesteel.

Die broodbome is baie skaars en van 'n beskermde spesie. Die skyfies is aangebring om hulle maklik te kan identifiseer en bevat inligting oor die presiese plek waar die bome groei.

Volgens mnr. Herman Erasmus, die MPR se spesiale ondersoekbeampte, het die parkeraad baie geld bestee om die broodbome met die mikroskyfies te merk. "Dit is dus baie bevredigend as dié strategie nou vrugte dra."

Die ses broodbome is die naweek na die MPR se kwekery in Lydenburg vervoer waar die plante gehou sal word totdat dit weer in Ngodwana gevestig sal word.

### Abstract

#### Microchips show up plant thieves

Six specimens of *Encephalartos laevifolius* were confiscated at houses in two Durban suburbs by members of the Mpumalanga Parks Board and the Natal Parks Board. Information gained from microchips implanted in the plants indicated that the cycads were stolen from the wild at Starvation

Creek, near Ngodwana in Mpumalanga.

The Mpumalanga Parks Board marked cycads in the wild with microchips at considerable expense. It is therefore very gratifying that this strategy is now yielding results.

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2030	GRIMBEEK, Mnr. P.J.	Greenstraat 134, PARKTOWN, PRETORIA 0084.
1400	GROBBELAAR, Mev. Hanneke	Tarentaalkloof, Posbus 15357, LYNN-OOS 0039.
HON.	GROBBELAAR, Prof. N. (ERELID)	Tarentaalkloof, Posbus 15357, LYNN-OOS 0039.
1855	GROBLER, Mnr. F.	Posbus 794, HARTBEESPOORT 0216.
0143	GROBLER, Mev. Maria	Posbus 914, PIETERSBURG 0700.
1840	GROBLER, Mnr. P.S.	Posbus 20871, NEW CASTLE 2940.
0420	HANACZECK, Mr. H.W.	P.O. Box 44, DUIWELSKLOOF 0835.
1178	HARRIS, Mr. M.V.	5 FitzPatrick Street, SASOLBURG 9570.
1600	HARRIS, Mnr. R.	Posbus 16514, VERWOERDBURG 0140.
0601	HART, Mr. G.B.	P.O. Box 72727, LYNNWOOD RIDGE, 0040.
1534	HARVEY, Mr. N.N.	P.O. Box 28444, DANHOF 9310.
0077	HATTINGH, Mev. E.F.	Posbus 615, GROBLERSDAL 0470.
0704	HEARD, Mr. W.	41 Protea Way, DURBANVILLE 7550.
1586	HEIBERG, Mnr. B.	Posbus 21079, HELDERKRUIN 1733.
1964	HEINE, Mnr. E.W.P.	Groenweide 10, STELLENBOSCH, 7600
0115	HENMAN, Mr. Enrico	12 Dhlinsa Street, ESHOWE 3815.
0433	HENNING, Dr. N.G.C.	Cantonmentsweg 80, Lyttelton Manor, VERWOERDBURG 0157.
2096	HENNING, Dr. J.C.	Posbus 1168, ELLISRAS 0555
1610	HENRICO, Mev. H.	Harrisonstraat 15, Doorn, WELKOM 9459.
1892	HEYMANS, Mnr. J.L.	Ceresrylaan 7, Kenmare 4, KRUGRSDORP 1739.
1080	HEYNS, Mnr. J.O.	Wenningstraat 115, Groenkloof, PRETORIA 0181.
2063	HLOMOHLOMO GAME RESERVE cc	P. O. Box 95192, GRANT PARK 2051.
2006	HOBBS, Mnr. E.T.	Bosveldweg 157, Wonderboom, PRETORIA 0182.
1711	HOLLANDER, Prof. W.J.	Randse Afrikaanse Universiteit, Posbus 524, AUCKLANDPARK 2006.
9002	HOOFDIREKTORAAT NATUURBEWARING	Privaatsak X209, PRETORIA 0001.
1794	HOOG, Mr. R.J.L.	22 Douglas Road, KLOOF 3610.
0086	HOOLE, Mr. James C.	P.O. Box 7958, Newton Park, PORT ELIZABETH 6055.
1692	HOOPS, Mnr. H.O.	Posbus 6, ALEXANDRIA 6185.
1529	HORAK, Mev. G.	Posbus 7127, Flamwood, KLERKSDORP 2572.
1946	HÖRING, Mr. H.J.	12 Leeuwenhof Street, Oak Glen, BELLVILLE, 7430
1983	HORSTHEMKE, Mr. R.E.	P.O.Box 365, FERNDAL, 2160
0498	HULSHOF, Mr. A.	P.O. Box 1526, KLERKSDORP 2570.
1766	HUNTER, Dr. J.J.	Nietvoorbij, Privaatsak X5026, STELLENBOSCH 7599.
1155	ISACKS, Mr. G.A.	8 Medway Road, WESTVILLE 3630.
1168	ISACKS, Mr. G.R.	44 Windham Avenue, HILLARY 4094.
0528	JACOBS, Mnr. W.J.	Ashleyweg 19, SCOTTSBURGH 4180.
2047	JAN & TANIA TRUST	8 Medway Road, WESTVILLE 3630.
2102	JANSE VAN RENSBURG, Mnr. D.E.	Posbus 4124, POTGIETERSRUST 0600
1900	JANSE VAN RENSBURG, Mnr. J.A.	Posbus 345, PIETERMARITZBURG 3200.
1002	JANSE VAN RENSBURG, Mnr. J.M.	Posbus 92, VRYHEID 3100.
1217	JANSE VAN RENSBURG, J.P.	Jopie Fouriestraat 374, PRETORIA-NOORD 0182.
1851	JANSE VAN RENSBURG, Mnr. W.J.	Nondweni S.W.S., Privaatsak X4027, TZANEEN 0850.
0458	JOHANNES, Mr. G.	P.O. Box 215, PIET RETIEF 2380.
0644	JOHANNES, Mr. H.C.	P. O. Box 276, PAULPIETERSBURG 3180.
1797	JOHANNESBURG PUBLIC LIBRARY	Market Square, JOHANNESBURG 2001.
0624	JORDAAN, Dr. A.J.J.	Posbus 6461, WELTEVREDEPARK 1715.
1415	JORDAAN, Mnr. A.S.	Ponsfordsingel 36, ESCOMBE 4093.
2076	JORDAAN, Dr. J.B.	Posbus 480, NELSPRUIT 1200.
1527	JORDAAN, Past. Ben	Waterbokstraat 9, Faunapark, PIETERSBURG 0699.
0146	JORDAAN, Sakkie & Anna	Posbus 104, WARRENTON 8530.
1531	JOUBERT, Mnr. L.J.	Borriusstraat 8, Bailliepark, POTCHEFSTROOM 2520.
1355	JOUBERT, Mnr. W.	Posbus 376, WARMBAD 0480.
1462	KABLE, Mr. A.J.	12 Orchid Road, Tygerdal, GOODWOOD 7460.
0223	KACHELHOFFER, Mr. N.J.	P.O. Box 3107, PRETORIA 0001.
1791	KADWA, Dr. M.A.	Park Lane Clinic, Junction Avenue, PARKTOWN 2193.
0714	KANTOR, Mr. S.R.	P.O. Box 59542, KAREN PARK 0118.
2002	KELLERMAN, E.O.	Posbus 73618, LYNNWOODRIF 0400.
0010	KEMP, Mr. H.J.	51 Constance Road, Broadwood, PORT ELIZABETH 6070.
1989	KEMPKES, Mr L	P. O. Box 1850, VEREENIGING 1930.
2151	KENDALL, L.	P. O. Box 11324, HATFIELD 0028
0081	KENNEDY, Mnr. H.C.	Panoramastraat 2, PAARL 7646.
0745	KLOPPERS, Mnr. J.S.	Posbus 24, GROBLERSDAL 0870.

