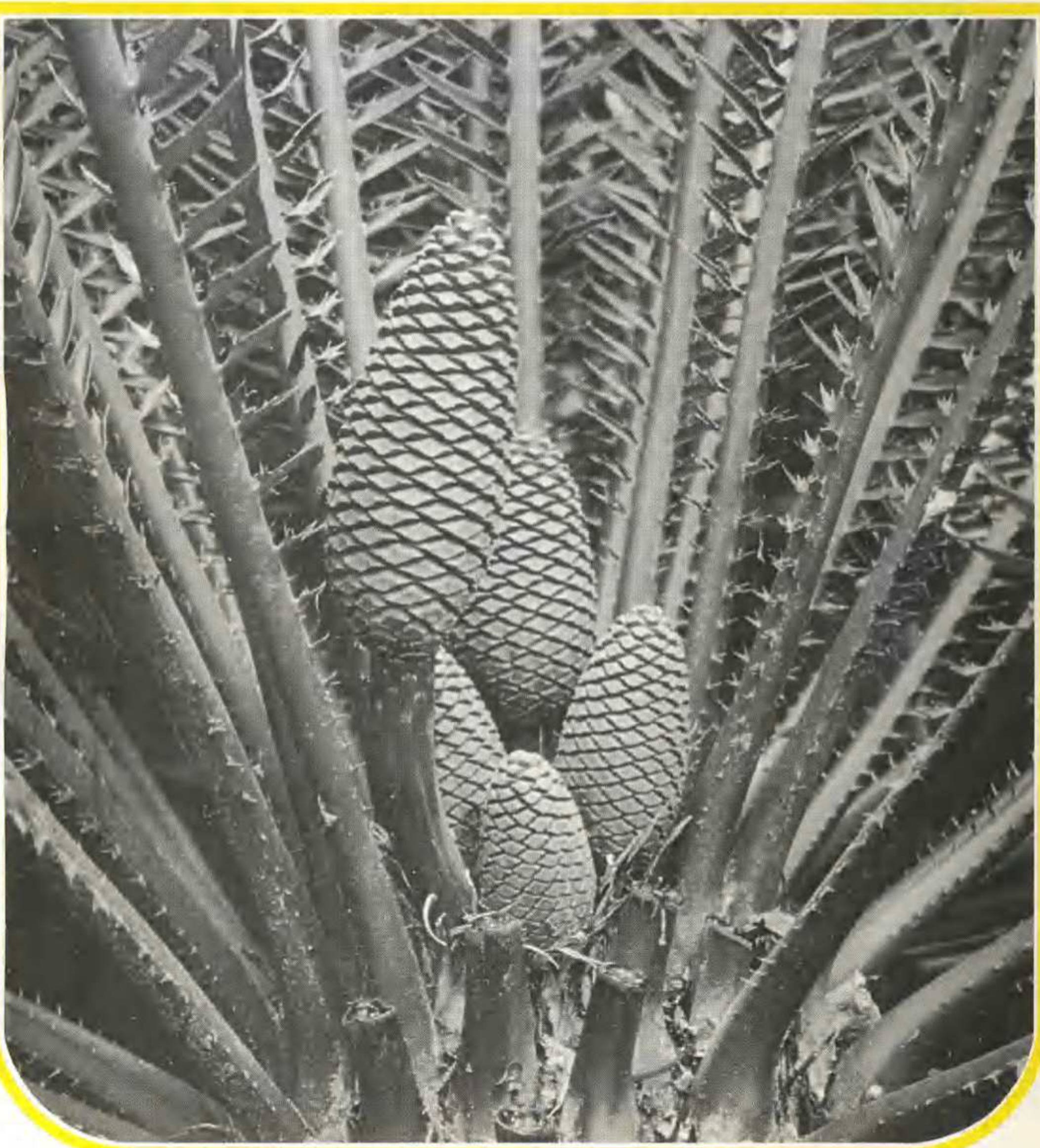
ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

NO. 44 DECEMBER / DESEMBER 1995 ISSN 1012-9987



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COVER / VOORBLAD : *Encephalartos equatorialis* juvenile male cones

The cones do not appear simultaneously but in sequence, hence the marked difference in cone size

Photo: Norman Kachelhoffer

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With best wishes

for a joyful

Christmas and

peace throughout

the New Year

'n Wens van vreugde

en vrede

aan u met Kersfees

en deur die

Nuwe Jaar

FROM THE PRESIDENT

Our Society has just experienced a great set-back. Roy Osborne has notified us that he is emigrating to Australia (see his letter on page 48 of this issue) and this is going to leave a gap which will be very difficult to fill. Inspired by his own inisiative, Roy was the founder of the Cycad Society of South Africa ten years ago. That which started as a small organisation with a few members, has over the ten years grown to the strong Society we have at present. Roy had not only started the Society, but in almost every issue of the journal he turned out to be the main contributor with articles and other valuable information. We certainly are going to miss Roy and we would like to wish him and his family all the best and that they would speedily adapt to their new "habitat". Fortunately there are many cycads in Australia and we trust that through his pen, lots of new information about these plants will reach members of the Society.

Taking cycad events of the year in retrospect, it is delighting to note that there is still an increasing interest in cycads. Up to the end of September more than 100 new members have joined the Society and most of the existing members have renewed their membership. Some new *Encephalartos* species have been described and collectors are faced with the challenge to add some of these to their collections. It would of course be ideal to obtain large specimens, but members must realize that it is very unlikely that nurseries would have any in stock at such an early stage. Most of the newly described species must be regarded as endangered and we call on members to assist in preventing these plants from being removed from their natural habitat. This brings me to legislation on cycads. Members are upset about differences in the legislation on cycad conservation by different Conservation Authorities and the relative ease by which cycads are still being removed from the wild. Conservation Authorities should thrive towards a more uniform, concise, simple and sensible legislation applicable to all provinces and banning the removal of any cycads from the wild. On the other hand, a free flow of cycad seed and seedlings should be allowed. Thanks to activities in our Society, knowledge about the production of cycad seed and seed germination has improved tremendously over the last couple of years with the result that seed and seedlings are now more readily available. Restrictions on the free flow of this material seems therefore unnecessary. Nursery-grown cycads are now more often being used in landscaping projects and this trend should be encouraged.

At the moment we are already in the process of preparing the last issue of "*Encephalartos*" for this year and as customary I would like to thank Council members, steering-committees of regional branches and every person or organization who took part in the activities of the Society for their contributions. May every member enjoy the coming festive season and may 1996 bring you happiness and prosperity.

Hannes Robbertse

VAN DIE PRESIDENT

'n Groot terugslag het die Vereniging getref! Roy Osborne het laat weet dat hy na Australië verhuis (kyk sy brief op bladsy 48 van hierdie uitgawe) en dit gaan 'n groot leemte in die Vereniging laat. Roy het die Broodboom Vereniging van Suid-Afrika tien jaar gelede uit eie inisiatief begin. Aanvanklik was dit 'n klein organisasie met 'n beperkte aantal lede, maar gedurende die tien jaar het dit gegroei tot die organisasie wat ons tans het. Roy het nie alleen die Vereniging begin nie, maar was met feitlik elke uitgawe die grootste bydraer ten opsigte van artikels en ander inligting wat hy voorsien het. Ons gaan vir Roy voorwaar mis en ons wil hom en sy gesin alle voorspoed toewens met hul nuwe planne en vertrou dat hulle spoedig in hul nuwe omgewing sal aanpas. In Australië is daar gelukkig ook baie broodbome en ons vertrou dat daar nog baie inligting uit sy pen die Vereniging sal bereik.

In 'n terugblik op gebeure rakende broodbome die afgelope jaar, blyk dit dat die belangstelling in broodbome nog steeds toeneem. Ons het tot aan die einde van September reeds meer as 100 nuwe lede bygekry en die meeste bestaande lede het hul lidmaatskap hernu. Nuwe *Encephalartos* spesies is beskryf en versamelaars het nou weer die uitdaging om van die nuwe soorte te bekom. Die ideaal sou natuurlik wees om groot plante te bekom, maar lede moet besef dat dit baie onwaarskynlik is dat kwekerye nou reeds groot plante van nuwe spesies kan lewer. Die meeste nuwe spesies moet reeds as bedreig beskou word en ons moet help om te voorkom dat van hierdie plante uit hul natuurlike habitat verwyder word. Dit bring my by die wetgewing oor die beskerming van broodbome. 'n Saak wat baie lede ontstel, is die verskille wat nog bestaan in wetgewing van verskillende Bewaringsowerhede en die relatiewe gemak waarmee volwasse plante nog steeds uit die natuur verwyder word. Daar behoort 'n meer eenvormige, beknopte, eenvoudige en sinvolle wetgewing opgestel te word wat vir alle provinsies geld en waar die verwydering van groot plante uit die natuur totaal verbied word. Aan die ander kant behoort bewaringsowerhede 'n vryer vloei van saad en saailinge aan te moedig. Kennis in verband met saadproduksie en ontkieming van broodboomsaad het, danksy die aktiwiteite van die Vereniging geweldig toegeneem met die gevolg dat saad en saailinge tans meer geredelik beskikbaar is. Beperkings op die vrye vloei van hierdie materiaal blyk daarom onnodig te wees. Broodbome wat deur kwekers gekweek word, word in 'n toenemende mate in landskapbeplanning gebruik en hierdie gebruik moet ten alle koste aangemoedig word.

Ons is alreeds besig met die laaste uitgawe van die tydskrif vir die jaar en soos gebruiklik, wil ek die lede van die Raad, die bestuur van streektakke en elke ander persoon of instansie wat gehelp het met die aktiwiteite van die Vereniging, van harte bedank vir hul bydrae. Ek wil ook aan elke lid 'n aangename feestyd toewens en hoop dat 1996 vir elk van u die geluk en voorspoed sal bring waarna u verlang.

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 kollig op:

ENCEPHALARTOS EQUATORIALIS Hurter

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Rewritten reproduction of "*Encephalartos equatorialis*, (Zamiaceae) a newly described species from tropical Africa". Some of the illustrations and phrasing reprinted from the *South African Journal of Botany*, 61(4): 226-229, August 1995, with permission from the editor.

INTRODUCTION

Roy Osborne (1995) reported recently on the two "Heenan" expeditions to east and central Africa. In Uganda the cycad-exploration part of the first expedition took place from May till mid-June 1973 and two probable new *Encephalartos* species (*E.* "Lake George, *E.* "Jinja") were recorded (Heenan 1977, Osborne 1995).

The senior author has visited Uganda in October 1994. His evaluation of Zamiaceae near the equator in Uganda, has revealed the existence of a new *Encephalartos* species. In particular this species differs markedly from that reported by Heenan (1977).

DESCRIPTION

1. STEM

Plant treelike in growth (arborescent), suckering from the base. Mature trunks are up to 3.5 or rarely 4.2 m long and 350-450 mm in diameter, large trunks mostly prostrate (Figure 1). Leaf-bases are persistent and not falling off.

2. LEAVES

The numerous leaves, arranged in a dense crown (Figure 2), are green, subsessile, erect and rigid, linear oblanceolate (lanceolate with the more pointed end at the base), with the apices slightly recurved. The leaves are 3.1-3.4 (-4.1) m long and 345-350 (-430) mm wide, tapering slightly to the rounded apex and gradually to the base. Petiole not apparent, bulbous basally (Figures 3, 4c), up to 13 mm long, at first fulvous (reddish-yellow), tomentose, glabrous at maturity. Rachis tomentose, becoming glabrous with age, ovate in cross section, shallowly grooved between the leaflets (pinnae). The leaflets (Figures 3, 4c-d, 5) are hard and rigid, ascending, dentate, with 3-6 teeth on both margins; veins not raised abaxially (lower surface)); margins slightly thickened; leaflets directed towards the apex of the leaf at an angle of about 30° to the rachis, opposing leaflets slightly inflexed (bent inwards), set at an angle of about 90° to each other, overlapping mainly succubously (leaflets obliquely inserted on the rachis so that the leaflet edge facing the leaf apex is overlapped by and covered by the lower edge of the leaflet above); terminal leaflets strongly imbricate (arranged so as to overlap like roof-tiles) and incubous (obliquely inserted on the rachis so that the leaflet edge facing the leaf apex overlaps and thus covers the lower edge of the leaflet above); proximal leaflets (nearest to the base of the leaf) gradually reduced to a distinct series of spines (Figures 3, 4c). Median leaflets 200-260 mm long and 20-26 mm wide, narrowly elliptic, gradually acuminate towards the apex, pungent (terminating in a hard sharp point), subsessile; apices somewhat turned towards the leaf apex.

Figure 1 Large specimen of *E. equatorialis*, with prostrate trunk. Part of the trunk must have formed a hollow centre (see article by William Tang on page 42 of this issue), and it became a "beehive" for honey-bees. On the left, damage caused by locals collecting honey, can be seen on the upper side of the prostrate trunk. Photo: Norman Kachelhoffer.

Figure 2 *Encephalartos equatorialis* in habitat, showing the dense crown of numerous leaves. Note the adult in the foreground being dwarfed by the size of the plants. Photo: Norman Kachelhoffer.

3. CONES

The dark green, pedunculate, dimorphous, glabrous cones are seriate (not appearing together but in sequence), and have smooth scale facets.

About five subconical male cones (microstrobili) (Figures 6, 7) are borne per trunk and they are 300-400 mm long and 90-100 mm in diameter, and have a peduncle 200-300 mm long. The median male cone scales (microsporophylls) [Figures 4b (i-iii), 6, 7] are slightly ascending (directed upwards); the bulla (expanded outer head of a cone scale) is deflexed (turned downwards), with the terminal facet flat or slightly concave.

Figure 3 The trunk apex of *E. equatorialis*, showing the dentate leaflets gradually reduced to spines towards the leaf-base. The bulbous nature of the leaf-bases are best seen where leaves have been cut off. Photo: Johan Hurter.

One to three female cones (megastrobili) (Figure 8) are borne per trunk, they are erect and ovoid, 360-400 mm long and 180-200 mm in diameter, with a peduncle of up to 250-310 mm long. The median female cone scales (megasporophylls) [Figures 4a (i-iii), 8] are rhombic (diamond-shaped with oblique angles and equal sides), with two lateral and one concave terminal facet.

Seeds about 200 per cone; sarcotesta (fleshy outer skin) orange-red; kernel 35-38 mm long and 23-30 mm in diameter, ellipsoid and smooth.