0823	KNOX-DAVIES, Prof. P.S.	35 Union Avenue, STELLENBOSCH 7600.
1867	KOCKOTT, Mrs. C.P.	P.O. Box 1253, STILFONTEIN 2550.
2112	KOEN, Mr. J.J.	P. O. Box 6838, HOMESTEAD 1412.
1358	KOFMAN, Mnr. J.H.	Floraunaweg 806, Florauna, PRETORIA-NOORD 0182.
1538	KOK, Mnr. M.B.	Posbus 48187, HERCULES 0030.
1871	KONIG, Mr. Andrew	P.O. Box 890442, LYNDBURST 2106.
1939	KORKIE, Mnr. & Mev. E.S.	Vampirestraat 569, ELARDUSPARK, 0181
1812	KRIEL, Mnr. W.H.	Rupertlaan 34, SOMERSET-WES 7130.
1302	KRUGER, Mrs. F.J.	22 Approach Avenue, Selwyn, FLORIDA 1709.
1923	KRUGER, Mnr. Leon	Posbus 13586, LERAATSFONTEIN, 1038
1373	KRUGER, Mnr. N.J.S.	Posbus 46, RANT-EN-DAL 1751.
0853	KRUGER, Dr. P.W.B.	Posbus 3173, PRETORIA 0001.
1140	KRUGER, Mnr. S.R.	Reineckestraat 45, Panorama, BETHLEHEM 9700.
1672	KUSCHKE, Mnr. A.E.	Posbus 54, HAZYVIEW 1242.
1832	KUUN, Mnr. P.J.C.	Posbus 39718, MORELETAPARK 0044.
1888	KUYPER, Mnr. A.	Posbus 161, MONTANAPARK 0159.
1636	LAMBERT, Miss. A.	Durban Botanical Gardens, P.O. Box 3740, DURBAN 4000.
0109	LASNITSKI, Mrs. M.	1 Viljoen Street, ROUXVILLE 2192.
1679	LEACH, Mev. Marie	Kingfisherstraat 124, Horison Uitbreiding, ROODEPOORT 1725.
2114	LEEB, Mnr G.A.R.	Posbus 1275, TZANEEN 0850.
1431	LE ROUX, Mr. Stan	39 Dick King Road, Athlone Park, AMANZIMTOTI 4126.
1532	LESSING, Mnr. & Mev. J.	Oribistr. 30, JEFFREYSBAAI 6330.
1166	LIGHTLEY, Mr. C.G.	c/o S.A.Wire, P.O. Box 756, EMPANGENI 3880.
1948	LOMBAARD, Mnr. J.A.	Posbus 50689, WIERDAPARK, 0149
1240	LOMBARD, Mnr. J.H.	Posbus 908285, MONTANA 0151.
1494	LOTTER, Mnr. D.	Posbus 6881, FLAMWOOD 2572.
2133	LÖTTER, Mnr. J.L.	Posbus 8776, NEWCASTLE 2940.
0645	LOTTER, Mr. W.J.	Posbus 48520, Hercules, PRETORIA 0030.
0159	LOUBSER, Prof. J.D.	Posbus 11315, QUEENSWOOD 0121.
2033	LOUBSER, Mr. Neil	261 Canopus Street, WATERKLOOF 0181.
1676	LOUW, Mr. J.P.	5 Hanlon Road, VALHALLA 0185.
1272	LOUW, Mnr. W.H.	Posbus 57, NABOOMSPRUIT 0560.
1324	LOVATT, Mr. M.	P.O. Box 338, EMPANGENI 3880.
0296	LOWVELD	P.O. Box 1024, NELSPRUIT 1200.
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2094	LUBBE, Mnr. C.E.J.	Posbus 1126, TZANEEN 0850
1587	LUBBE, Mnr. D.P.	Giraffeweg 47, Monumentpark, PRETORIA 0181.
2083	LUCAS, Mr. S.C.	36 Feldspar Rd., Helderkruin, ROODEPOORT 1724.
1978	MACGREGOR, Mr. C.A.	P.O.Box 101525, MORELETAPARK 0044
1980	McARTHUR, Mr. H.B.	P.O. Box 452, GILLITS, 3603
1660	McCLELLAN, Dr. Tracy	Department of Genetics, University of the Witwatersrand, Private Bag 3, WITS 2050.
1721	MALAN, Mnr. C.	Posbus 11258, QUEENSWOOD 0121.
2069	MANGA, Mr. Vasan	P. O. Box 1546, BENONI 1500.
0561	MARAIS, Mnr. A.J.	Posbus 28006, Sunridge Park, PORT ELIZABETH 6008.
1265	MARAIS, Mnr. G.J.	Posbus 5018, NEWCASTLE 2940.
1973	MARAIS, Mr. R.E.B.	67 Glover Avenue, DORINGKLOOF, 0157
2065	MARNEWICH, Mr. C.	105 Dan Pienaar Ave., Florida Hills, ROODEPOORT 1709.
0088	MARX, Mnr. Frank	Kurumanskloof 29, Summerstrand, PORT ELIZABETH 6001.
1372	MARX, Mr. M.A.M.	Private Bag X1668, BERGVILLE 3350.
1805	MAUD, Mr. C.S.	Howard Place, DURBAN NORTH 4051.
2142	McBEAN, Mr. W.	8 Louw Avenue, MONUMENT 1739.
1667	MERESMAN, Ms. Avis	P.O. Box 4726, DURBAN 4000.
0205	MEYER, Mnr. C.C.	Ralstonweg 20, Fernglen, PORT ELIZABETH 6045.
1575	MEYER, Prof. J.J.M.	Departement Plantkunde, Universiteit van Pretoria, PRETORIA 0002.
1109	MEYER, Mr. P.K.	P.O. Box 435, ST. MICHAEL'S-ON-SEA 4265.
1107	MIDDELMANN, Mr. W.J.	402 CPOA, 231 Main Rd., RONDEBOSCH 7700.
1809	MIDDLEWICK, Dr. G.C.	P.O. Box 1383, ROOSEVELD PARK 2129.
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2110	MINNAAR, Mnr. J.J.	Posbus 1580, GARSFONTEIN 0042
0006	MINNIE, Dr. Ollie J.	P.O. Box 137, MTUBATUBA 3935.
1210	MOODIE, Mnr. S.T.	Posbus 3125, PRETORIA 0001.
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2037	MOSTERT, Mr. Q.B.	307 Blackbarn Road, DURBAN NORTH 4051.
0741	MULDER, Mr. I.B.	Saffraanlaan 10, Weltevredenpark x9, ROODEPOORT 1709.

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0523 MYBURGH, Mnr. P.P.  
1922 MYBURGH, Mnr. & Mev. F.M.  
1620 MYERS, Mev. M.M.  
1470 NASSER, Mr. M.  
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1570 NAUDE, Mnr. J.J.  
0261 NEL, Mnr. D.P.  
1423 NEL, Mnr. J.J.G.  
1519 NEL, Mnr. M.H.B.  
1784 NEL, Mnr. P.W.  
2124 NELL, Dr. Johan  
1943 NELL, Mnr. J.F.  
0227 NEL, Mnr. William  
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2061 NICHOLSON, Mr. Ian  
1194 NIEMAND, Mr. & Mrs. H. & D.  
1192 NIEUWENHUIZEN, Mr. R.  
1503 NIEUWOUDT, Mnr. J.  
0829 NIEWOUDT, Prof. C.F.  
2009 NEWOUDT, Mev. M.C.  
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1968 OBERHOLZER, Neil & Thea  
0975 OBERPRIELER, Mr. Rolf G.  
1588 OCHSE, Mr. A.L.  
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0094 OLIVIER, Mnr. & Mev.  
1732 OLIVIER, Mnr. H.G.  
1960 OLSEN, Mrs. E.C.  
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0078 PINKER, Mr. Colin  
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1941 POTGIETER, Dr. Chris  
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34 Crestview Road, Bellevue, PIETERMARITZBURG 3201.  
3 Dickens Place, PINETOWN 3610.  
19 Winston Road, KLOOF 3610.  
Olifantslaan 83, DORINGKLOOF 0157  
626 Jan Visse Avenue, ROSEVILLE 0084.  
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1917	QUINN, Peter & Linda	P.O.Box 77, DURBAN, 4000
0832	RADEMEYER, Mev. C.	Windsorstraat 5, GEORGE 6530.
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1197	REINACH, Dr. Norman	Posbus 1834, GEORGE 6530.
1370	RICHTER, Mr. M.P.	P.O. Box 209, KNYSNA 6570.
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1654	ROBBERTSE, Prof. P.J.	Astridstraat 167, Meyerspark, PRETORIA 0184.
1253	ROBINSON, Mr. Ken	P.O. Box 41168, CRAIGHALL 2024.
1201	ROOS, A.	Marine Rylaan 303, Brighton Strand, DURBAN 4052.
1699	ROOS, Mr. C.A.	14 Arundel Road, Dinwiddie, GERMISTON 1401.
2005	ROOS, Mnr. P.B.	Posbus 11076, Bendorpark, PIETERSBURG 0699.
2175	ROOSEDAAL, Mr. S.	29 Bamboes Street, KILNER PARK 0186.
0187	ROSS, Mr. W.D.	20 Wanless Road, Glenmore, DURBAN 4001.
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0973	ROSSOUW, Mr. N.B.	38 Middleton Road, ESCOMBE 4093.
2171	ROUSSEAU, Mnr. Robert	Posbus 32416, GLENSTANTIA 0010.
1853	ROUWENHORST, Erik	Posbus 620, NEWCASTLE 2940.
1442	ROUX, Mnr. J.J.	Graphitestraat 64, WILROPARK 1724.
1633	ROUX, Mnr. T.	Posbus 16464, PRETORIA-NOORD 0116.
1893	RUDMAN, Mr. E.R.	35 Brand van Zyl Avenue, Vanes Estate, UITENHAGE 6230.
0415	RUDMAN, Mr. R.R.	3 Dunn Road, Jansendal Township, UITENHAGE 6230.
1402	RYAN, Mnr. M.J.	Mahemlaan 3, RUSTENBURG 0300.
1829	SCHAAP, Mnr. S.	Posbus 149, GRAVELOTTE 0895.
1685	SCHELE, Mr. Anton	P.O. Box 72917, LYNNWOOD RIDGE 0040.
0311	SCHIMMER, Mr. C.M.	P.O. Box 274, ALLANRIDGE 9490.
0424	SCHMIDT, Mnr. & Mev. C.F.	Posbus 16657, PRETORIA-NOORD 0116.
1984	SCHMIDT, Mr. E.V.	4 Lauriston Lanes, 55 Vildng Rd., GLEN LAURISTON 0185
1881	SCHOEMAN, Mnr. J.	Posbus 38448, GARSFONTEIN 0042.
2128	SCHOLTZ, Mnr. W.C.	Posbus 924, ELLISRAS 0555
0082	SCHOEMAN, Mnr. S.J.	Posbus 16001, PRETORIA-NOORD 0116.
1729	SCHOLTZ-KOEN, Dr. M.	Posbus 16343, PRETORIA-NOORD 0116.
1880	SCHUTTE, Mev. J.E.	Posbus 1745, RUSTENBURG 3500.
1077	SCHUTTE, Dr. R.L.	P.O. Box 65580, BENMORE 2010.
0647	SCHWELLNUS, Mnr. M.R.	Posbus 7045, Newton Park, PORT ELIZABETH 6055.
2028	SCHREUR, Mev. A.S.	Kitaatstraat 7, Dalpark, BRAKPAN 1540.
1612	SCOPEL, Dr. G.	32 12th Street, Orange Grove, JOHANNESBURG 2192.
2000	SCOT, Mr. J.J.	17 Slangkop Avenue, Rand Park Ext. 4, RANDBURG 2195.
0477	SCRIBA, Mr. J.H.	College for Foresters, Saasveld, Private Bag X6531, GEORGE 6530.
1249	SEEDAT, Hassim	P.O. Box 48611, QUALBERT 4078.
0052	SHOOTER, Mr. E. Roy	21 Channel View Road, FYNNLANDS 4052.
0254	SLABBERT, Mnr. J.F.	Diazweg 122, Adcockvale, PORT ELIZABETH 6001.
1688	SLAVIERA, Mr. G.F.	1 Murray Street, Dagbreek, WELKOM 9459.
1650	SLAVIERO, Mr. L.	2 Pierneef Road, Elma Park, EDENVALE 1610.
2022	SLAZUS, Dr. J.J.	Thibaultstraat 3, STELLENBOSCH 7600.
1959	SMALBERGER, Mnr. H.C.	Posbus 17190, PRETORIA-NOORD, 0116
0534	SMIT, Mnr. D.D.	Posbus 17167, PRETORIA-NOORD 0116.
1821	SMIT, Mnr. J.	Meppenstraat 32, Gerdview, GERMISTON 1401.
1580	SMITH, Mrs. D.J.F.	29 Chipstead Avenue, Bluff, DURBAN 4052.
0903	SMITH, Dr. G.F.	Nasionale Botaniese Instituut, Privaatsak X101, PRETORIA 0001.
1356	SMITH, Mr. J.D.	P.O. Box 210, WINKLESPRUIT 4145.
2116	SMITH, Mr. M.R.	P. O. Box 21316, BROEDERSTROOM 0240.