DIAGNOSTIC FEATURES AND AFFINITIES

Encephalartos equatorialis superficially resembles *E. hildebrandtii* A. Br. & Bouché (Melville 1957, 1958) and *E. ituriensis* Bamps & Lisowski (Bramps & Lisowski 1990) because of its stiff, dentate and pungent green leaves. However, even vegetatively it is easily distinguished from both species. In *E. hildebrandtii* the

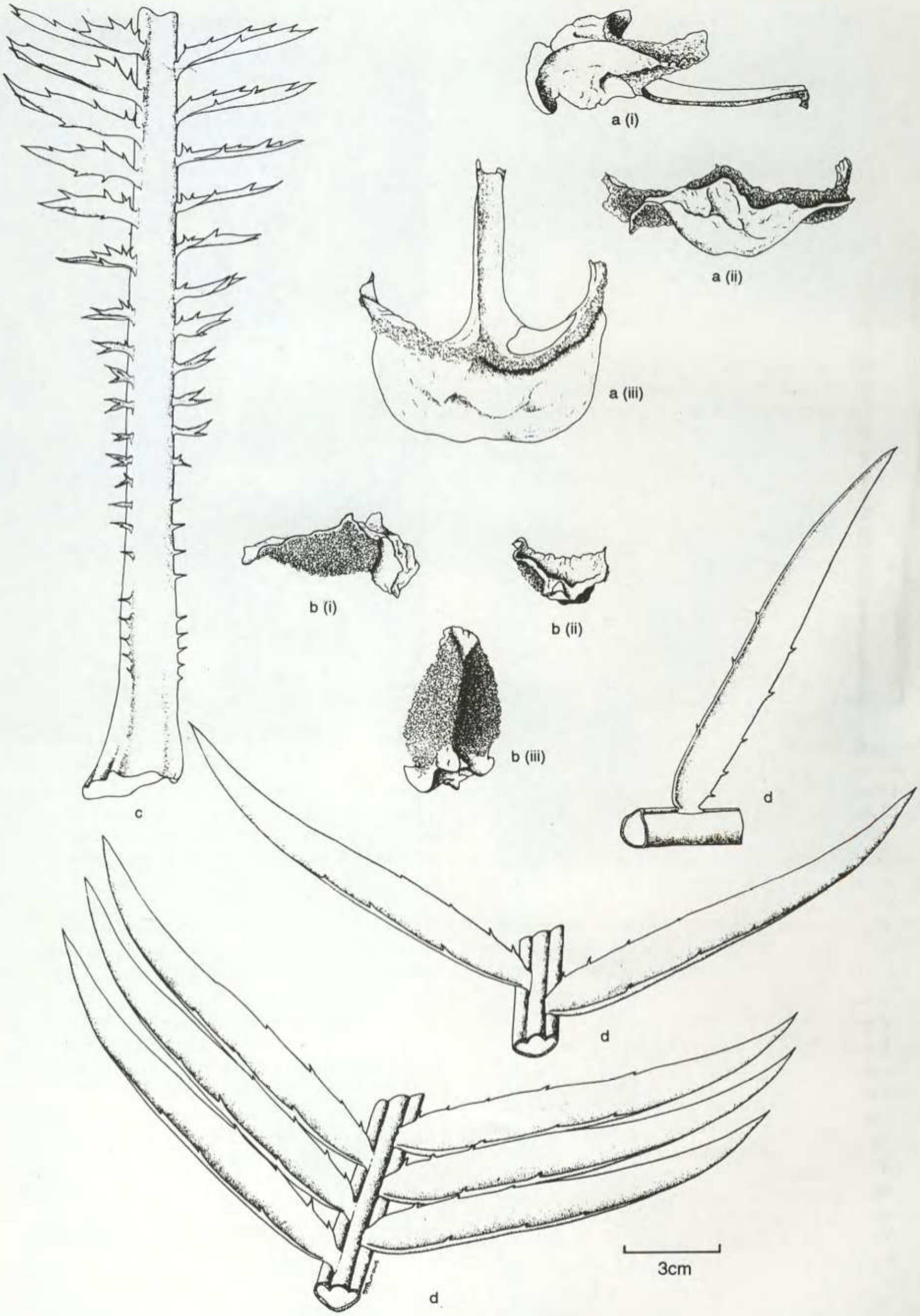

Figure 4 *Encephalartos equatorialis*: **(a) median female cone scale, (i) side view, (ii) frontal view, (iii) abaxial view; (b) median male cone scale, (i) side view, (ii) frontal view, (iii) abaxial view; (c) petiole and proximal leaflets; (d) median leaflets. Drawings: S. Burrows. [Reprint of original Figure 1.]**

Figure 5 *Encephalartos equatorialis*, **part of leaf crown showing the arrangement of the leaflets on the rachis. Note the overlapping of the leaflets (best seen on the right near top of photo). Photo: Norman Kachelhoffer.**

Figure 6 *Encephalartos equatorialis* **with erect seriate male cones showing the cone scales spreading and only slightly ascending towards the apex of the cone. Photo: Johan Hurter. [Reprint of original Figure 2.]**

leaflets are ascending, falcate (curved like a sickle), with apices directed towards the base of the leaf; in *E. ituriensis* the leaflets are spreading and falcate with apices directed towards the base of the leaf and in *E. equatorialis* the leaflets are ascending, not falcate and apices are directed towards the apex of the leaf. In both *E. hildebrandtii* and *E. ituriensis* the leaflets are succubously orientated throughout the length of the leaf; in *E. equatorialis* the leaflets are succcubously orientated along the basal and median section of the leaf, becoming strongly incubous and imbricate towards the apex. In *E. hildebrandtii* the apex of a leaflet often ends in two or three sharp spines; in both *E. equatorialis* and *E. ituriensis* the leaflet apex consists of a single sharp spine. The lamina (leaf blade) in *E. ituriensis* and *E. hildebrandtii* is soft and pliable, while the lamina in *E. equatorialis* is hard and rigid. Profound differences are also observable between the cones of *E. equatorialis* and those of the other two species mentioned. In *E. equatorialis* the male cones are dark green at maturity, while in both *E. hildebrandtii* and *E. ituriensis* the male cones are greenish-yellow, or reddish in some colonies of *E. hildebrandtii*. The size of the male cones in *E. equatorialis* is about a third of that in *E. hildebrandtii* and *E. ituriensis*. In *E. ituriensis* the male cones are mostly pendulous (hanging down), while in *E. equatorialis* and *E. hildebrandtii* the male cones are erect. In *E. hildebrandtii* the male cone scales are strongly ascending, in *E. equatorialis* the male cone scales are only slightly ascending, while those in *E. ituriensis* are spreading and only slightly ascending towards the apex of the male cones. In *E. equatorialis* the adaxial (upper) surface of the male cone scales is indented and striated while in both *E. hildebrandtii* and *E. ituriensis* the adaxial surface of the male cone scales is smooth or only slightly indented. Female cones of *E. equatorialis* are dark green at maturity, while female cones in both *E. hildebrandtii* and *E. ituriensis* are greenish-yellow, or reddish in some colonies of *E. hildebrandtii*. In both *E. hildebrandtii* and *E. ituriensis* the bullae of the female cone scales have clearly defined median facets, while in *E. equatorialis* the median facets are ill defined. *Encephalartos hildebrandtii* var. *dentatus* Melville differs from the present species in several

Figure 7 A close-up view of part of a male cone of *E. equatorialis* to illustrate the detail of the cone scales. Photo: Johan Hurter.

Figure 8 *Encephalartos equatorialis* with seriate female cones showing ill-defined median facets on the median cone scales. Photo: Johan Hurter. [Reprint of original Figure 3.]

aspects, most notably in the toothlike protrusions (hence the name) on the bullae of both female cone scales and male cone scales. The senior author has seen Melville's plant in several localities in Tanzania, and concluded that they were definitely not similar to *E. equatorialis*. Heenan (1977) refers to plants said to be the same as Melville's from near Jinja in Uganda. We doubt the accuracy of some details of this report, as (1) there is no Arab village, ruined or otherwise, near Fort Thruston (spelt thus in the best gazetteer available to us [United States Board ... 1964], not 'Thuston' as Heenan has it), (2) Fort Thruston has been a jail for political prisoners, not a ruin, since 1970, and (3) the cycads in the area do not match Melville's description.

The following key may serve to clarify some of these distinguishing characters:

1 Apices of leaflets pointing towards leaf apex, with 1 spine; leaflets not falcate; lamina hard and rigid; cones dark green at maturity; male cones erect; bullae of female cone scales with ill-defined median facets . . . . . ***E. equatorialis***

1 Apices of leaflets pointing towards leaf base, with 1-3 spines; leaflets falcate; lamina soft and pliable; cones usually greenish-yellow at maturity; male cones erect or pendent (hanging); bullae of female cone scales with well-defined median facets, ... 2

2 Leaflets ascending; apices with 2-3 spines; male cones erect . . . . . ***E. hildebrandtii***

2 Leaflets spreading; apices with 1 spine each; male cones pendent . . . . . ***E. ituriensis***

GEOGRAPHICAL DISTRIBUTION AND HABITAT

At present this species is known only from a single granite hill on the eastern shore of Thruston Bay, Lake

Figure 9 *Encephalartos equatorialis* **in habitat near Thruston Bay, Lake Victoria, Uganda. Photo: Johan Hurter.**

Victoria, Uganda. Plants grow exposed on the western aspect of the hill in severely degraded rainforest dominated by Rubiaceae and Euphorbiaceae species (Figure 9). The surroundings of the hill are entirely under cultivation.

CONSERVATION STATUS

This species must be considered severly threatened, No recruitment was observed; all seeds were infertile and it appears as if the species-specific pollinator may be extinct. Considerable evidence of recent collector activity was observed and several previously removed but discarded trunks had to be replanted. Threats to the species appear to be mainly collectors, human encroachment and the species' inability to reproduce. The species only persists at its locality through the copious formation of basal suckers.

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ARTICLES / ARTIKELS

IN SEARCH OF *ENCEPHALARTOS DELUCANUS*

Ian Turner
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Received 26 July 1995

I had heard about a cycad growing in Tanzania somewhere near Lake Tanganyika, and later that it was being named *Encephalartos delucanus*. I was quite keen to go there to find this species so with a friend, who is interested in cycads, three of my children and one of my gardeners, we set out in a one-ton pick-up and travelled to the Zambezi River which is our border with Zambia. We crossed the bridge and stayed the first night at a nice motel not far from Lusaka, the capital city of Zambia. The next morning we made a stop in Lusaka to change some money. We left the gardener, Damson, to guard the truck while we were away from it. There were some quite smart people there who distracted Damson long enough so they could get a suitcase out of the back of

the truck so that one daughter was left with the clothes she was standing in. So we had to visit the market to buy some clothes for her to wear.

We eventually left Lusaka, having learnt a good lesson, and travelled the rest of the day over mostly very good roads to get to the border with Tanzania. The last 30 km to the border was very rough indeed because very few people enter Tanzania this way and the road is never maintained. The border is just a pole across a track and people walking or on bicycles pass on either side as if there is no border at all. We had to go and call the customs and immigration people from their houses to get our passports stamped - it was 20h00 at night but they came quite willingly. We carried on, then found a suitable place to camp on the side of the road.

Figure 1 The Monastery "in the back of beyond" in Tanzania.

The next day we carried on over still very rough roads to a town called Sumbawanga. Then headed north to the area where we thought we might find some cycads. We asked quite a lot of people and eventually ended up at a beautiful mission where some one said he had seen cycads growing. But he must have been mistaken because there were no cycads there. The mission was in a very far away place and it had taken many hours to get there so we were quite disappointed. The mission had been built in 1927 and was really impressive. The church was beautiful and just as big as ones seen in many big cities. We carried on after getting more directions and came to a very nice Monastery (Figure 1). It is truly amazing to find such nice places right in the back of beyond and I was even more amazed to see an almost new combine harvester at their complex. The priests had been teaching the local people how to grow wheat and they had got the machine to harvest the wheat. After more hours, going with a man who was sure he could show us cycads but instead showed us tree ferns (Figure 2), we returned to the Monastery and spent a very comfortable night as guests of the very hospitable priests.

Figure 2 The road to the tree ferns.

The next day we were lucky to find a "medicine man" who was sure he knew the plants we were looking for. Again it was very far away and took about three hours travelling over rough roads to get to the foot of a big mountain. With the medicine man in the lead, and soon with the rain pouring down, three hours later we came to one cycad plant and I was amazed to see it was *Encephalartos marunguensis* (Figure 3). This species has not been recorded in Tanzania before and was only known from the other side of Lake Tanganyika in Zaïre. Since the main object of the trip was to get some seeds we were sorry to see only one plant. Our "friend" knew of some others but they were too far away to go on that day, so we returned to the truck, soaked to the skin, and travelled on to the lake to spend the night. We found a very nice Danish family living there who gave us rooms to stay in.

The whole of the next day was spent climbing up and down another high mountain but this time nothing was to be found. Our guide could not locate the position of the plants so the whole day was wasted.

We returned to the lake and decided we must go further north. My children who had spent the day with the Danish family thought they would like to stay there while the two of us and Damson carried on. Since my friend had to leave by air from Harare on a certain day, we did not have much time to spare. So at 20h00 we headed on and drove through the night to get to Mpanda. It was a long rough road and we eventually arrived at 08h00 the next day.

After asking a few people one man said he knew the plants. So we headed in the direction of the lake again although much further north. We came to a small

Figure 3 A solitary *Encephalartos marunguensis* specimen, an unexpected find in Tanzania.

village and made more enquiries but most people were not keen to say where the plants were to be found because cycads are used by the locals to make very powerful medicine although I never found out what for. Anyway, one man eventually agreed to show us the way to go. After many hours of walking we came across one single *Encephalartos delucanus* plant (Figures 4, 5) growing among quite long grass, so of course no seeds again.

Figure 4 The single *Encephalartos delucanus* specimen found growing among quite long grass.

We returned to the village and spent the night in what was once a very nice rest house. Since we were in mountainous country the altitude was high and the air very cold, so we were glad to be able to make a big fire to sleep beside in the rest house because all the windows had been broken.

The next day we again found a man who said he could show us some cycads but they were, as usual, far away. We travelled for two hours on a road, then turned off

Figure 5 Leaf detail of *E. delucanus*.

and drove two more hours on a track through the bush which had not been used for two years and had become completely overgrown. We eventually had to leave the truck with Damson and carry on by foot. We arrived at a very small village by 12h30. A man there agreed to take us up a nearby mountain but he had to have his lunch first! So we left at 13h30. We walked for miles through the foot-hills, then started a steep climb above the tree-line on to a mountain with grass and a few Proteas growing on it. It was very high indeed and the air seemed to be thin because I got out of breath quite quickly. For a person who has lived all his life on level ground and travelled around on four wheels most of the time it is quite an effort to make it to the top of a high mountain. Anyway, we came to the top eventually and found a rocky outcrop with big candelabra type Euphorbias growing among the rocks and between some of the rocks were two female *Encephalartos delucanus* plants. Both plants had sterile seed around them but there was only one seedling about one year old. The guide had said that there were many plants on the mountain, so we asked why only two were to be found. He indicated that the main colony was another hour's walk along the top of the mountain, but since it was now

17h00 we had to start back to where we had left the truck. It soon became dark and the going was very hard indeed. On three occasions we had to wade through bogs with at times, water above our knees. It was bad enough in daylight but in darkness really rough. Fortunately the guide lives in that area and knows his way very well and we got back to the truck at 22h30. It took us until 01h30 to get back to the main village where we said goodbye to our, by now, good friend. We then left and drove through the rest of the night back to Mpanda. We had a good breakfast there then carried on to where we had left the children, arriving at 20h00.

I have done a few trips to look for cycads but without any doubt, this was the hardest trip I had ever done. It is definitely not a good idea to go off and have to be back by a certain date.

It was strange to find the first *Encephalartos delucanus* (Figures 4, 5) growing in long grass very far away from any other plants and not in a typical habitat. I can only guess that the seed must have been dropped there by a bird as it flew over. And the small seedling? Well obviously there are some insects flying around on top of the mountain looking for cycad cones! Truly amazing how only one seed out of hundreds had been pollinated.

THE CONSERVATION STATUS OF *MACROZAMIA PLURINERVIA* (ZAMIACEAE)

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Figure 1 *Macrozamia plurinervia*. **Large female individual. Photo: P.I. Forster.**

Macrozamia plurinervia (L. Johnson) D.L. Jones is a very uncommon small cycad with grey-green to blue-green spiral leaves (Figure 1). This species was for many years considered a subspecies of *M. pauli-guilielmi* W. Hill & F. Muell. as a result of the work of Johnson (1959) where a number of taxa that were not closely related were classified together in an omnibus species. *Macrozamia plurinervia* was recently upgraded to specific level by Jones (1991) and thought to occur both in northern New South Wales and southern Queensland (Jones 1993).

Revision of the *M. plurinervia* complex in Queensland has found that *M. plurinervia* does not occur in that state at all, with the complex in southern Queensland represented by *M. machinii* P.I. Forst. & D.L. Jones, *M. cranei* D.L. Jones & P.I. Forst., *M. occidua* D.L. Jones & P.I. Forst. and *M. viridis* P.I. Forst. & D.L. Jones (Jones & Forster 1994). The current circumscription of *M. plurinervia* only includes plants found in semi-inland northern New South Wales. The type collection of *M. plurinervia* was based on a specimen collected at "'Reedy Creek' Station, near Bonshaw" by J. Leader (Johnson 1959). We have not been able to relocate this population and believe it to be extinct. Johnson (1961) cited a number of other specimens under his concept of *M. plurinervia*, but the majority of these are not conspecific with the type collection and represent further undescribed species (Jones, in prep.). Hence given these factors, it appears that *M. plurinervia* has a relatively restricted distribution.

To date we have been able to locate a single population of plants conspecific with the type collection of *M. plurinervia*. Plants from this population are illustrated in Jones (1993). This population is small in size and we have counted approximately no more than 50 extant plants (up to 1994).

There may be a problem with cross-pollination in the population as while the plants have regularly coned for the last 10 years, no seed set has ever occurred and as a result no seedlings are present. Examination of the population during a pollen-shedding event revealed the complete absence of insects associated with the cones. Given the general association of small beetles with pollen-shedding cones and receptive female cones of other taxa in the *M. plurinervia* complex (Forster *et al.* 1994), it may be assumed that the loss of the putative pollinator from this population of *M. plurinervia* has resulted in the lack of seed set.

Figure 2 Road widening at habitat of *M. plurinervia*. Photo: P.J. Machin.