1830	SMITH, Mr. T.D.	10 Amber Valley, Ambleside Lane, COWIE'S HILL 3610.
0698	SMUTS, Mnr. M.N.	Posbus 13682, SINOVILLE 0129.
2120	SNYMAN, Mnr. A.D.	Posbus 520, UTRECHT 2980
1481	SNYMAN, Mr. A.J.	P.O. Box 101, ILLOVO BEACH 4155.
1815	SNYMAN, Dr. P.H.R.	Posbus 565, MONTANAPARK -159.
0992	SPICER, Mr. B.E.J.	P.O. Box 32074, MOBENI 4060.
9003	STAATSBIBLIOTEEK	(Afdeling Pligeksemplare), Posbus 397, PRETORIA 0001.
2115	STEENKAMP, Mnr. C.	Posbus 73269, LYNNWOODRIF 0040.
0911	STEENKAMP, Mnr. & Mev. K.	Ontevrede, Posbus 115, LOUWSBURG 3150.
1935	STEENKAMP, Mnr. M.L.	Posbus 792, DURBANVILLE, 7550
1816	STEFFENS, Mnr. A.S.	Posbus 115, EMPANGENI 3880.
1576	STEP, Mnr. E.O.	Van Riebeecklaan 133, Lyttelton Manor, VERWOERDBURG 0157.
1629	STEYN, Dr. E.M.A.	Privaatsak X101, PRETORIA 0001.
2050	STEYN, Dr. G.F.	Voortrekkerstraat 183, GREYTOWN 3250.
1236	STEYN, Mr. R.C.	P.O. Box 1218, HONEYDEW 2040.
2007	STEYNBERG, Mr. S.R.	P. O. Box 7034, DUNSWART 1508.
1958	STOLS, Mnr W.J.	Posbus 13170, WITFIELD, 1467
1004	STRANEX, Mr. Phillip	P.O. Box 53235, KENILWORTH 7745.
1117	STRANG, Mrs. C.	P.O. Box 69212, BRYANSTON 2021.
2004	STRIJDOM, Mnr. Johan	Posbus 35288, MENLPARK 0102.
1401	STROBOS, Mr. J.G.	P.O. Box 1732, LINKHILLS 3652.
0084	STROEBEL, Mr. Pieter	Posbus 189, PORT ELIZABETH 6000.
2004	STRIJDOM, Mnr Johan	Posbus 35288, MENLOPARK 0102.
0213	STRYDOM, Dr. Dawid	Prospecting Services, Anglo American, Private Bag X5035, KLERKSDORP 2570.
1625	STRYDOM, Mr. F.	39 Skegness Avenue, Hillary, DURBAN 4093.
2056	STRYDOM, Mr. G.	21 Constantia Street, Culemborg Park, RANDFONTEIN 1760.
1264	SUBROGEN, Mr. M.	P.O.Box 117, DESAINAGAR 4405.
9006	SUID-AFRIKAANSE BIBLIOTEEK	(Afdeling Pligeksemplare), Posbus 496, KAAPSTAD 8000.
1986	SWANEPOEL, Dr. A.C.J.	Rabiestraat 176, MEYERSPARK, 0184
0139	SWANEPOEL, Mnr. Johan	Posbus 911, BLOEMFONTEIN 9300.
1879	SWANEPOEL, Mnr. Louis	Posbus 6093, BIRCHLEIGH 1620.
1425	SYDOW, Mr. J.	27 Perth Road, Tokai, CAPE TOWN 7945.
1833	TAPPIN, Mr. G.S.	P.O. Box 162, WELKOM 9460.
0265	TARR, Dr. A.A.	14 St. Matthews Road, EAST LONDON 5201.
0147	TATE, Mr. D.M.	P.O. Box 8099, DIE HEUWEL 1042
1689	TENCATE, Mnr. A.S.	Posbus 1, BROEDERSTROOM 0240.
1708	TERBLANCHE, Johan	Mimosalaan 448, LYNNWOOD 0081.
1865	THE NURSERY	National Botanical Institute, Private Bag X101, PRETORIA 0001.
2078	THEUNISSEN, Mnr. P.	Posbus 244, HECTORSPRUIT 1330
1808	THURSTON, Mrs. V.A.	c/o Private Bag X6, MAIDSTONE 4380.
0304	TOPHAM, Mr. Andre	P.O. Box 44, HOEDSPRUIT 1380.
0178	TOPHAM, Mnr. C.W.	Apiesdoringlaan 88, Wonderboom, PRETORIA 0182.
2048	TOWNSEND, Mrs. F.A.	8 Spray Street, Farramore, BENONI 1506.
1981	TROLLIP, Mnr. S.W.K.	Posbus 3622, BRITS, 0250
0184	TRUTER, Mr. J.W.	Moreson, P.O. Box 4, RIEBEECK EAST 6140.
1599	ULRICH, Mnr. B.J.	Posbus 1956, LADYSMITH 3370.
0678	UNGERER, Mr. H.	P.O. Box 279, MELVILLE 2109.
1760	UYS, Mev. A.G.	Posbus 683, VRYHEID 3100.
0322	VALLABH, Mr. P.D.	373 Mink Street, Laudium, PRETORIA 0037.
0646	VAN AARDE, Mr. J.W.	48 Sandpiper Street, Yellowwood Park, DURBAN 4011.
2032	VAN ASWEGEN, A.C.	Posbus 96, LEVUBU 0929.
2134	VAN DAM, Mev H.C.	Posbus 8496, NEWCASTLE, 2940.
1631	VAN DEN BERG, Mnr. H.J.	Palmstraat 73, Florapark, PIETERSBURG 0699.
1526	VAN DEN BERG, Mnr. L.J.	Williamsstraat 59, Wilkoppies, KLERKSDORP 2571.
1478	VAN DEN BERG, Mnr. M.J.	Posbus 194, HARTBEESPOORT 0216.
1836	VAN DEN BERG, Mnr. T.	Posbus 768, POTGIETERSRUS 0600.
1144	VAN DEN HEEDE, Mr. A.M.P.	P.O. Box 2031, PINETOWN 3600.
0991	VAN DER LINDE, Mr. C.	281 Impala Road, AMANZIMTOTI 4126.
1882	VAN DER MERWE, Antoinette	P.O. Box 4404, LINDEN 2104.
1283	VAN DER MERWE, Mnr. C.H.	Posbus 993, Rant-en-Dal, KRUGERSDORP 1751.
0136	VAN DER MERWE, J.F.	Posbus 39, DUIWELSKLOOF 0835.
1918	VAN DER MERWE, Mnr. F.A.	Posbus 679, BARBERTON, 1300
2126	VAN DER MERWE, Mr. L.	501 Helderberg Village Private Bag X19, SOMERSET WEST 7129
2059	VAN DER MERWE P.J.	Posbus 339, LEVUBU 0929.
0816	VAN DER MERWE, Mnr. T.J.	Posbus 1011, LADYSMITH 3370.