The small size of the single known population and the apparent problem in reproduction both mean that *M. plurinervia* should be considered as a CRITICAL species using the criteria of Mace *et al.* (1992) or as an ENDANGERED species using the criteria of Lucas and Synge (1978). To date this species has not been included on listings of Rare or Threatened plants for New South Wales, although Osborne (1995) proposed conservation codings of RARE (sensu Lucas and Synge) or VULNERABLE (sensu Mace *et al.*) based on an estimated population size of 5000 individuals in the wild. This inflated figure of 5000 is undoubtedly based on the previously broad taxonomic concept applied to this taxon and is no longer applicable following the recent taxonomic work.

Figure 3 Individual of *M. plurinervia* on edge of newly widened road. Photo: P.I. Forster.

Figure 4 Parts of destroyed individual of *M. plurinervia*. Photo: P.I. Forster.

The single population known unfortunately occurs on the edge of a minor road. Hence it was with great dismay that we recently (April 1995) discovered new roadworks in progress at the locality (Figures 2-5). The dirt road had been widened and somewhat straightened, with many trees knocked down and heaped on top of

Figure 5 Individual of *M. plurinervia* partially buried and damaged by roadworks. Photo: P.I. Forster.

Figure 6 Evidence of poached individual of *M. plurinervia*. Photo: P.J. Machin.

the cycad plants. We were able to locate only six extant individuals of *M. plurinervia*, and at least two dead ones. There was also direct evidence of recent poaching at the site as there was a filled in hole with cut cycad leaves scattered nearby (Figure 6). All of this activity appeared to have occurred during the month of March 1995.

Macrozamia plurinervia is a CRITICAL species under any circumstances, and the prognosis for this population is grim. It is likely that further work will progress on the road and that the heaped timber will be burnt up at some stage. Whether official intervention can prevent extinction of this population remains to be seen. The area where the population occurs is rather remote and unexplored away from road systems, hence it is to be hoped that further populations exist of this plant.

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ENCEPHALARTOS ALTENSTEINII: A MASSIVE RAPE BUT POSSIBLE RECOVERY

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April 1995 saw the uncovering of one of the largest cycad thefts in the Eastern Cape Province of the Republic of South Africa. The incident probably received more media publicity than any cycad happening in the Republic to date and newscoverage also found its way into the international media.

Figure 1 The easterly limit of the theft site. Note the bulldozer tracks across the ravine. The arrow shows a large cycad awaiting transport. At the bottom right note the depth of earth moved. Div de Villiers of the Cape Nature Conservation Department is partially obscured.

Figure 2 Excavated cycads with Div de Villiers.

The event should be viewed in three parts:

1. The theft of 31 tons of *Encephalartos altensteinii*.
2. The replanting programme.
3. The long term survival rates of this newly established colony of *E. altensteinii*.

1. THE THEFT

Astute reconnaissance by officials of the Cape Nature Conservation Department and surveillance of possible sites resulted in the nocturnal interception, on 20 March 1995, of a massive longhauler with 31 tons of the indigenous Eastern Cape cycad *Encephalartos altensteinii*. The theft site, some 10 km south of the Kingwilliamstown-Grahamstown national road, in an area between the Keiskamma River and the upper reaches of the Tyolomnqa River, is well away from the public eye. This site is the habitat which is further from the coast for *E. altensteinii* (Dyer 1965). One traverses kilometres of gravel roads, then grasslands to arrive eventually at a semicircular riverine bushy site on sloping ground. Evidence of cut fences and the honeycomb from different vehicle tracks in all directions bear witness to the prolonged operation conducted by the thieves. One is struck by the enormity of the exercise mounted by the accused, named in the press as Konstantinos Guileas, an Orange Free State businessman. Bulldozer excavation clearly shows the large roadways used for access, some contoured, another traversing the area and all designed for better removal of the cycad colony onto the lowbed vehicle (Figure 1). It appears the larger multiple-stemmed old clumps of *E. altensteinii* were dug out manually before mechanical means were used to remove the plants.

Various authorities who examined the cycads were impressed by the excellent condition of the specimens. Seldom did one find a stem that was scarred or a trunk that appeared to have been severed. This observation was contrary to some press reports.

A question which will possibly remain unanswered is how many of these enormously heavy and unwealdly clumps of cycads were dropped at the time of removal or during the loading?

One can only assume that given the machinery and time the thieves had at their disposal, the size of the clumps of *E. altensteinii* transported (some being multiple-stemmed and up to 5 m in length) and the pristine nature of the recovered stems, it is quite feasible that individuals with previous cycad experience were involved in this massive thieving operation.

Furthermore, given the unfortunate interception (from the thieves' view point) outside Grahamstown and the number of partially dug out cycads and removed specimens placed on their sides waiting for transportation from the site, one is left with the inevitable question: how many more large loads of cycads were to be stolen?

It is the author's viewpoint that, given the infrastructure the thieves laid, their operation would be finalised only when the very last cycad in the valley was stolen.

As for the thieves' motivation one can only speculate. Financial gain appears to have been the primary incentive, with an alleged 4 million Rand payout mentioned. As regards government complicity in the event, high ranking provincial officials Ms Tozie Mazitshane, one of the aides in the Eastern Cape Premier's office, and Vax Mayekiso, Free State provincial housing minister, have been implicated in *press reports.*

2. THE REPLANTING PROGRAMME

The decision to replant the colony of plants, comprising 48 clumps of mature specimens and individual stems and 15 smaller plants, to a secure environment and not back to their original site, was made by the Eastern Cape Nature Conservation officials.

The Thomas Baines Nature Reserve, a site 130 km west of the cycads' original indigenous habitat and 30 km north of the south-westerly limit of *E. altensteinii*, i.e. the west bank of the Bushmans River (Giddy 1984), was chosen for security reasons. [Some authorities record locations further west for *E. altensteinii*, e.g. Alexandria (Goode 1989)]. This Nature Reserve, roughly 15 km west of Grahamstown, is about 40 km south of the nearest *E. altensteinii* habitat and has previously been used for relocation of confiscated cycads. Slight concern was expressed that planting the colony within 10-15 km of an existing *E. caffer* reserve could result in cross pollination. "It is a well documented fact that no other species seems so much involved in natural hybridization as *E. altensteinii*" (Dyer 1965).

The cycads were removed from the trailer and laid in two rows of plants at the Nature Reserve for a short period while a team was summoned to decide "where and how".

All credit must go to the Eastern Cape Nature Conservation officials and specifically Deon "Div" de Villiers for summoning various eclectic inputs and in formulating a team approach to ensure that this new cycad colony had the best possible survival chance. In many respects this project has similarities with another cycad relocation project as documented in *Encephalartos* **27** (Giddy 1991).

A wet Sunday morning 8 April 1995 saw the get together of the scientists, the agronomist, the landscaper, the conservators and the curator in planning the replanting project (Figure 2).

A site was chosen some 400 m from where the plants had been originally offloaded from the vehicle: a gentle south-westerly slope, some 50 metres away from a natural stream. Soil samples from the original site and the new site were compared. The landscaper, with previous cycad replanting expertise, was content with the site and planting commenced on 10 April 1995.

Whilst every cycad gardener has his own method of planting and is usually dogmatic about the treatment and planting of cycads, he tends to be less vocal about the long term survival rates of his treatment. Furthermore, as mentioned by Wayne Boyd at CYCAD 1993, the large scale replanting of certain cycad species has not always had a favourable outcome and often leads to a high mortality rate.

Figure 3 The author examining the condition of one of the newly relocated cycad clumps.

Method: All leaves were removed. Roots were pruned and "Previcur" (a systemic and contact fungicide) was applied. "Chlorpyrifos" (an organophosphate insecticide) was sprayed over the plants and any scars were treated with "Bravo 500" (a contact insecticide).

Metal rods, with number 8 wire covered with hosepipe, were used to stabilize the larger plants from the elements and the inquisitive rhino and buffalo on the Reserve. Due to the time delay, hessian bags were placed over the roots of cycads awaiting planting. (Figure 3).

The operation was overseen by a professional landscaper, Allan Hart of Shamrock Nurseries from East London, who donated days of his time free of charge, and the Reserve Manager, Derek van Eeden.

Donations: All cycad lovers owe a word of appreciation to the sponsors of this project who donated either their time or material or contributed financially.

The Grahamstown T.L.C., City Engineers Department and Parks and Forestry Department; The Provincial Administration, Grahamstown; Phoenix Roller Mills, Grahamstown; Iscor Heavy Minerals, Pretoria; Shamrock Nurseries, East London; Rhino Plastics, Port Elizabeth; A.E. Homman, Grahamstown; Pretoria Portland Cement, R70 000; Border Branch of the Wildlife Society of Southern Africa; Decor Profile Randburg; Kynoch Fertilizer, Grahamstown and East London.

3. LONGTERM SURVIVAL OF THE NEWLY ESTABLISHED COLONY

It is a well documented phenomenon that *E. altensteinii* is one of the more hardier members of the genus. Stress and shock often provoke reactionary growth (Jones 1993). As alluded to under points 1 and 2, the possibility exists that certain plants could have been dropped resulting in internal disruption, unseen on the outside. All care has been taken in this replanting experiment and the exact applications recorded.

Survival rates of transplanted *Encephalartos* species from the wild amongst amateur gardeners is usually confined to anecdotal evidence. Furthermore, this practice has been prohibited in South Africa since 1985. Success was often claimed and failure seldom mentioned. In many cases of failure, when a cycad died, a replacement specimen from the wild was substituted.

The cycad literature is devoid of accurate data on peculiarities of *Encephalartos* species, method of treatment and survival rates, especially over a prolonged period (Donaldson 1995). Jones (1993) mentions that "cycads are generally very easy to transplant and even very large specimen plants can be removed successfully providing a few basic horticultural procedures are observed". Unfortunately he does not specifically cite *Encephalartos*, nor does he quote long term survival rates.

Therefore it is quite opportune here to not only cite some six previously documented exercises in replanting of cycads from the wild in South Africa but to tabulate the long term survival rates as a basis for determining the expected long term survival of this new colony of *E. altensteinii*.

1. Unpublished data by Drs Dyer and Verdoorn on the subsequent history of the 6000 *E. lebomboensis* removed from the wild in "Operation Wildflower" during the building of the Jozini Dam revealed a long term survival of 40% (Giddy, *pers. comm.*).

2. About 100 *E. horridus* cycads, confiscated by the Eastern Cape Nature Conservation Department and replanted by the Uitenhage Parks Department in well-drained indigenous *E. horridus* habitat, during which damaged plants were treated with fungicide, revealed a long term survival rate, after 5 years, of 20% (Farrington, *pers. comm.*).

3. The replanting of *E. laevifolius* of "Operation Stork" in which four stems were transplanted with utmost care and supervised by experts, revealed a 25% survival (Giddy, *pers. comm.*).

4. Jones (1993) cites two resettlement schemes, in 1986 and 1989, of *E. humilis*. Facts reveal that 6000 *E. humilis* plants were removed from within established mono-culture plantations to the ex-provincial nursery. Subsequently, 3000 plants have been put back into the wild at two locations. As at 1995, an 80% success rate has been obtained in both cases. (Boyd, *pers. comm.*)

5. A total of 114 *E. inopinus* plants were translocated to a safer but similar site on a provincial nature reserve. Once placed at this site it was discovered that the plants were easily accessible from a nearby roadway. The plants were then moved again to a new site further within the reserve. This operation revealed a mortality rate of ±90%, ascribed to the soil moisture content in the new area rising to a high level during the wet season as a result of seepage from a nearby dam. (Boyd, *pers. comm.*)

6. The Eastern Cape Nature Conservation Department confiscated *E. latifrons* plants, removed from the Bathurst District in 1993. The plants were re-established within their natural environment in a secure existing nature conservancy. The author re-examined each of the original plants during 1995, 18 months after re-introduction. Survival rate was recorded as ±21%.

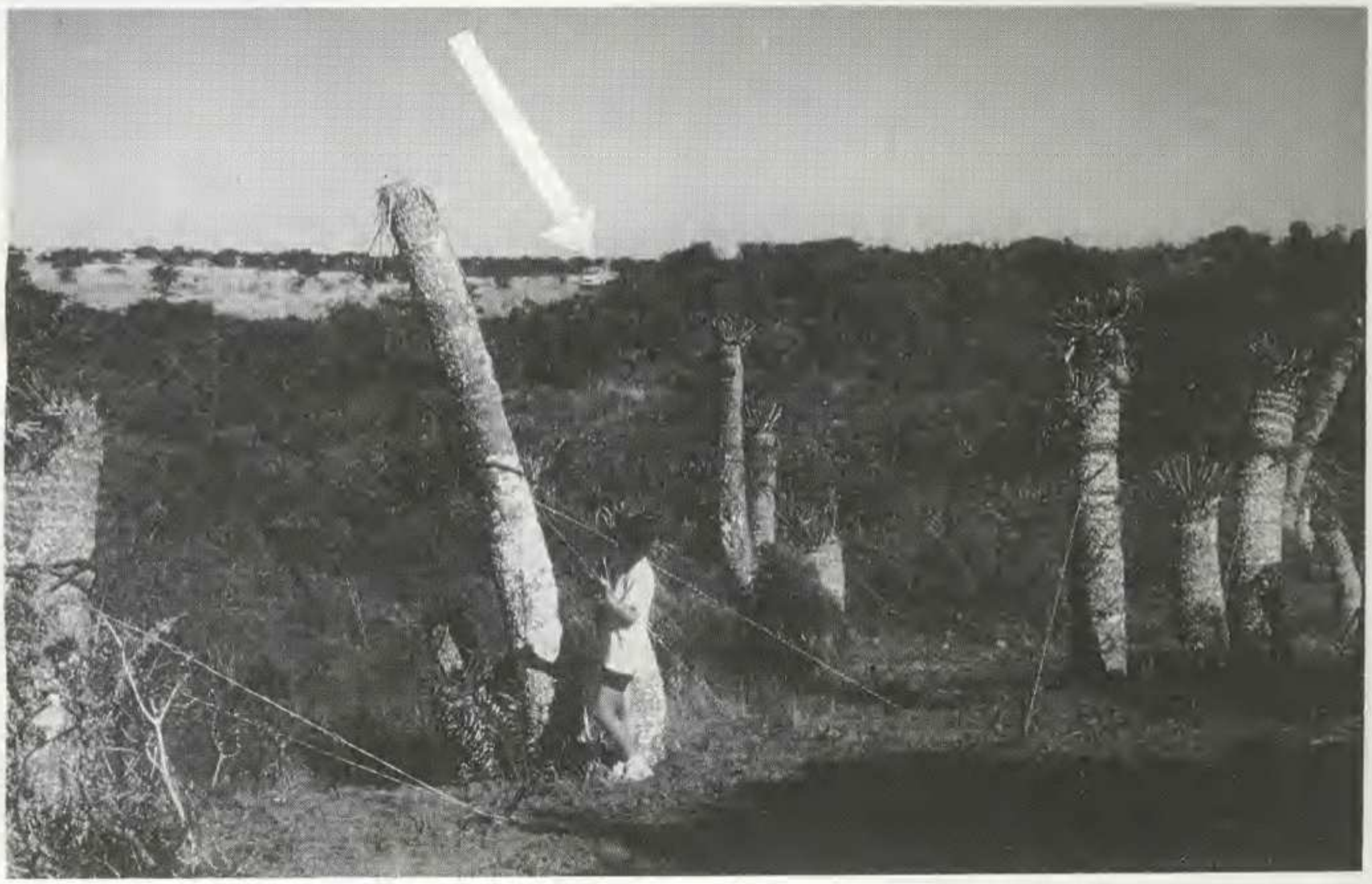

Figure 4 The replanting project on completion. Note the height of the plants in relation to the 1.73 m person. The arrow towards the vehicle marks the original site from where the plants were transported.

The conclusion from these observations in transplanting six species of *Encephalartos* from the wild, reveals a mean survival rate of 32%, or conversely, a death rate of 67%. Whilst the cited cases obviously raise much debate due to the variability and uniqueness of each species and the peculiarity of the replanting exercise conducted, this percentage could provide a bench mark for single populations of *Encephalartos* transplanted from the wild with which the progress of the new colony of *E. altensteinii* can be compared (Figure 4). The first follow-up one year later, in April 1996, will hopefully be presented at Cycad 1996. All plants have been measured as a starting point for long term study on translocated *Encephalartos* cycad species from the wild and their subsequent survival rates.

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THE BOTANIC GARDENS OF JAVA

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INTRODUCTION

About 1000 km long and 150 km wide, Java Island is a volcanic land mass lying just south of, and running parallel to, the equator. Now part of the Republic of Indonesia, it is populated mainly by people of Malay stock and most of the inhabitants are of the Muslim faith. The warm climate with seasonal monsoons resulted in a typical tropical rainforest vegetation over much of the landmass but, as in many countries, agricultural, commercial and urban development have much reduced the natural rainforest area.