1745	VAN DER MERWE, Mr. W.S.	P.O. Box 13655, SINOVILLE 0129.
2140	VAN DER WALT, Mnr. A.J.	Posbus 39, ELLISRAS 0555
0203	VAN DER WALT, Mnr. A.S.J.	Posbus 77720, Fontainebleau, RANDBURG 2032.
0038	VAN DER WALT, Mev. Ita	Cycad Kwekery, Posbus 15251, LYNN-OOS 0039.
1558	VAN DER WALT, Mnr. J.	Theunsweg 225, MURRAYFIELD 0184.
2091	VAN DER WALT, Mnr. P.J.C.	Cowens Crescent 32, Sunny Side, PIETERMARITZBURG 3201
0746	VAN DER WESTHUIZEN, J.F.G.	Posbus 1536, NORTHCLIFF 2115.
2077	VAN DER WESTHUIZEN, Mnr. Johan	Posbus 335, AMANZIMTOTI 4125
2103	VAN DER WESTHUIZEN, Mnr. J.H.	Privaatsak X051, CALEDON 7230.
2127	VAN DER WESTHUIZEN	Posbus 424, Magalieskruin, PRETORIA 0150
1728	VAN DEVENTER, J.C.	Posbus 6379, Welgemoed, BELLVILLE 7530.
2125	VAN DYK, Mr. C.P.	18 Headingley Ave., WESTVILLE 3630
1987	VAN ELST, Mr. Deon	P.O.Box 89201, LYNDHURST, 2106.
0752	VAN GREUNING, Mnr. J.	8ste Laan 940, WONDERBOOM-SUID 0084.
2010	VAN HEERDEN, Mnr. F.J.	Posbus 90678, Magalieskruin, PRETORIA, 0150.
1185	VAN HEERDEN, Dr. H.G.	P.O. Box 237, STRAND 7140.
0938	VAN HEERDEN, Mr. J.L.	2 Undine, Eversdal, DURBANVILLE 7550.
1933	VAN HEERDEN, Mnr. J.M.	Sinovichstraat 833, DASPOORT 0082.
2105	VAN JAARSVELD, Mnr. W.	Posbus 28283, DANHOF 9310
2070	VAN NIEKERK, Dr. A.R.	Posbus 252, SOUTHBROOM 4277.
1924	VAN ROOYEN, Mnr. H.C.	Posbus 2690, WELKOM, 9460
1903	VAN ROOYEN, Mnr. H.G.	Dept. Kurrikulumstudies, Randse Afrikaanse Universiteit, Posbus 524, AUCKLANDPARK 2006
1925	VAN ROOYEN, Ds. J.C.	Posbus 2752, MIDDELBURG, 1050
2136	VAN ROOYEN, Mnr. L.A.	Posbus 69, GREYTOWN 3250.
1258	VAN ROOY, Mnr. Leon	Posbus 1019, WITRIVIER 1240.
1717	VAN ROOYEN, Mev. J.J.	Posbus 594, NELSPRUIT 1200.
2136	VAN ROOYEN, Mnr. L.A.	Posbus 69, GREYTOWN 3250.
0569	VAN ROOYEN, Mnr. L.D.	Onrust, Posbus 69, GREYTOWN 3500.
2075	VAN SOEST, Mr. Rodney.	P. O. Box 513377, WIERDA PARK 0149.
1651	VAN STADEN, Mr. S.	P.O. Box 148, ANERLEY 4230.
2035	VAN STRATEN, Mnr. J.G.	Posbus 3784, RUSTENBURG 0300.
1671	VAN TONDER, Mnr. J.H.	Departement Openbare Werke, Privaatsak X65, Poyntons (Kamer 1510), PRETORIA 0001.
1819	VAN VUUREN, Mr. J.	P.O. Box 13474, CLUBVIEW 0014.
1872	VAN WYK, Mnr. Cobus	Ninastraat 115, MEYERSPARK 0184.
0229	VAN WYK, Mev. G.	Posbus 11306, HATFIELD 0028
2145	VAN WYK, Mnr. G.B.	Blommendale, BELLVILLE 7530..
1937	VAN WYK, Mr. M.R.	P. O. Box 73241, LYNNWOOD RIDGE, 0040
1267	VAN WYK, Mnr. P.L.	Posbus 12881, ONDERSTEPOORT 0110.
1891	VAN WYK, Mnr. R.J.	Posbus 113, MOOINOOI 0350.
1999	VAB ZTL, Bennie	Posbus 31178, WONDERBOOMPOORT 0033.
1756	VAN ZYL, Elkie	Posbus 115, MOOKETSI 0825.
0910	VAN ZYL, Mnr. J.H.	Posbus 95332, WATERKLOOF 0145.
1643	VAN ZYL, Dr. P.C.	Posbus 35557, Menlopark, PRETORIA 0102.
1823	VAN ZYL, Mnr. R.	Posbus 17, CRAMERVIEW 2060.
2060	VELDKAMP, Mnr. J.A.	Jan Versterlaan 42, PIERRE VAN RYNEVELDPARK, CENTURION 0157.
0681	VENTER, Mnr. F.F.C.	Ontdekkersweg 367, Florida Park Uitbreiding 3, FLORIDA 1709.
1907	VENTER, Mnr. J.A.	Posbus 96013, BRIXTON 2019.
1135	VERMAAK, Mr. A.J.	P.O. Box 536, MTUNZINI 3867.
2057	VERMAAK, Mnr. E. de J.	Perskeblomweg 9, Pellissier, BLOEMFONTEIN 9322.
1033	VICE, Dr. A.R.	54 Frere Road, Vincent, EAST LONDON 5247.
1945	VILJOEN, Mr. Frank	P.O.Box 261. FERNDAL 2160.
1825	VILJOEN, Mnr. G.T.R.	Tugelaweg 1, DUNDEE 3000.
1607	VILJOEN, Mnr. Jaap	Posbus 1735, MULBARTON 2059.
2123	VILJOEN, Mnr. J.H.	Mineroastraat, 8, Amanda Glen, DURBANVILLE 7550
1609	VILJOEN, Mnr. J.J.	Republiekstraat 88, VRYHEID 3100.
1949	VILJOEN, Mr. Norman	28 Cheviot Road, The Hill, JOHANNESBURG, 2197
0071	VISSER, Mnr. Ben	Posbus 3538, BRITS 0250.
2092	VISSER, Mnr. J.B.	Posbus 913, HARTBEEPOORT 0216
2013	VISSER, Mr. George	39 Rouxton Road, LANSDOWNE 7780.
1770	VISSER, Mnr. W.P.	Windhoekweg 2, Arauna, BRACKENFELL 7560.
0917	VORAJEE, Mr. R.	3 Princess Street, LADYSMITH 3370.
0016	VORSTER, Dr. Piet	Departement Plantkunde, Universiteit van Stellenbosch, Privaatsak X1, MATIELAND 7602.
0051	WALTERS, Mr. George	198 Torquay Avenue, BLUFF 4052.
0847	WALTERS, Mr. J.W.	5 Nagel Street, Lakefield, BENONI 1501.