Cycas rumphii grows naturally on Java Island, Sumatra Island and the Mentawai Archipelago situated some 50 km off the western coast of Sumatra Island. Populations of this species have suffered from plant poachers (see *Encephalartos* **28**: 23) but a number of factors have diminished this impact: the plants are in remote areas, transportation costs are high and many of the plants do not survive transplanting. Furthermore, the demand for specimens is limited because there is an insect (*Chilades pandava*, family Lycaenidae) which lays eggs on the cycad leaves and the resulting larvae vigorously devour new foliage to make the plants unsightly in garden plantings. It is believed that there are still tens of thousands of wild *Cycas rumphii* plants in Indonesia.

There are three main botanic gardens in Java: at Bogor, Cibodas and Purwodadi; all are administered by the Indonesian Science Institute. Other important gardens in Indonesia, not covered in this article, are the Sibolangit Botanic Garden in North Sumatra, the Setia Mulia Botanic Garden in West Sumatra and the Eka Karya Botanic Garden on Bali Island.

THE BOGOR BOTANIC GARDEN

The Bogor Botanic Garden (*Kebun Raya Bogor*) is the official botanic garden of Indonesia. The city of Bogor is about 60 km south of Jakarta and is nicknamed "Rain City" (*Kota Hujan*) on account of its 4000 mm p.a. rainfall. The 110 ha. garden, established in 1817 by C.G.C. Reinwardt as the *s'Landplantentuin*, is situated in the heart of the city and is at 260 m altitude. Like many of the early colonial botanic gardens, its purpose at the time of establishment was to explore the economic potential of indigenous plants and to introduce useful crop plants, e.g. the oil palm, from abroad. Despite its relative meagre funding, the internationally-famous Bogor Botanic Garden is considered the best of the botanical gardens in South-East Asia (Chris Reid, letter to *Nature*, 2 June 1994). The garden has an impressive collection of rainforest trees, many interesting epiphytic plants and a variety tropical flowering plants. A major tourist attraction is the bizarre *Amorphophallus titanum* which is considered the largest flower in the world (Figure 1) (despite some competition from *Rafflesia arnoldii* - both these plants are Indonesian). [A report on a visit to the Bogor Botanical Garden, by Paul Forster, was published in *Encephalartos* **41**: 19-20 - Editor.]

Figure 1 *Amorphophallus titanum*, Bogor Botanic Garden, March 1994. A water-loving botanical curiosity, this Indonesian plant flowers in a leafless condition during the rainy season. It is probably the largest single flowering structure in the plant kingdom.

Figure 2 *Dioon edule* **plants in splendid condition at the Bogor Botanical Garden.**

Figure 3 The prostrate trunk of *Encephalartos laurentianus* at the Bogor garden. [It is noted that Paul Forster (*Encephalartos* 41: 19-20) has the same plant, in his Figure 4, as part of a group of *E. hildebrandtii* - Editor.]

Mature cycad specimens at the Bogor garden include *Bowenia spectabilis, Cycas seemannii, C. revoluta, C. rumphii, C. taitungensis, Dioon edule* (Figure 2), *Encephalartos hildebrandtii, E. laurentianus* (Figure 3), *E. villosus* (Figure 4), *Lepidozamia hopei, L. peroffskyana, Macrozamia mountperriensis, Zamia muricata, Z. loddigesii* and *Z. tuerckheimii*. Although the number of plants is not large, many of these specimens were established many years ago and are now most impressive in size and condition.

Figure 4 A well-established clump of *Encephalartos villosus* at the Bogor garden.

THE CIBODAS BOTANIC GARDEN

The Cibodas Botanic Garden is situated near the town of Sindanglaya on the slopes of Mount Gedeh (3000 m), about 100 km southeast of Jakarta. Established in 1866 by Johannes Teysmann, it is suited to plants which grow in wet highlands in view of the rainfall (4000 mm p.a.) and the altitude (1450 m). The 129 ha. garden is noted for its collection of conifers.

Mature cycad specimens at the Cibodas garden include *Cycas taitungensis, Encephalartos altensteinii* (Figure 5), *E. horridus* (Figure 6), *Zamia furfuracea, Z. integrifolia* and *Z. loddigesii*.

THE PURWODADI BOTANIC GARDEN

The Purwodadi Botanic Garden is situated in the Lawang Region of the East Java Province, near the town of Purwodadi, about 500 km to the east of Jakarta and 70 km south of Surabaya. This 85 ha. garden was established in 1939 by D.F. van Slooten and caters for plants which grow in dry lowlands because of its comparatively lower rainfall (2700 mm p.a.) and altitude (300 m).

Mature cycad specimens at the Purwodadi garden include *Cycas circinalis (?), C. revoluta, C. rumphii, Zamia integrifolia* and *Z. furfuracea*.

Figure 5 Specimens of *Encephalartos altensteinii* at the Cibodas Botanic Garden. The plant on the right is bearing male cones.

Figure 6 *Encephalartos horridus* at the Cibodas garden, the plant in the foreground with a female cone.

ACKNOWLEDGEMENT

The author thanks Roy Osborne for his kind assistance in the preparation of this article.

Figure 7 The author (left) with his wife Yuen (right) and their children, standing under a specimen of *Pandanus utilis* at the Cibodas Botanic Garden.

Fadjar Marta (Figure 7), *one of the early international members of the Cycad Society of South Africa, welcomes visitors to his country and is willing to escort small groups to the botanic gardens at Bogor and Cibodas. He has access to many species of palm seed and would like to exchange them for cycad seeds. Write to him at P.T. Indoparts Utama, Jl. Gaya Motor I No. 8 - Sunter II, P.O. Box 3061, Jakarta 10002, Indonesia. Fax 6512716 or telephone 6511232 (office hours) or 7414908 (after hours).*

HAND-POLLINATION OF *ENCEPHALARTOS HEENANII* IN THE SONGIMVELO GAME RESERVE, MPHUMALANGA PROVINCE

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SUMMARY

Only a few hundred *Encephalartos heenanii* still occur in the wild. Little natural recruitment has been observed and hand-pollination was attempted in order to boost seedling numbers. Due to its erratic coning and the difficult access to plants in their mountainous habitat only a limited number of cones were pollinated. The pollinated cones developed fully and according to the flotation test several hundred viable seeds were present. However, only 18 seedlings emerged. Suggestions are made as to possibly enhancing the success rate of the pollination. The operation was deemed worthwhile despite the small numberr of seedlings obtained. The 18 seedlings represent an increase of the known population by almost 5%.

BACKGROUND

Encephalartos heenanii was only discovered in 1969 and described three years later (Dyer 1972). Heenan's cycad grows in steep rocky areas in montane grassland at elevations between 1300 and 1600 m (Goode 1989) along the north-west Swaziland-South Africa border. It was never a plentiful species and following its discovery it was exposed to the customary depredations by unscrupulous collectors. Only an estimated 400 plants still occur in the wild (Osborne 1995), most of which are found in the Songimvelo Game Reserve. This 49 000 ha area is administered by the Mphumalanga Parks Board and incorporates the old Ida Doyer Nature Reserve which was set aside for the conservation of *E. paucidentatus* although *E. heenanii* was subsequently also discovered at this locality.

HAND-POLLINATION AND SEED PRODUCTION

The specimens in Songimvelo exhibit erratic coning both within the population and within time (Swanepoel, personal communication). Little natural recruitment has been observed in the field.

In situ hand-pollination was attempted in order to address the recruitment problem. This approach has already been used successfully with other species such as *E. middelburgensis* (Strydom 1995).

On 22 April 1992 two male cones of *E. heenanii* were harvested and the pollen was extracted. Six female cones were pollinated on 27 April using the wet pollination method. Pollen was mixed with distilled water and injected at the top of the female cones until liquid started dripping out from between the bottom scales.

The pollinated cycads were visited again on the 27th of May 1992 and the cones were covered by citrus bags in order to prevent the ripe seed from being carried away by rodents.

Four ripe cones were harvested on 13 October 1992, while the last two cones were harvested on 6 January 1993. Cones were weighed separately while seeds were also counted per cone (Table 1).

GERMINATION

The fleshy outer layer (sarcotesta) was stripped from the kernels. A flotation test was performed after which

Table 1 Cone weight and seed numbers from six hand-pollinated *E. heenanii* cones

Characteristic (n = 6 cones)	Average	Minimum	Maximum	Standard deviation
Cone weight (kg)	2.64	1.11	6.53	1.97
Number of seeds	184	108	315	70

Table 2 Seed characteristics of six hand-pollinated *E. heenanii* cones

Characteristic (n = 6 cones)	Average	Minimum	Maximum	Standard deviation
No. of "viable" seeds	128	0	162	63
Weight "viable" seed (g)	6.96	5.4	8.2	1.15

only the "viable" seed were selected for planting in seed trays (Table 2).

Ten seeds of each cone were planted on 9 April 1993 as a test. First germination was on 24 May 1993 after which the remaining seeds were planted. All seeds were treated with a fungicide prior to planting.

A total of 18 seedlings were obtained by October 1993. The other seeds were tested again and discarded after proving to be all non-viable.

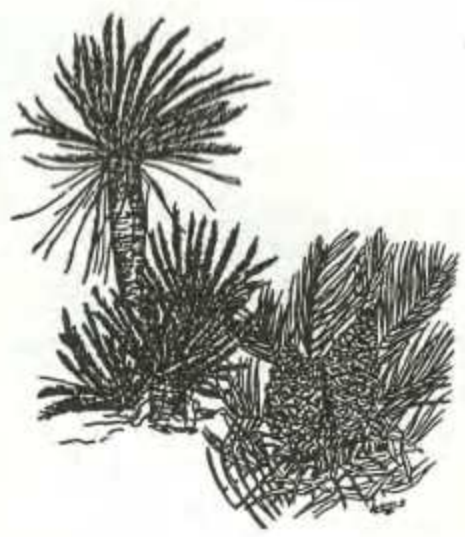
DISCUSSION AND RECOMMENDATIONS

The 18 seedlings which were obtained resulted from only two cones of which one actually yielded 16 seedlings. Both these cones were collected almost three months later than the first batch of four cones. The seed number and seed weight of the most successful cone were respectively 148 and 7.9 g. These values fell well within the range of the other cones.

The fact that almost all the seedlings resulted from one specific cone points towards problems with the pollination rather than to problems in the nursery.

It seems critical to pollinate at the right stage of receptiveness of the female cone. The difficult access to most of the plants makes repeated pollination within the span of a few days problematic.

The best management strategy in future might be to concentrate all efforts on this repeated pollination of only a few selected plants rather than trying to reach all cones. The amount of available pollen is also limited and can probably be used most efficiently by intensive pollination of a few female cones.



CONCLUSION

The final total of 18 seedlings is small in terms of the manpower expended on this project. However, it represents several years of natural recruitment in the veld. These 18 seedlings form a significant addition to the estimated 400 plants remaining in the wild. At the moment the seedling leaves are 0.3-0.4 m long. The seedlings are still in the nursery

ACKNOWLEDGEMENTS

Willem Froneman of the Lowveld National Botanical Garden assisted with the actual pollen collection and subsequent hand-pollination. Steven Glass and the Songimvelo game scouts located coning cycads. Kevan Zunckel commented on the initial draft.

PERSONAL COMMUNICATIONS

Mr W. Swanepoel. Mphumalanga Parks Board, P.O. Box 1990, Nelspruit 1200.

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PRODUCING MORE SEEDS WITH A BETTER FERTILIZER REGIME

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As a nurseryman, I always experiment with ways to speed plant growth and improve my propagation. I read papers and attend presentations to learn about these plants in their native habitats, where they should thrive. I have learned that wild cycads all over the world produce cones infrequently. In cultivation, I have noticed that male plants of *Cycas revoluta* will cone every year, but a seed bearing female will skip a year before coning again. I saw a *Dioon edule* at a nearby nursery that remained defoliated for three years after coning. In my own nursery, *Zamia* plants that produce in excess of 2000 seeds per plant will defoliate for a year, and twice even died. It seems that the plant's energy levels are very important for continued growth and coning.

Cycads are slow growing. They usually cone at the same time each year. Something, however, helps determine whether each plant will cone in a given year. I have found that many "stubborn" flowering plants will flower within a few weeks after I apply a high phosphate fertilizer. This all lead to my experiment.

I decided to use a group of *Zamia fischeri* from my nursery that were small, single-headed, plants of coning size. I placed forty in a test group and forty in a control group. In 1991, the first group produced four male cones and six female cones, the control group's results were not recorded.

In 1992, I fertilized the test group with triple super phosphate (0-46-0) two months before I expected the emergence of cones. In addition I applied a weekly foliar fertilizer known as "Super bloom" (9-59-8). The control group was fertilized with my standard fertilizer, a four month formulation of (24-7-8 with minors), four months before the expected emergence of cones.

The test group responded with fewer cones than the previous year, five as opposed to ten. The control group, however, produced ten cones. My first experiment had failed. But, I still thought that something was missing from my standard cultural methods.

In 1993, I thought about a comment I heard referring to cone sporophylls as "modified leaves". I decided to try a high nitrogen fertilizer, which encourages foliage production, and see what would happen. This time I split the test group in half. In Group 1a, twenty were fertilized two months before expected cone emergence with my standard fertilizer (24-7-8 with minors), supplemented with a foliar fertilization (20-10-10). A high percentage (14.7%) of the nitrogen in my standard fertilizer is urea, a fast reacting form of nitrogen. My application rate of the standard fertilizer was 20% higher than the recommended rate. In Group 1b, the other twenty in the test group were treated in the same manner one month later.

To my amazement, all of the plants in Group 1a produced cones. Sixteen plants of twenty in Group 1b also produced cones. The cones of Group 1b matured one month later than those of Group 1a. I believe that this big nitrogen push, one to two months before expected coning, is what triggered these plants to cone. However, some of the female plants in Group 1b never became receptive to pollination.

Figure 1 ***Ceratozamia hildae*** **with cones on offsets.**

Excited by my results, I tried the same procedure on *Cycas revoluta*, *Dioon edule*, and four types of *Ceratozamia*, *C. hildae, C. kuesteriana, C. norstogii* (the flat-leafed form), and *C. norstogii* (the "plumose" form). As a result of this fertilization programme, I tripled the cone production from the previous year on the *Cycas revoluta*. Every mature *Dioon edule* produced cones, including two small plants with stem diameters of just 70 mm. Most of the *Ceratozamia* plants produced cones, including females that had produced seeds the year before, doubling my seed production. As shown in the photograph (Figure 1) even offsets as small as 30 mm in diameter produced cones.

In 1994, I used my standard fertilizer (24-7-8) as well as a new slow release fertilizer on the control groups. Even though the time release fertilizer produces a healthy plant, only the plants with the (24-7-8) produced cones.

I would caution readers not to use this high-nitrogen method on plants that are weak because heavy seed production can kill an unhealthy mother plant. But, I believe that this may be an important missing element in both cultivated and natural populations. I have been observing a local population of *Zamia integrifolia* on a friend's property, that has not been reproductive. He has given me permission, and I intend to test my fertilization technique on these wild plants this year.

I am curious to know if this method will improve coning in African and Australian cycads. I would like to hear from anyone who tries, or has tried, similar methods of improving cone and seed production in cycads.

STEM INJURY IN CYCADS: AN EXPERIMENT

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The cycad stem is a delicate organ. Internally it is composed mainly of soft watery tissue, which can be easily bruised or crushed. Damaged stem tissue is prone to infection by fungi and bacteria and often leads to the death of the entire cycad stem. Edgar Wohlberg and Aston Vice, who have much experience transplanting large *Encephalartos* specimens out of the path of construction projects, report that the flexing of large stems often leads to internal damage and subsequent rot of the trunks (Tang 1995). Cynthia Giddy reports that a large trunk of an *Encephalartos* may suffer fatal bruises if dropped from a height of only one centimeter (Giddy, personal communication). These observations document the delicate nature of cycad stems and suggest that bruises to cycad stems may be an important cause of death in both wild and cultivated cycads. Because bruises and internal damage to cycad stems cannot be seen with the eye unless the damage is severe or until after the stem has already begun to rot, it is often impossible to detect and treat before rot has spread. Undoubtedly, many cycads die from stem bruises without their owners realizing that this was the cause of death.

Below I describe an experiment that measures the amount of stem injury caused by blows of known force and energy. To my knowledge, no careful work has previously been conducted on this topic. With the results of this experiment it may be possible to predict with some accuracy the size of the bruise that a cycad stem will suffer if dropped from a known height.

MATERIALS AND METHODS

Nineteen stems of *Zamia furfuracea* were obtained from a nursery. They all appeared to have been grown under uniform conditions and their leaves and roots had been cut off several days before being procured by the author. Their diameters ranged from 46 to 62 mm and their masses from 94 to 215 g. The leaf-bases of *Z. furfuracea* stems are deciduous. Both leaf-bases and scale leaves remain attached to the stem for two or more years after emerging from the apex, but eventually are shed as the plant ages. Therefore the upper part of these stems were clothed with leaf-base "armour" much as in the genus *Encephalartos* and most other cycad genera. The lower portions of the stems were bare of leaf-bases as in the African genus *Stangeria*.

The mass of each stem was determined. The stems were then assigned randomly to four treatment categories: (1) stem to be dropped from a height of 1.5 m; (2) dropped from a height of 2.5 m; (3) dropped from a height of 4 m and (4) control - stems not dropped. The stems were dropped onto a piece of typing paper soaked with stamp pad ink so that the position and size of the impact area on the stem would be clearly marked. Beneath the ink-soaked paper was a concrete floor (see Figure 1).

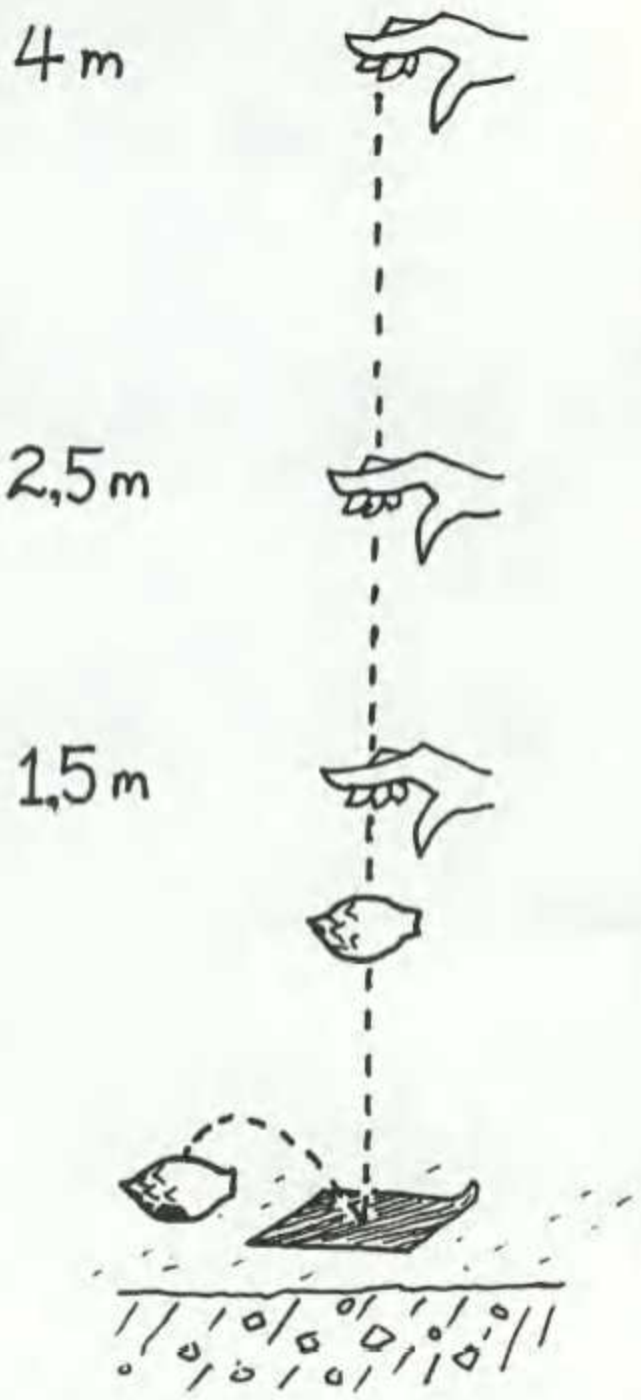

Figure 1 Drawing of the experimental procedure; *Zamia furfuracea* stems were dropped from three heights, 1.5 m, 2.5 m and 4 m, onto a sheet of typing paper, soaked with ink, on top of a concrete floor.

After being dropped the stems were placed individually into ziploc bags to prevent dessication. Two to five dayslater, time enough for damaged tissue to begin dying and turn brown, the stems were cut in half from the apex to the root along a line through the centre of the impact area. The brown, bruised area exposed was photographed and drawn on tracing paper and the area of bruised tissue was later measured. The area of impact, recorded by the ink imprint was also traced and the area later measured.

The energy of impact was measured using the following index:

(mass of stem in grams) x (distance fallen in meters).

To calculate the actual amount of energy of impact suffered by the dropped stems this index can be multiplied by the acceleration of gravity (a constant) to obtain energy in joules. This measurement of the energy of impact does not take into account the air friction experienced by the stems as they fell. Air friction would reduce the estimated energy of impact by a relatively small percentage. For practicality, it is ignored in these calculations.

Figure 2 Photograph of a cross-section of a *Zamia furfuracea* stem that had been dropped from a height of 1.5 m. Notice the brown bruise on the left side. The impact on this stem was absorbed by a leaf base.

The volume of bruised tissue* (in cm^3) was estimated using the formula:

$$\frac{(\text{impact area in } cm^2) \times \sqrt{(\text{area of bruise exposed after cutting stem})}}{2}$$

*After estimating the area of the cross-section of the bruise by fitting in rectangles and triangles, I summarize the area as a square. I then take the square root as an estimate of the "depth" of the bruise at the centre of the impact area. Since the depth of the bruise tapers toward the edge of the impact area, I divide the square root by two to account for this. I have tried different methods of estimation. Although they give slightly different results the trend of the regression line and correlation coefficient are similar.

The energy of impact was then graphed against volume of bruise (Figure 4).

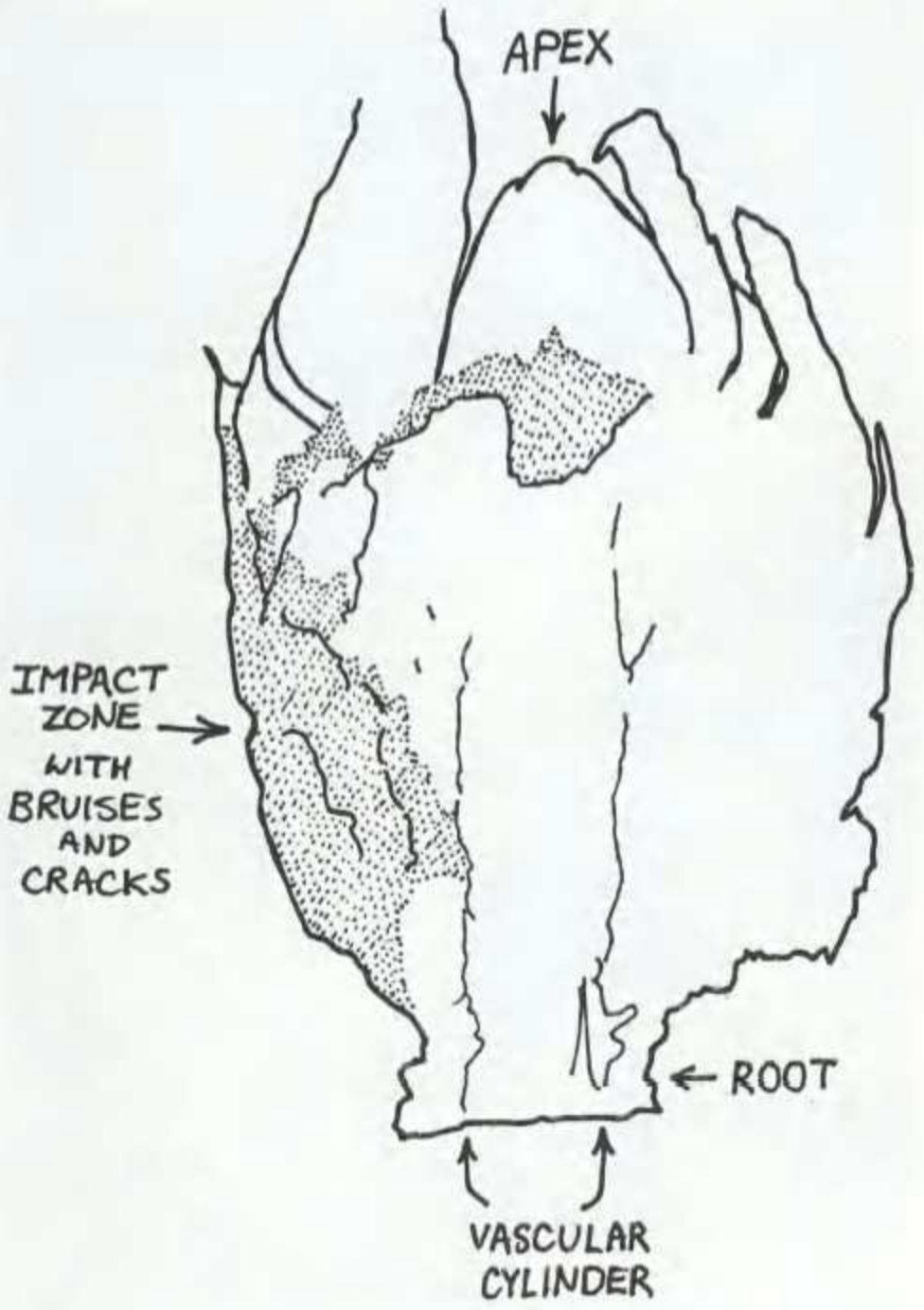

Figure 3 Line tracing of a stem that had been dropped from a height of 4 m. The shaded area is bruised tissue. The wiggly lines are cracks. Note the irregular shape of the damaged tissue, especially the crack which extends past the vascular cylinder and under the apex of the stem.

RESULTS

I predicted that the *Zamia* stems would exhibit clean, symmetrical bruises that would be hemispherical in cross-section, as in a bruise formed on an apple when it is dropped. Some of the *Zamia* stems did indeed exhibit such bruises (see Figure 2). However, unlike an apple, which has a nearly uniform texture inside, cycad stems have a surface armour of leaf-bases that varies in thickness and an interior texture that varies because of vascular tissue, which occupies the centre of the stem and winds its way through the cortex (see Figure 3). Thus, an impact which occurred on the thick, cushioned leaf-base of the cycad resulted in only a small bruise while those impacts of similar energy on unprotected parts of the stem exhibited much larger bruises. Many stems exhibited damage, in cross-section, that consisted of a complex pattern of bruising, crushed tissue and cracks (see Figure 3). These factors made it harder to compare the extent of damage among the stems. The graph of impact energy against bruise volume (Figure 4), however, forms a clear pattern and fits a line with some scatter. The control stems, which were not dropped, showed no bruises, indicating that the bruises were caused by the fall and not some other factor. Several stems used in the experiment were excluded from the results because rot had occurred in the pith and appeared to have interfered with the bruising pattern.

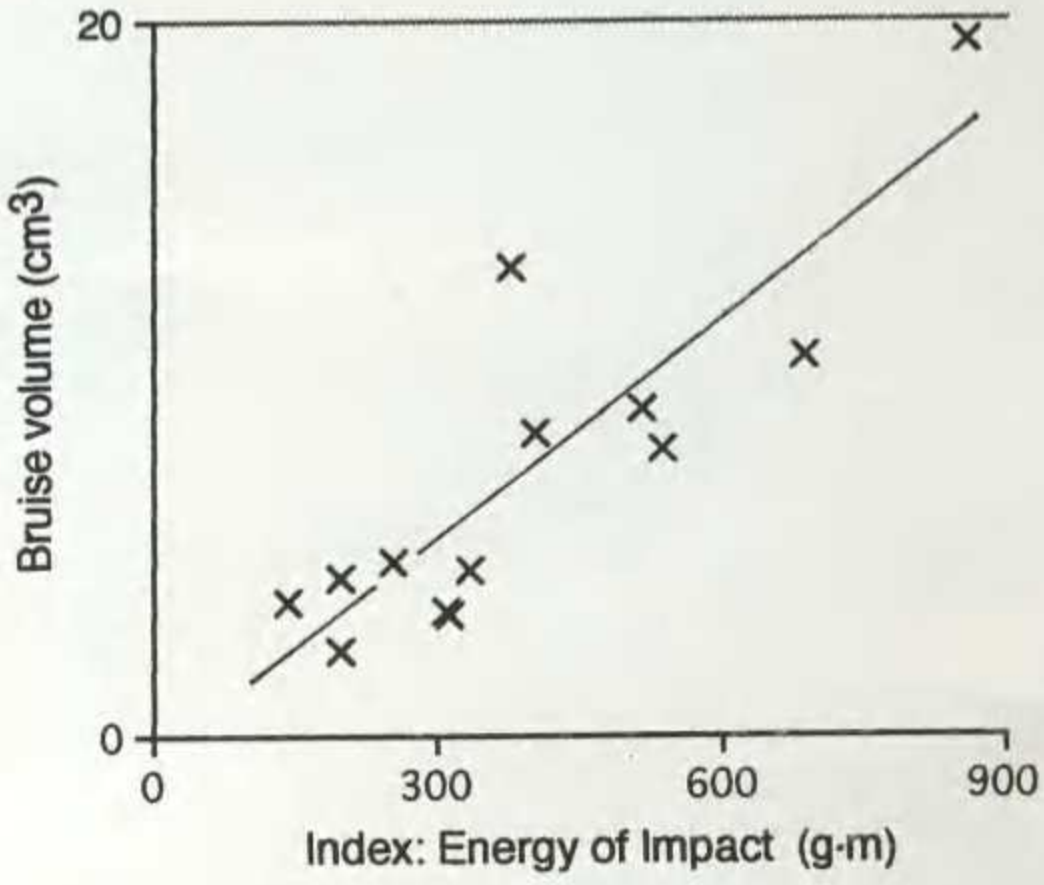

Figure 4 Index of impact energy experienced by *Zamia furfuracea* stems is graphed against the estimated volume of bruised tissue that resulted. The relationship is roughly linear. The larger the energy of impact, the larger the volume of bruised tissue. Slope of regression line = 0.02; y-intercept = -0.6; correlation coefficient = 0.86. See text for further discussion.

DISCUSSION

With this graph (Figure 4) it is possible to predict with some degree of accuracy the amount of bruising that a cycad stem will suffer when dropped. If we make the assumption that the internal texture and strength of the *Zamia* stems used in this experiment are typical of most cycad stems, and this appears to be a reasonable assumption, we can extend the conclusions of this experiment to include other cycad species and genera. If the mass of the stem is determined and the height at which it is dropped is known, the size of the bruise can be estimated. For instance, if a stem weighing 20000 g (20 kg) is dropped 2.5 cm, it would suffer damage approximately equivalent to a 200 g stem that was dropped from a 2.5 m height! Clearly, the larger the

stem the greater its vulnerability to massive damage when it is dropped even from a small height. Dropping a small cycad, even from a small height, may lead to small, but potentially fatal injuries.

ACKNOWLEDGEMENTS

This experiment was inspired by discussions with Loran Whitelock and with Cynthia Giddy, Aston Vice and Edgar Wohlberg during CYCAD 93. Many thanks to Loran, Cynthia, Aston, Edgar and the many participants of that conference.

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THE BOTANICAL GARDEN OF FLORENCE, ITALY

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The "Giardino dei Semplici di Firenze" (literally *The Garden of Simplicity at Florence*) is the third-oldest botanical garden in the world. Its origin can be traced back to 1 December 1545, when the Grand Duke Cosimo I of Medici acquired the property, on which the garden was developed, from a group of Domenicum nuns. [This was not the first such project of Cosimo I; about two years earlier he had founded a University botanical garden at Pisa.] The name "Giardino dei Semplici" relates to the fact that, like many of the early botanical gardens, the Florence garden was first planned for the cultivation of medicinal plants. The layout was designed by Niccolò, known as "il Tribolo", who had already participated in many similar projects. The work relating to the construction of the new garden was supervised by Luca Ghini, who also supplemented the plant collection.

The Florence garden occupies an area of 23892 m^2 and is bordered on the south by the University Departments of Plant Biology and Earth Science. The entrance is situated at No. 3, Via Micheli.

The plant collection comprises about 5500 specimens but the garden's pride lies in its collection of cycad plants - al cultivated in containers. Of special interest are two huge specimens of *Encephalartos altensteinii* (Figure 1) and *Dioon spinulosum* (Figure 2), each 5 m tall, in terra-cotta pots 1.5 m in diameter designed in the "Tuscan lemon" style.