2041	WATKINS, Mev. C.	Posbus 264, WARMBAD 0480.
2119	WEBB, Mr. A.R.F.	25 Anemone Road, PRIMROSE 1401
0175	WELLS, Mr. B.K.	P.O. Box 7068, Newton Park, PORT ELIZABETH 6055.
2172	WELKEN, Mnr. Pieter A. (Jnr)	Posbus 398, PONGOLA 3170.
0039	WENTZEL, Mr. B.	19 Rietfontein Road, Primrose, GERMISTON 1401.
1712	WENTZEL, Mnr. J.H.	Assegaiwoonstelle 8, Broadway South-straat, VALHALLA 0185.
1380	WENTZEL, Mnr. P.	Posbus 1016, KROONSTAD 9500.
0047	WENTZEL, Mr. Stephanus W.	Blackwoodstraat 170, ARCADIA 0083.
2144	WESSELS, Mnr. A.P..	Posbus 3110, KENMARE 1745.
0448	WESSELS, Dr. F.H.	P.O. Box 7, PHALABORWA 1390.
1318	WESSELS, Mnr. J.W.	Posbus 31, HEIDELBERG 6760.
1441	WIGGILL, Mr. D.L.	P.O. Box 6260, FLAMWOOD 2572.
1990	WILLIAMS, Mr. S.M.	P. O. Box 35050, MENLOPARK 0102.
0008	WOHLBERG, Mr. H. Edgar	10 Stephens Avenue, WESTVILLE 3630.
1775	WOLPERT, Mr. F.	108 Brackenhurst, 14 Corlet Drive, ILLOVO 2196.
9009	WORLD WILDLIFE FUND: Director of Communication	P.O. Box 456, STELLENBOSCH 7599.
1164	WUNDERLIN, Mr. P.	9 Monarch Road, WESTVILLE 3630.
1644	YSSEL, Mnr. G.E.	Posbus 16677, PRETORIA-NOORD 0116.
0728	ZAIMAN, Dr. I.M.	Posbus 2160, GEORGE 6530.