The garden's cycad collection presently stands at 138 plants, representing 40 species in 8 genera, e.g. *Ceratozamia*, *Dioon* (Figures 2, 3), *Encephalartos* (Figures 1, 4, 5), *Macrozamia* (Figure 6) and *Zamia*.

Figure 1 ***Encephalartos altensteinii*, one of the two largest cycad specimens in the garden.**

Figure 2 *Dioon spinulosum*, **the other large cycad specimen in the garden.**

Figure 3 *Dioon purpusii*, **a specimen of one of the several** *Dioon* **species in the garden.**

The majority of these plants were donated to the garden by Commendatore Ernesto Modigliani who had, in turn, acquired them from a cycad enthusiast, Dr. G. Garbari, from his home in Treno.

Amongst the very striking examples, one can list *Dioon edule, D. spinulosum* (Figure 2), *Encephalartos altensteinii* (Figure 1), *E. lehmannii, E. horridus* and *Ceratozamia mexicana*. It seems that the naming of the specimens is not quite consistent with the current taxonomy - except for the more recent introductions of fairly small *Dioon* spp. which have been obtained from the Botanical Garden of Naples, which leads the field in this area. Nevertheless, it is clear that the Florence collection has many rare specimens. I do not know these well enough to venture identifications, especially for the smaller plants without cones. These plants will ultimately prove to be of great interest.

Amongst the many Europian botanical gardens, that in Florence is especially worth visiting, despite the limitations arising from the age of the structures and the fact that the garden's location in the centre of Florence has restricted any expansion. The collection of rare

Figure 4 A specimen of *Encephalartos friderici-guilielmi*, **one of the slow-growing South African species.**

plants and the love of the Tuscan people for arts make this city an essential destination in any tour itinery. The artistic treasures, for which Florence is renowned as a world capital, and the scenery of the surrounding region (considered to be the most beautiful part of Italy), well

Figure 5 An *Encephalartos trispinosus* female plant in cone in the garden.

Figure 6 A *Macrozamia macdonnellii* specimen doing well in its container.

justify such a visit. One gains admission to the garden on Wednesday mornings by ringing the bell at the entrance gate for No. 3, Via Micheli.

I would like to thank the now-retired Luciano Giugnolini, for his inspiration in my appreciation of this garden, and Giovanna Cellai-Ciuffi, whose publication provided a valuable reference source in the preparation of this report.

A PRELIMINARY STUDY OF THE *CYCAS MICHOLITZII* COMPLEX

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Received 12 October 1995

The *Cycas micholitzii* complex is remarkable in the genus *Cycas*. In 1902, Sir W.T. Thiselton-Dyer (1902) first gave the name of *Cycas rumphii* var. *bifida* Dyer to a branched (dichotomous) leaflet cycad from Guangxi, China, in the *Journal of the Linnean Society*, basing his description on a leaf specimen collected by H.B. Moore. Two years later, Micholitz collected leaves and megasporophylls from a similar plant in which pinnules were repeatedly dichotomous, from Annam, Vietnam. When assessing the various herbarium specimens,

Thiselton-Dyer (1905) gave the formal name *Cycas micholitzii* in honour of the collector. He thought that Moore's and Micholitz's plants might be the same species since Kwangsi (= Guangxi) is adjacent to Vietnam. Subsequently, most botanists (Prain 1909, Schuster 1932, Pant & Mehra 1962, Hu 1964, Jones 1993) considered these two collections to represent the same species.

In the *Florae Republicae Popularis Sinicae* (Chen *et al.* 1978), the description of *C. micholitzii* is an almost direct translation from Schuster (1932). The authors could not decide whether the above two taxa are the same species as final resolution could be made only after they had seen the male and female cone material of both plants. In the *Flora of Guangxi* (Li & Liang 1991) the authors accepted a common species concept but gave only a very brief description of leaf and stem material without illustrations. The "one species" idea is widely accepted in China at present.

Several years ago, people became aware of another similar cycad in China's Yunnan province and also called it "*Cycas micholitzii*" as its leaf is also dichotomous. Ian Turner from Zimbabwe visited China to search for *C. micholitzii* and he was particularly pleased to get a young plant of "*Cycas micholitzii*" from Kunming Botanical Garden. He reported this achievement both in *Encephalartos* (Turner 1990) and at the Second International Conference on Cycad Biology (Turner 1993). This development lead to a new species being described. In 1992, Si-Yuan Yang collected a specimen in the Red River Valley of Yunnan province. In 1993, Jia-Rui Chen reported on this find and named the Yunnan plant *Cycas* "*multipinnata*" at the Third International Conference on Cycad Biology in South Africa. The formal description was given the following year (Chen & Yang 1994).

However, when Si-Lin Yang undertook his 1993 cycad expedition in China, he recognized yet another kind of plant, with dichotomously branched but narrow pinnae, and thought it to be a variety of *Cycas micholitzii*, suggesting the name *Cycas micholitzii* var. "*stenosis*"*. He photographed the specimen at the home of a Sichuan nurseryman but unfortunately did not collect herbarium material at the time (Yang & Pu 1994). From the photo it seems that the plant was growing in a pot, and has only one leaf and no cones. Perhaps it was just an immature plant. *[In the original publication by Yang and Pu (1994, p. 15, Figure 12) the varietal epithet is given as "*stonensis*". - **Editor.**]

How many species are there in this branched leaflets complex? Two or three? What is the taxonomical position of the complex? These questions remain to be answered. With the discovery of *C. multipinnata* things became much more complicated. What is the relationship between the apparent sister species *C. micholitzii* and *C. multipinnata*? Do they belong to the same complex? If so, is this complex primitive or advanced in the genus? Some people think them primitive, regarding especially *C. multipinnata* as the most primitive species of the genus due to its fern-like appearance. All these questions are very interesting, challenging and difficult to answer.

Figure 1 A seedling of *C. rumphii* var. *bifida* in the wild, Lonzhou, Guangxi. Photo: Dingyue Wang.

Since the end of 1993 the author has undertaken seven expeditions which took about seven months and covered seven provinces (Sichuan, Guizhou, Guangxi, Guangdong, Fujian, Hainan and Yunnan). He has increased his collection numbers with nearly 500 and collected nearly 5000 herbarium specimens and has taken nearly 3000 photos and 10 hours of video recordings. Another cycad expedition to Guangxi, Guangdong and Hunan will commence shortly. About eight new species of *Cycas* are thought to exist, of which two species belong to the *Cycas micholitzii* complex. **Formal descriptions of these new species will be presented in the book "Cycads in China", expected to be published before the CYCAD 96 Conference.** Based on extensive field work, the author believes that he may be able to arrive at taxonomic clarity. At present, the work indicates results as follows:

1. <u>The *Cycas micholitzii* complex is a natural one</u>

The *Cycas micholitzii* complex has the following common characters:

Subterranean caudex, with 1-4 leaves, only *C.* "*multifrondis*" reaching up to 10 leaves, repeatedly

dichotomous pinnules. However, the leaflets of seedlings are simple and undivided (Figure 1) while in young plants only parts of leaflets will display the unique branching character. Even in mature plants only median leaflets display typical and most frequent dichotomous branching. The upper and lower leaflets gradually reduce in dichotomous extent, the topmost 2-6 leaflets being undivided. The megasporophyll is pectinate.

This complex is found in Vietnam and Southern China (Guangxi and Yunnan provinces).

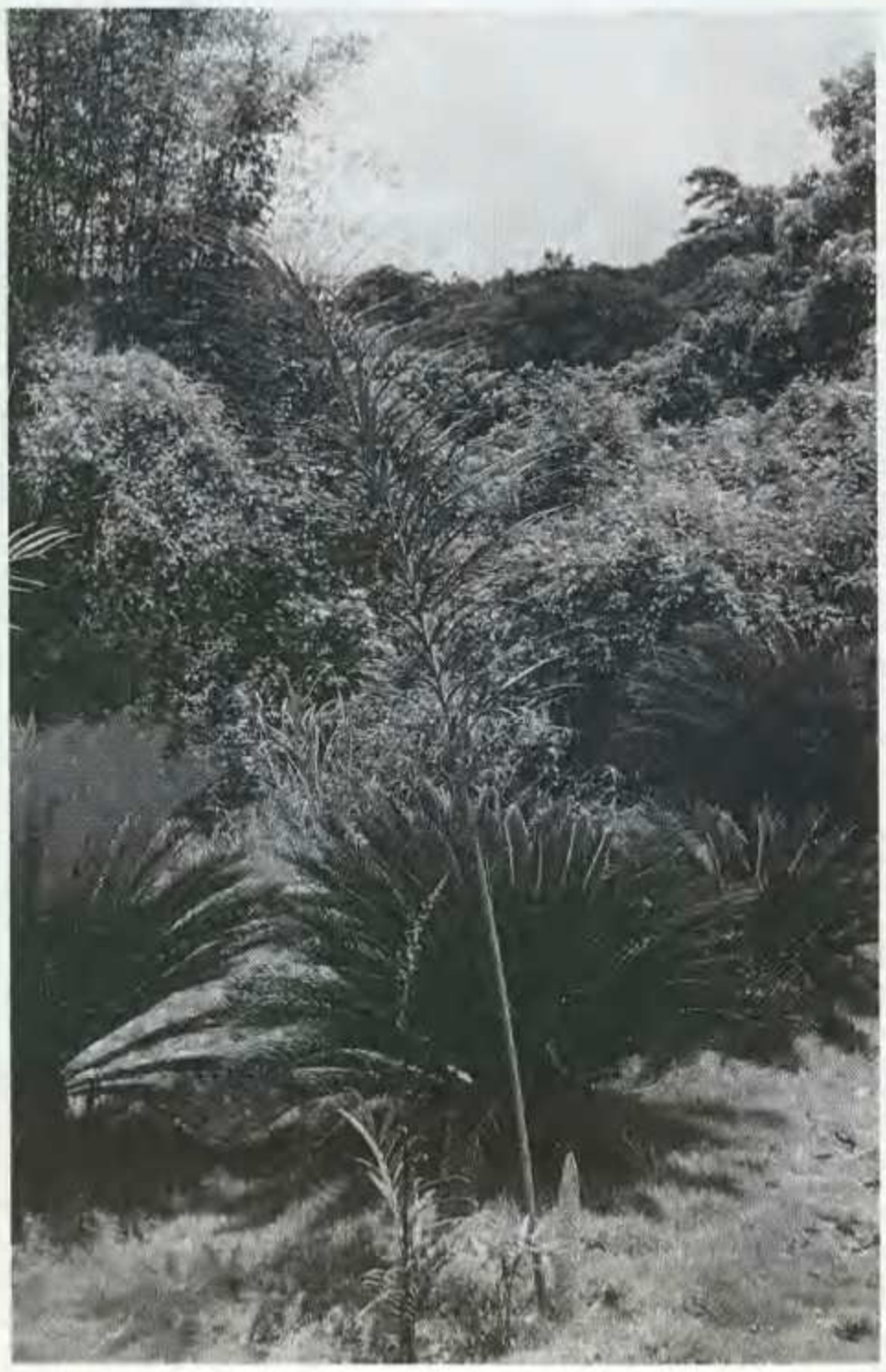

Figure 2 *Cycas rumphii* **var.** *bifida* **Dyer (=** *C. micholitzii* **Dyer?) A plant (foreground) with a male cone, cultivated in Shenzhen Fairy Lake Botanical Garden. Photo: Dingyue Wang.**

Thiselton-Dyer (1905) believed that *Cycas micholitzii* belongs to the small group confined to an area extending from Nepal to Cochinchina, in which the margins of the megasporophylls are pectinate or comb-like as in *C. pectinata* and *C. siamensis*. Schuster (1932) put *C. micholitzii* into his section *Indosinenses*. However, *C. micholitzii* has dichotomous leaflets and soft, short apiculate microsporophylls, somewhat akin to the genus *Stangeria* in the monotypic family Stangeriaceae. After Schuster, Smitinand (1971) proposed a fourth section namely *Stangerioides*. Hill (1993, 1994) combined Schuster's three sections of *Cycas*, and Smitinand's two sections, into four sections with section *Micholitzii* as one. Deghan (1987) placed *C. micholitzii* in a subsection of the section *Circinalis* (= section *Cycas*). D.J. DeLaubenfels proposed that *C. micholitzii* be placed in a new genus, "*Epicycas*", but genetic evidence does not support the establishment of this new genus (Tang 1994).

Figure 3 The male cone of *C. rumphii* **var.** *bifida* **cultivated in Shenzhen Fairy Lake Botanical Garden. Photo: Dingyue Wang.**

In view of the pectinate megasporophyll, the complex is more closely related to section *Indosinenses* (such as *C. pectinata* and *C. siamensis*) and section *Asiorientales* (such as *C. revoluta*), than to the dentate megasporophyll section *Cycas* (such as *C. circinalis* and *C. rumphii*). Thus Thiselton-Dyer's idea is more acceptable and Dehgan's allocation of the subsection *Stangerioides* to the section *Cycas* seems inappropriate. Nevertheless the author would like to place the complex

Figure 4 The female cone of *C. rumphii* var. *bifida*, cultivated in the Shenzhen Fairy Lake Botanical Garden. Photo: Dingyue Wang.

Figure 5 Author with plants of *C. "multifrondis"*, cultivated in Fuzhou Arboretum, Fujian. Photo: Liangqiu Lan.

Figure 6 Trunks and dry male cone of *C. "multifrondis"* at Fuzhou Arboretum, Fujian. Photo: Dingyue Wang.

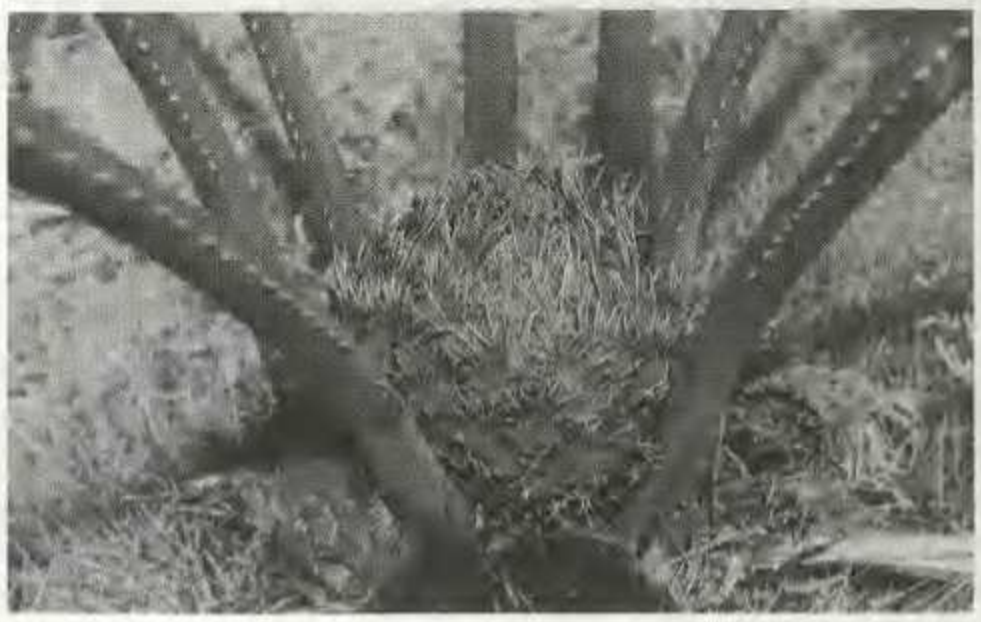

Figure 7 A female cone of *C. "multifrondis"* at Fuzhou Arboretum, Fujian. Photo: Dingyue Wang.

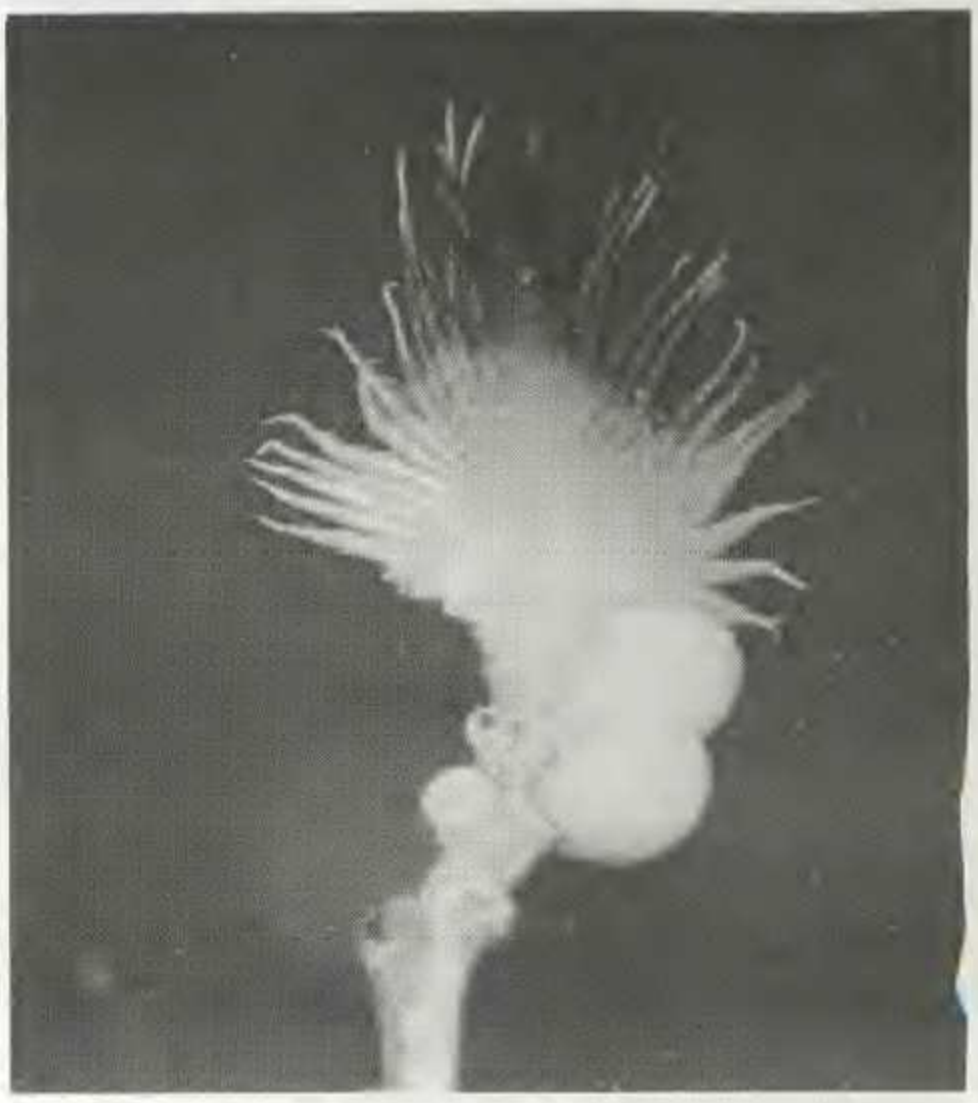

Figure 8 A megasporophyll with seeds of *C. "multifrondis"*, from Xiamen Botanical Garden, Fujian. Photo: Dingyue Wang.

in a subsection *Stangerioides* (divided leaflets), but in the section *Panzhihuaensis* (seed lacking a spongy layer) of the subgenus *Pectinatae* (pectinate megasporophyll). Detailed discussion about the taxonomical system of the genus *Cycas* will be presented in the author's forthcoming book "Cycads in China".

Since the leaflets of seedlings of the group are simple and undivided, as in other cycads, the author considers it as an advanced group rather than a primitive one, according to Taktajan's theory. The leaf of the seedling of *Cycas multipinnata* is pinnate (once divided) (Turner

1990), in young plants bipinnate (twice divided) (Turner 1993), and tripinnate (three times divided) in mature plants.

The leaf evolutionary trend in *Cycas* maybe as follows:

a) Leaves pinnate with simple and undivided leaflets → divided leaflets, pinnate (e.g. *C. micholitzii*, *C.* "*multifrondis*") → divided leaflets, bipinnate (e.g. *C.* "*longipetiolula*") → divided leaflets, multipinnate (e.g. *C. multipinnata*).
b) Leaves more (e.g. *C.* "*multifrondis*" 4-10) → fewer (e.g. *C. multipinnata* 1-2).
c) Dichotomies fewer (e.g. *C.* "*multifrondis*" 2-3 times) → more (e.g. *C. multipinnata* 5-7 times).
d) Ovules more (e.g. *C.* "*multifrondis*" 6-8) → fewer.

It is known that "normal" *Cycas* plants sometimes show leaflet dichotomies. Tang (1994) reported several examples of this phenomenon such as seen in *C. inermis* (= *C. miquelii*), *C. scratchleyana* and *C. revoluta*. The author has also found such branched leaflets occurring occasionally in *C. revoluta* (Southwestern Guizhou Forestry Institute), *C. guizhouensis* (Shiping Nursery, Yunnan) and *C. revoluta* x *C. miquelii* (Nanning Arboretum, Guangxi).

So the complex is an advanced group among the genus *Cycas*. *C.* "*multifrondis*" appears to be a relatively primitive species while *C. multipinnata* is considered the most advanced one in the complex.

Figure 9 Yongxing Chu with a plant of *C.* "*longipetiolula*", wild in Red River Valley, Yunnan. Photo: Dingyue Wang.

2. <u>There are at least four species in the *C. micholitzii* complex</u>

Although the subsection may contain 5-6 species, at present the following four species are recognized:

a) *Cycas micholitzii* Dyer (Figures 2-4)
The type location of the species is at Annam, Vietnam. It is still a poorly known species. The author has checked the wild specimens of "*Cycas micholitzii*" (= *C. rumphii* var. *bifida* Dyer?) in Guangxi and the cultivated specimens in the Shenzhen Fairy Lake Botanical Garden. In order to prove whether *C. rumphii* var. *bifida* Dyer is the same taxon as *C. micholitzii* Dyer, the author attempted, but without success, to borrow the type specimens of these two taxa from the herbarium of the Royal Botanical Garden, Kew. Since the author has not yet seen the types it is still difficult to reach a conclusion.

b) *Cycas* "*multifrondis*" D.Y. Wang (Figures 5-8)
Trunk 200-600 mm tall, 150-300 mm in diameter. Leaves pinnate, 4-8(-10), up to 3.5 m long; petiole 1.3-1.7 m long, spines about 39-69 pairs; pinnae 23-65 pairs, 2(-3) times dichotomous, pinnules linear, coriaceous, 300-490 mm long, 15-24 mm wide, with 20-40 mm long petiolules, pinnae glossy deep green above, paler beneath, midrib prominent above, margin flat. Male cones fusiform-cylindrical, 350-400 mm long, 50-70 mm in diameter. Female cones 200-250 mm high, 300-400 mm in diameter; megasporophylls 160-220 mm long, brown-tomentose, with 6-8 ovules, sterile part ovate, 85-95 mm long, 70-85 mm wide, with 15-20 gracile segments on each side.

The new species is named for its greater number of leaves (4-10) than in sister species (1-4) of the complex. It distributes along the border of Yunnan and Guangxi provinces.

This species is similar to *C. micholitzii* but has 4-10 leaves, petiolules 20-40 mm long, ovules 6-8, segments of megasporophyll more gracile, while the latter has 1-3(-4) leaves, petiolules 2-15 mm long, ovules 2-4(-6), segments thicker.

Whether the proposed variety *C. micholitzii* var. "*stenoensis*" is a form of this species is still difficult to judge. There is little information available about the variety except for one photo and a brief description in a table (Yang & Pu 1994). Occasionally the leaflets of *C.* "*multifrondis*" are also narrow in young plants, e.g. 120-170 mm long and 9-12 mm wide.

Figure 10 The author with a plant of *C.* "*longipetiolula*" dug up at Red River Valley, Yunnan. Photo: Han Peng.

c) *Cycas "longipetiolula" D.Y. Wang* (Figures 9, 10)
Trunk subterranean, or up to 400 mm tall, 200-250 mm in diameter. Leaves 2-3, up to 4.3 m long, 500-800 mm wide, petiole subterete, 1.9-2.3 m long, 25-30 mm thick in the middle, 45-50 mm at the base, spines about 50-70 pairs, 3-5 mm long, spaced at 35-40 mm on rachis; pinnae bipinnate, trullate in outline, with 17-25 opposite or nearly opposite, primary pinnae, spreading at an angle of 45-80° on the main rachis, openly kneeled (*sic*) in section at 60-120° on the rachis. The middle to lower pairs of primary pinnae longer, fan-shaped or obovate, 300-400 mm long, petiolules 50-80 mm long. Upward pairs of primary pinnae and petiolules gradually

Figure 11 The author with a plant of *C. multipinnata*, wild in Red River Valley, Yunnan. Photo: Han Peng.

shorter, pinnae up to 250 mm long, petiolules 10-20 mm long. Distance between two primary pinnae 80-100 mm. Petiole, main rachis and petiolules rusty pubescent and becoming glabrescent. Secondary pinnae 3, lower 2 pinnae 2-3 times dichotomous, upper pinnae 1-2(-3) times dichotomous, totally 4-5 times dichotomous. Pinnules linear, coriaceous, 250-330 mm long, 17-19 mm wide, apex acuminate to caudatiacuminate, tail 15-20 mm long, base decurrent, glossy deep green above, paler beneath, midrib prominent above, slightly prominent and glabrescent beneath, margins flat or sometimes wavy. Male cones fusiform-cylindrical, 360 mm long, 60 mm in diameter with 400 mm long peduncle, yellow when mature. Median microsporophylls obovate or obovate-linear, 15-20 mm long, 15-18 mm wide, truncate, densely brown pubescent, mucronate at apex, apex murinus, 2-4 mm long, 3-5 denticulate on both sides. Female cone and seed details not known at present.

This new species occurs in Red River Valley of Yunnan province. It is extremely rare, scattered in

Figure 12 The male cone of *C. multipinnata* at Red River Valley, Yunnan. Photo: Dingyue Wang.

the semi-shaded monsoon rainforest.

The species is named for its longer petiolules (50-80 mm long), much longer than in other sister species such as *C. micholitzii* (2-15 mm long) and *C. "multifrondis"* (20-40 mm long). The species is similar to *C. micholitzii*, but it is bipinnate, petiolules 50-80 mm long, primary pinnae 4-5 times dichotomous. *C. micholitzii* is pinnate, petiolules 2-15 mm long, pinnae (1-)2(-3) times dichotomous. However, *C. "longipetiolula"* is also somewhat similar to *C. multipinnata*, but has linear pinnules 250-330 mm long, 17-19 mm wide, primary pinnae 17-25 pairs, secondary pinnae only 3. *C. multipinnata* has pinnules 70-80 long, 15-23 mm wide, primary pinnae 6-8(-11) pairs, secondary pinnae 7-11.

This new species maybe is an evolutionary bridge between *C. multipinnata* and the related *C. micholitzii*.

d) *Cycas multipinnata* C.J. Chen & S.Y. Yang (Figures 11-13)
Leaves 1-2(-3), up to 4.85 m long, 1.5-1.8 m wide, bipinnate to tripinnate, petiole 1.5-2.7 m long, spines 73-76 pairs at a distance of 30-35 mm, 3-5 mm long. Primary pinnae 6-8(-11) pairs, petiolules 15-30 mm long, secondary pinnae 7-11, 5-7 times dichotomous, pinnules oblongilinear, 70-180 mm long, 10-23 mm wide, apex caudatiacuminate to acuminate, usually with 15-20 mm long tail, margin flat. Male cones cylindrical, golden yellow, 360 mm long, 80 mm in diameter, peduncle 35 mm long. Microsporophylls obovate, 25-30 mm long, 20-25 mm wide, fertile zone semirotundate, with 2-6 small apical serrations, brown pubescent. Female cones and seeds not known at present.

This species occurs in the Red River Valley, Yunnan province, China.

Figure 13 The leaf from a plant of *C. multipinnata*, cultivated in Kunming Rare and Endangered Plants Centre. Photo: Dingyue Wang.

Many small black beetles are found in the male cones of *C. multipinnata* and *C. "longipetiolula"* and they appear to be the same species that occur in male cones of *C. revoluta, C. taiwaniana* and *C. guizhouensis*. All these cycads appear to be insect-pollinated.

<u>Key to the complex</u>

1. Leaves pinnate, leaflets (1-)2(-3) times dichotomous
   2. Leaves 1-4, petiolules 2-15 mm, ovules (2-)4-6, segments of lamina thick . . . . . *C. micholitzii*
   2. Leaves 4-10, petiolules 20-40 mm, ovules 6-8, segments of lamina gracile . *C. "multifrondis"*
1. Leaves bipinnate or tripinnate, leaflets 4-7 times dichotomous

3. Leaves bipinnate, leaflets 4-5 times dichotomous, primary pinnae 17-25 pairs, secondary pinnae only 3, pinnules 250-330 mm long, 17-19 mm wide .... *C. "longipetiolula"*

3. Leaves bipinnate or tripinnate, leaflets 5-7 times dichotomous, primary pinnae 6-8 pairs, secondary pinnae only 7-11, pinnules 70-180 mm long, 11-23 mm wide ..... *C. multipinnata*

ACKNOWLEDGEMENTS

The author would like to thank Roy Osborne for his assistance in preparing this article, and Yongxing Chu, Pingbian Forestry Institute, Yunnan province, who guided him to see "*Cycas micholitzii*" in the Red River Valley and lead to the discovery of the new species *C. "longipetiolula"*.

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SHORT COMMUNICATIONS / KORT MEDEDELINGS

CYCAS SILVESTRIS DOES NOT HAVE BLUE FOLIAGE!

Paul I. Forster
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Received 3 August 1995

Cycas silvestris was named by Ken Hill in his preliminary account of the genus in Queensland (Hill 1992). This species is endemic to a remote area on eastern Cape York Peninsula and is poorly known in terms of its distribution with few collections in herbaria. Ken quite clearly states that the pinnae are "glossy mid-green" in colour, hence it is quite extraordinary that this species is now included in a "horticultural" grouping of blue-foliaged cycads by Butt (1995) [as *C. sylvestris* sic]. When I examined *C. silvestris* at the type locality some years ago all the plants quite definitely had glossy mid-green leaves. It seems that misinformation on Australian cycads continues to proliferate!

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others. *Australian Plants* 18: 57-67.
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ENCEPHALARTOS ALTENSTEINII: REMOVAL FROM THE WILD BECOMES A DEATH SENTENCE

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Received 14 August 1995

Figure 1 The 7-8 m newly translocated *E. altensteinii* sentinel at Queens Park Zoo, East London, in 1991.

Figure 2 The same plant depicted in Figure 1 in the process of dying, June 1995.

Readers might recall a press cutting and photograph published in *Encephalartos* **27**: 45 (September 1991) in which some of the largest *Encephalartos altensteinii* specimens were donated in 1991 by a farmer in the Macleantown district of the Eastern Cape to be translocated to the Queens Park Zoo, East London, some forty kilometres to the west. As often happens with replanting programmes, the replanting was publicised, but without a description of the treatment the cycads received. The long term survival rates hardly ever get reported.

Every effort to preserve the plants was made in the translocation and replanting exercise. The original photograph, for instance , clearly showed the 7 m stem

Figure 3 The second tall *E. altensteinii*, 1991.