## FOREIGN MEMBERS, ALPHABETICAL

### AUSTRALIA

- |      |                                                               |                                                                          |
|------|---------------------------------------------------------------|--------------------------------------------------------------------------|
| 0620 | ADELAIDE BOTANICAL GARDEN<br>LIBRARIAN (Karen Saxby)          | North Terrace, ADELAIDE, South Australia 5000.                           |
| 1209 | BALKENHOL, Mr.                                                | 10 Pinoak Grove, MENAI, New South Wales 2234.                            |
| 1997 | BEAUMONT, Mr G.                                               | P O Box 22, Katherine, NORTHERN TERRITORY 0851.                          |
| 1204 | BROWN, Mrs. M.J.                                              | 1 Mogford Street, MACKAY, Queensland 4740.                               |
| 0432 | BRYANT, Mr. D.                                                | Palmworld, 504/510 Parkridge Road, PARKRIDGE, Queensland 4125            |
| 1996 | CASEY, Mr David                                               | 98 Groth R., BOONDAL, Queensland 4034.                                   |
| 1731 | DAVIE, Mr Ian                                                 | P.O. Box 2192, KATHERINE, Northern Territory 0850.                       |
| 1623 | DOLLEY, Mr. B.H.                                              | P.O. Box 2069, MURRAY BRIDGE, South Australia 5253.                      |
| 0941 | DUMONT, Mr. P.L.                                              | P.O. Box 34, MACQUARIE FIELDS, New South Wales 2564.                     |
| 1753 | ELKADI, George                                                | 45 Amos Street, WESTMEAD, New South Wales 2145.                          |
| 1516 | FORSTER, Dr. P.I.                                             | P.O. Box 725, INDOOROOPIILLY, Queensland 4068.                           |
| 1205 | GUMMOW, Mr. G.P.                                              | P.O. Box 272, KURANDA, Queensland 4872.                                  |
| 1347 | HEIBLOEM, Mr. P.                                              | P.O. Box 700, NAMBOUR, Queensland 4560.                                  |
| 1517 | HOY, Mr. D.R.                                                 | 48 Falkirk Avenue, FINDON, South Australia 5023.                         |
| 1148 | JONES, Dr. D.                                                 | 13 Saville Close, MELBA, Australian Capital Territory 2615.              |
| 1995 | KEEN, Mr Alan                                                 | Cycad Gardens Nursery, 777 Tevoit Rd., NORTH MACLEAN, Queensland 4280.   |
| 0411 | KENNEDY, Mr. Paul                                             | 21 Sierra Road, ENGADINE, New South Wales 2233.                          |
| 1215 | KRAA, Mr. W.                                                  | 65 Lancing Street, PULLENVALE, Queensland 4069.                          |
| 1673 | LYLE, Mr. J.L.                                                | P.O. Box 99, TEWANTIN, Queensland 4565.                                  |
| 1518 | MACHIN, Mr. P.                                                | 111 Dorrington Drive, ASHGROVE, Queensland 4060.                         |
| 1554 | MORRIS, Mr. D.K.                                              | Greenlakes Road, PARKHURST, via Rockhampton, Queensland 4702.            |
| 1234 | NORTH QUEENSLAND PALM<br>SOCIETY                              | P O Box 1688, TOWNSVILLE, Queensland 4810.                               |
| 1096 | OLSEN, Mr. Ollie                                              | Lot 3, McKinnon Drive, TEWANTIN, Queensland 4564.                        |
| 1450 | ORRIEL, Mrs P.B.                                              | 45 Frape Avenue, MT. YOKINE, Western Australia 6060.                     |
| 0001 | OSBORNE, Roy & Angela (HON)                                   | c/o Plantation 2000, 281 Buckley Rd., BURPENGARY, Queensland 4505.       |
| 9013 | PALM & CYCAD SOCIETIES<br>OF AUSTRALIA<br>(Newsletter Editor) | P.O. Box 1134, MILTON, Queensland 4064.                                  |
| 9012 | PALM & CYCAD SOCIETY<br>OF WESTERN AUSTRALIA                  | P.O. Box 170, COMO, Western Australia 6162.                              |
| 1471 | RANDALL, Mr. L.M.                                             | Bruce Highway, PARKHURST, Queensland 4702.                               |
| 2118 | RICE, Susan                                                   | Sundance Way, Runaway Ilds., Queensland 4216                             |
| 1658 | RIEDL, Mr. R.W.                                               | 1 Coorabell Road, COORABELL, New South Wales 2479.                       |
| 1287 | ROCH, Mr. D.E.                                                | 7 Sublime Glade, NEERABUP, Western Australia 6031.                       |
| 1115 | ROUTLEY, Mr. B.                                               | 30 Clermont Avenue, NORTH STRATHFIELD, New South Wales 2137.             |
| 1710 | ROYAL BOTANIC GARDENS                                         | Mrs. Macquaries Road, SYDNEY, New South Wales 2000.                      |
| 1367 | STEWART, Mrs. L.R.                                            | 13/46 Fontenoy Road, NORTH RIDE, New South Wales 2113.                   |
| 2173 | SUNSHINE COAST BRANCH<br>PALSOA                               | P O Box 1007, NABOUR, Queensland.                                        |
| 0610 | THOMPSON, Mr. C.                                              | P.O. Box 140, SYLVANIA, New South Wales 2224.                            |
| 1856 | THOMPSON, Mr. Keith                                           | 11 Turner Street, CORINDA, Queensland 4075.                              |
| 1998 | TOOTH, Lorraine                                               | 1536 Ross River Rd., Kelso, THURINGOWA (via Townsville, Queensland 4815. |
| 1445 | VENAMORE, Mr. P.D.                                            | Pringles Road, Kobble Creek, Samsonvale, BRISBANE, Queensland 4520.      |
| 0251 | WALKLEY, Mr. & Mrs. Stan                                      | Buckley Road, BURPENGARY, Queensland 4505.                               |
| 1515 | WILSON, Mr. G.W.                                              | P.O. Box 5701, ROCKHAMPTON M.C., Queensland 4702.                        |
| 1060 | WILSON, Mrs. Vera                                             | P.O. Box 37921, Winnellie, DARWIN, Northern Territory 0821.              |

### AUSTRIA

- |      |                     |                                         |
|------|---------------------|-----------------------------------------|
| 0906 | BRUNNER, Mr. Julius | Bundesgarten Schönbrunn, VIENNA A-1131. |
|------|---------------------|-----------------------------------------|

**BELGIUM**

- 1715 AUSLOOS, Gert Huis de Monge, Biezenstr. 3, B-3000 LEUVEN.  
 1719 VAN VINCKENROYE, Peter St. Jansbergsesteenweg 101, Bus 464, HAVERLEE 3001.  
 1571 WIJNANTS, Dr. J. Oudstrijdersstraat 42, MERCHTEM 1785.

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- 1778 SAUNDERS, C. 4515 Alken Road, RR2 SARDIS, British Columbia V2R 1B1.

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- 1763 LAKE FAIRY BOTANICAL GARDEN Lian-tang, SHEN-ZHEN, Guangdong 518004.

**DENMARK**

- 0574 BOTAN. CENTRALBIBLIOTEK Solvgade 83 OPG S, KOBENHAVN DK-1307.

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- 2147 CARDONNIER, Dominique "La Palaudière, Chemin de Palay, 66700 ARGELES S/MER.  
 2031 COATIVY, Rene 129, 10c Avenue, 60260 LAMORLAYE.  
 2146 GONZALES, Jean Pillippe 45 Rue Hippolyte Desprès, PERPIGNAN 66000  
 1908 MONTEUX, Mr. G. 470 Route des Oliviers, Domaine de La PEYRIERE, 06250, Mougins.  
 1709 PELLISIER, Robert CD2-Rue De Germenos, AUBAGNE 13400.  
 1544 YVES MONGE, ETS Hortie. Quartier, Morgella-Pinea, BREIL SUR ROYA 06540.

**GERMANY**

- 1045 BRAUNWEILER, Mr. G.T. Hans Bredowstrasse 24A, WIESBADEN 65189.  
 2012 DURBAUM, Mr Johannes University of Oldenburg, Fachberiech Biologie, D-26111, OLDENBURG.  
 1361 HABEKOST, Mr. F. Schillerstrasse 69, STOLBERG/WERTH 52224.  
 1687 KÖNIG, Mr. E. Schulstrasse 3, HARSDORF 95499.  
 1637 MIERITZ, Mr. K. Stotelerstrasse 15, LOXSTEDT-NESSE 27612.  
 0804 SCHLEGEL, Dr. Helmut Wulfsdorferweg 112C, HAMBURG D-22359.  
 1446 SCHMID, Mr. R. Postfach 26, ADELSDORF D-91323.  
 0544 SCHOTT, Mr. E. Augustenburgstrasse 7, FRANKFURT-AM-MAIN 60488.  
 1992 SCHWAB, Mr Werner Grubenstrasse 3m 822/6 MAISACH.  
 1596 STORBECK, Mr. G. Alt Westerhusen 151, MAGDEBURG D-39122.  
 1490 WAGNER, Mr. S. Immergrunweg 6, HEIDENHEIM 89522.  
 1502 WIEGNER, Mr. Kai Eschstrasse 25A, BÜNDE 32257.

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- 1332 DHAR, Mr. Shri 20 Ballygunge Park Road, CALCUTTA 700019.  
 9032 PANT, Prof. D.D. (HON.) Department of Botany, University of Allahabad, ALLAHABAD 211 002.  
 1030 SINGH, Dr. R. Department of Botany, University of Delhi, DELHI 110007.

**INDONESIA**

- 1845 KOESNO, Soetjipto Raya Kendangsari 45-47, 60292 SURABAYA.  
 0858 MARTA, Mr S.H. Fadjar P.T. Indoparts Utama, Jl.Gaya Motor 1 No.8-SunterII  
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**ISRAEL**

- 2024 AVIVA NURSERY Haprahim Street 44, Moshav-Rishpon, DN.HOF HAS-HARON 4695.  
 2089 REGEV, Mr Moshe Kibbutz Givar-Brenner 60948, ISRAEL (sea mail)  
 0587 SHAHAK, Mr. D. Tirat TSVI, D.N. EMEK BEIT SHEAN 10815.

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1826	D.E.A.	002048/Ortobo, Via Lima 28, ROMA, 00198 RM
1754	FOCARELLI, Cesare	Barone, Via Broussard 2, CANTANZARO 88100.
0482	GARGIULO, Sig. Mario	Via Vocale 27, META (N/A), 80062.
2117	LIOTTA, Mr R.	Viale Delle Alpi M.40, PALMERO 90144.
1070	LOTTI, Dr. M.	Via Tasso 630, NAPOLI 80127.
1680	SANTAGATA, Mr. Luigi	Via Sanfelice 25, AVERSA (C E) I-81031.
0609	STAINER, Mr. O.	Via Lisbona 25, Treporti, VENEZIA 30010.

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 1506 HARDY, Mr. R.M.  
 1979 HOXEY, Mr P.  
 1388 JONES, Dr. Scott  
 1994 KENCHINGTON  
 0731 KING, Mr. A.  
 2001 LIBRARY, ROYAL BOTANIC  
 GARDENS  
 0929 NATURAL HISTORY MUSEUM  
 0734 PLATFORD, Mr. R.J.  
 9004 ROYAL BOTANIC GARDENS  
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 1456 BENNETT, Mr. R.K.  
 2155 BENZIE, Jim  
 1292 BERGMAN, Mr. W.P.  
 1052 BESSE, Dr. & Mrs. B.  
 1747 BIAGI, Louis  
 1734 BLAUER, John  
 1895 BOBICKS PALM GROWERS  
 1593 BRANDT, Mr. F.  
 1457 BROOME, Mr. T.  
 1394 BROWN, Mr. E.D.  
 1288 BURNETT, Mr. W.  
 1293 BURTSCHER, Roy H.  
 1771 CARLSON, E.J.  
 0844 CARNEY, Mr. Jack  
 0598 CAUDRY, Mr. J.  
 0709 CHEEK, Mr. B.  
 1595 CHEMICK, Mr. J.  
 1752 COBURN, C.R.  
  
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 1801 DOWDY, Mr. T.V.  
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 0137 DWYER, Mr. Patrick  
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 1772 ERICKSON, B.  
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1670	LEACH, Ms. M.P.	P.O. Box 726, MUTARE.
1218	MÜLLER, Mr. & Mrs. D.	P.O. Box 246, RUSAPE.
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1412	NIENABER, Mrs. R.J.	Riversdale Farm, P.O. Box 89, MHANGURA.
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