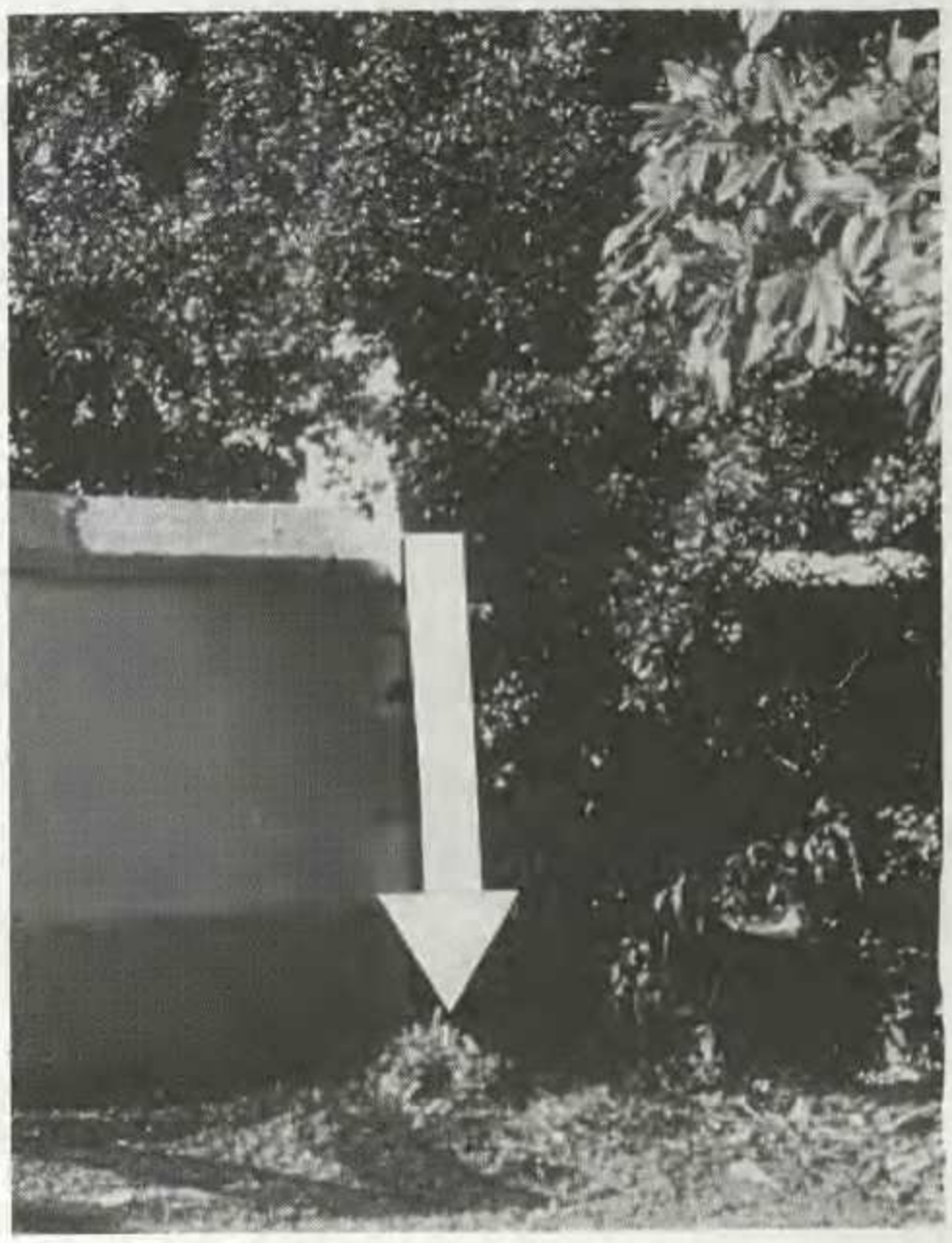

Figure 4 All that remains is a stump of the once magnificent plant shown in Figure 3, June 1995.

splintered with scaffold boards. The roots were treated with "Steriseal" while the plants were out of the ground for two weeks. Leaves were sprayed with "Wiltproof". The stems were periodically treated with "Ripcord" and ground soaked with "Metasystox".

Four years have passed since that time (Figure 1) and I sadly report that the largest of the plants, a 7-8 m male sentinel, which twice produced new leaves and coned once, is dying (Figure 2).

Furthermore, another translocated specimen, a multistemmed *E. altensteinii* (Figure 3) recorded in 1991, has also died and all that remains is a base (Figure 4) of this once magnificent plant.

Once again, the above exercise in transplanting mature *Encephalartos* specimens clearly shows that these particularly large plants do not readily take to being moved. In this particular case, a 100% death rate occurred. In other studies the author has recorded an average death rate of 67% in translocation of mature cycads from the wild.

"DOUBLE SEX" IN *CYCAS REVOLUTA*

Hajime Tomiyama
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Received 23 August 1995

The article (Osborne and Tomiyama) on *Cycas revoluta* in *Encephalartos* **41**: 5-15 appears to have been favourably received and has attracted considerable correspondence. It is also noted that a *Cycas revoluta*

female plant in Italy, produced a male cone, as documented in *Encephalartos* **40**: 20-21.

It is thus of interest to report on a specimen of *Cycas revoluta*, planted some 40 years ago in Kasari-cho, Amami Oh-shima in the Japanese Kagoshima prefecture. This specimen has a main trunk about 3 m in height which produces megasporphylls at the apex, i.e. in all respects a female plant. However, a lateral branch bears male cones! This plant was of sufficient interest to generate a newsreport in the *Okinawa Times* of 27 July 1995, as reproduced below.

奄美情報

ソテツに雌と雄花

突然変異？ モザイク現象？

笠利町

あら珍し！ 雌雄異株のはずだが

笠利町和野に住む森山俊秀和さんと調べた結果、雄花の部分は寄生したものではないことが分かった。

夫さん(七二)の畑でこのほど、一本の幹から雄と雌の花を同時に付けた両性ソテツが見つかり、話題となっている。

初めて目にする不思議な現象のため、奄美の植物に詳しい大野隼人氏にも調べてもらったところ、同氏は遺伝子の突然変異や染色体の組み替えなどによって発生する「モザイク」と呼ばれる現象ではないかと分析。「ニワトリなど生物では事例が確認されているが、ソテツでの事例は文献にもなく極めて珍しいケース」と語っていた。

ソテツは本来、雄雌異株の植物。森山さんの畑で見つかったこのソテツは、高さ三㍍ほどの成木で約四十年前に他のソテツ十数本と一緒に植えられたもの。

上部には球状の雌花を付けているが、幹の中間から分枝した部分からは紡錘状の雄花がしっかりと付いている。森山さんが隣人の渡

森山さん（中央）の畑で見つかった両性ソテツ

NATAL PARKS BOARD NURSERY QUEEN ELIZABETH PARK, PIETERMARITZBURG

Avis Meresman
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Received 7 September 1995

At the kind invitation of Mr Rob Symes, Chief Horticulturist at the Natal Parks Board's Queen Elizabeth Park nursery in Pietermaritzburg, Avis Meresman, Danie Nel and Roy Osborne visited the nursery on 2 August 1995. This was in response to allegations made some time previously that the nursery

Figure 1 Confiscated cycad specimens which have been potted-up and are presently held in the Natal Parks Board's Queen Elizabeth Park Nursery, Pietermaritzburg.

staff may not be giving adequate attention to the maintenance of confiscated cycad specimens under their control. These allegations had been vigorously refuted by the Natal Parks Board.

Mr Symes explained that his resposibility was much wider than a cycad holding operation; indeed he had to consider horticultural aspects of a wide range of endangered flora in Natal. Nevertheless, confiscated cycad specimens were given attention and held at the nursery until appropriate sites could be identified for their relocation. We inspected consignments of various confiscated *Encephalartos* specimens which were doing well in grouped plantings, as well as plants held in containers (Figure 1) in a secure area of the nursery. All these appeared to be responding well to treatment.

The nursery had also been recipient of a number of offsets and suckers from the *Encephalartos* sp. affinis *laevifolius* which had been relocated from the Umtamvuna valley. This material was delivered to the nursery in a poor condition and prognosis for survival was limited. Nevertheless, at least two of the suckers had survived and appeared in a satisfactory condition. These are now critically-important plants as the larger specimens did not survive the relocation to the Umtamvuna Reserve.

One point of concern during our visit related to the large number of cycads set out at the administrative offices of the Natal Parks Board. Although aesthetically pleasing, the plants comprised a mix of *mainly E. lebomboensis*, some *E. natalensis* and *E. villosus*, interspersed with other Natal and non-Natal cycads. In this situation the chance of cross-pollination will be high and any seed crops would be of suspect purity. From our viewpoint, grouped plantings representing material from specific localities would be an alternative approach which could be aesthetically rewarding but also be useful in potential seed production.

Specimens within the main area of Queen Elizabeth Park appeared to be suffering from the effects of drought and a fire which had scorched many of the plants. Here again, group plantings of species by recent locality in a more managed, but admittedly more costly approach would be a programme we would prefer.

This visit was part of an ongoing programme in which we hope to promote a mutually-beneficial relationship between the Natal Parks Board and the Cycad Society.

HOLLOW STEMS IN *ENCEPHALARTOS*

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Received 3 October 1995

When cycad stems begin to rot, whether due to an injury or some other cause, fungal decay spreads rapidly through the watery starch-filled pith and cortex of the stem. Usually the apex and all or most of the trunk will rot and die. Occasionally, however, the stem manages to control the infection and the stem and stem apex survive.

Figure 1 A female specimen of *Encephalartos hildebrandtii* at Fairchild Tropical Garden. Note the large hole in the trunk and the hollow centre.

Figure 2 A specimen of *Encephalartos altensteinii* (?) at Lotusland with a hole through the centre of its trunk.

When this occurs the surviving stem may form a hollow centre. I have only noticed a few rare instances of this in the genus *Encephalartos*. One such specimen is an *E. hildebrandtii* at Fairchild Tropical garden (Figure 1). Its centre has rotted out leaving a shell of leaf-bases. A tap root has grown and rooted in the hollow centre. The plant continues to produce leaves and female cones, however, at a slightly less vigorous rate than normal specimens next to it. I have also seen a specimen of *E. altensteinii*(?) at Lotusland in California (Figure 2). Its trunk had a large hole and light could be seen shining through the stem. In such stems the main system of vascular tissue (plumbing) has been destroyed and it is interesting to speculate on how the stem manages to transport enough water and nutrients between the roots and leaves to keep the plant vigorous.

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0030 Lynn-oos

Ontvang 9 Oktober 1995

Op Sondag 2 Julie het ongeveer 38 lede die tuin van Kol Jan Deetlefs besoek om sy broodboomversameling te bestudeer. Nat Grobbelaar het daarna 'n praatjie oor die bestuiwing van broodboomkeëls en die kieming van broodboomsaad aangebied wat veral gemik was op die behoeftes van beginners. Hierna het die Deetlefs gesin

die aanwesiges op 'n gulhartige wyse met verversings getrakteer; ons opregte dank aan hulle.

Figuur 1 Die kransbegrensde pragtige kop wat op die Entabeni natuurreservaat se kenteken pryk.

Figuur 2 'n Gedeelte van die groep stappers om die lang omgevalle stam van 'n ou *E. eugene-maraisii* kliphard besig om oor die ouderdom van die plant te spekuleer.

Op Saterdag 2 September was 'n besonder geslaagde uitstappie deur 43 lede met hul gesinne en vriende na die Entabeni privaat natuurreservaat onderneem. Die groep het aanvanklik in Naboomspruit by die Wag-'n-bietjie kwekery van Johan Roos en sy ouers vergader waar hulle gul onthaal is. Ons opregte dank aan die Roos familie vir hul gasvryheid. Die reservaat is sowat 60 km noord van Naboomspruit op pad na Vaalwater geleë. Op die reservaat het Dolf en Cecile Blignaut wat die reservaat bestuur ons met die hulp van twee gidse, Jerry en Jesaja, per vierwielaangedrewe voertuie tot 'n paar honderd treë van die naaste *Encephalartos eugene-maraisii* plante vervoer. Tydens 'n gemaklike sirkelvormige staproete van 'n paar kilometer teen die noordelike hang van 'n pragtige kransryke berg (Figuur 1) het die gidse meer as 'n dosyn ou *E. eugene-maraisii* eksemplare aan ons uitgewys waarvan party se omgevalle stamme tussen drie en vier meter lank was (Figuur 2). By die meeste plante was heelwat gesonde groot suiers (Figuur 3) aanwesig maar slegs in die geval van enkele plante was daar tekens van regenerasie deur middel van saailinge. Volgens een van die gidse kom daar wel insekte in die manlike keëls tydens stuifmeelvrystelling voor. Indien insekbestuiwing wel by hierdie spesie voorkom sal dit waarskynlik 'n groot bydrae tot die voortbestaan van die spesie in hierdie gebied maak aangesien die individuele plante teenswoordig redelik ylverspreid voorkom en die kanse op windbestuiwing gevolglik klein is. Slegs een van die plante wat ons te sien gekry het, het die verwronge blaarvorm gehad wat as tipies van die Palala-vorm van *E. eugene-maraisii* beskou word.

Figuur 3 Een van verskeie van die mooi eksemplare van *E. eugene-maraisii* wat op die staproete te sien was.

Na die stimulerende staptoer is middagete onder koeltebome aan die oewer van 'n helder stroompie genuttig wat oor en tussen blinkgepoleerde rotsblokke sy weg gebaan het. Benewens die broodbome en verruklike natuurskoon bevat die reservaat ook 'n menigte wild. Ons kon talle sebras, wildebeeste, blesbokke, etlike reuse wit renosters en 'n paar koedoes sien terwyl die groot hoeveelheid olifantmis ons oortuig het dat die beweerde aanwesigheid van die gediertes op die reservaat nie sommer 'n storie is nie.

U word vriendelik aan die volgende herinner:

20 Januarie 1996 - Vergadering in hoofgebou van die Nasionale Botaniese Instituut, Pretoria om 14h00. Dr Elsie Steyn sal 'n lesing en skyfievertoning oor "**Bevrugting by *Encephalartos villosus***" aanbied. (Let asseblief op die datumverandering - was vroeër 6 Januarie).

9 Maart 1996 - 'n Gesamentlike uitstappie met die Dendrologiese Vereniging na die Lillie Natuurreservaat naby Mica is gereël om die hoogs bedreigde *Encephalartos dyerianus* in habitat te ondersoek en

te bewonder.

Daar word aanbeveel dat lede wat vêr van die natuurreservaat woon, die vorige nag (Vrydag 8 Maart 1996) by die Duivelskloof Ontspanningsoord in Duivelskloof oornag waar 2- en 4-bed hutte teen 'n redelike tarief beskikbaar is. Lede moet egter self reëlings vir sodanige verblyf tref. Die ontspanningsoord se telefoonnommer is 0152-3099651.

Persone wat aan die uitstappie wil deelneem moet dan om 08h30 op Saterdag 9 Maart 1996 by die hoofingang van die Ben Vorster Hoërskool in Boundaryweg, Tzaneen, vergader vanwaar daar 70 km na die Lillie Natuurreservaat gereis sal word. Let Wel: Deelnemers moet bereid wees om die laaste 2 km te voet af te lê. Die staproete is egter gemaklik.

Antwoord asseblief voor 29 Februarie 1996 aan Hanneke by 012-8080995 (of rig 'n skrywe na haar posadres).

LEDE WORD GENOOI OM PLANTE EN/OF SAAD NA DIE BYEENKOMS OP 20 JANUARIE 1996 VIR UITRUILDOELEINDES TE BRING.

CYCAD 93 PROCEEDINGS

Roy Osborne
Department of Chemistry, University of Natal, Private Bag X10, 4014 Dalbridge

The Proceedings of CYCAD 93, the Third International Conference on Cycad Biology, held in Pretoria in July 1993, will be available in the near future and will be sent to all who subscribed to the publication at the time of the Conference. The Proceedings are published in a 460-page illustrated volume in which all contributions have been refereed by a panel of experts under the careful editorship of Dr Piet Vorster. This work comprises up-to-date, comprehensive and substantial reports on current developments in all fields of cycad research.

The Proceedings will be available at a price of R90.00 or US$30 per copy, all inclusive of packaging and surface mail dispatch. Overseas orders must be accompanied by an international money order and not by personal cheques.

Orders for the CYCAD 93 Proceedings must be addressed to **Giel Fourie, Secretary, The Cycad Society of South Africa, 9 Hobson Street, 2550 Stilfontein, South Africa.**

IN MEMORIAM: MNR THYS DE BRUYN

Ruan Harris
Posbus 50429, 0149 Wierdapark

Ontvang 9 Oktober 1995

Thys de Bruyn (Figuur 1) was 'n welbekende broodboomentoesias van Pretoria wat oor die jare 'n pragtige versameling inheemse broodbome opgebou het. Hy het sy kennis oor hierdie groep plante vryelik met vriende en veral beginners gedeel.

Na 'n lang ongesteldheid het Thys, wat op 20 April 1922 gebore is, op 3 Julie 1995 heengegaan. Een van Thys se aktiwiteite wat hom baie plesier verskaf het, was sy reuse-aandeel in die totstandbringing van die broodboomtuin in die huidige gronde van die die Universiteit van Suid-Afrika. Afgesien van sy aktiewe betrokkenheid by die Broodboom Vereniging van Suid-Afrika, was hy ook welbekend in die geledere van die Vetplantvereniging van Suid-Afrika en die Bonsaivereniging van Suid-Afrika.

Figuur 1 Wyle mnr Thys de Bruyn.

FINANCIAL STATEMENT / FINANSIËLE STAAT

THE CYCAD SOCIETY OF SOUTH AFRICA

INCOME AND EXPENDITURE STATEMENT FOR THE YEAR ENDED 31.12.94

			1993
INCOME		41 022	41 288
Subscriptions	29 997		27 377
Donations	6 016		3 511
Interest Received	3 173		2 546
Sales - Back Issues	1 836		2 804
Sundry Income	-		5 050
LESS: EXPENDITURE		35 036	41 374
Bank Charges	506		564
Branch Transfers	1 343		-
Depreciation	168		-
"Encephalartos" Printing	15 487		32 204
Postage	17 190		2 591
Sundry Expenditure	342		6 015
NET SURPLUS (LOSS) FOR THE YEAR		5 986	(86)
UNAPPROPRIATED SURPLUS - Prior Years		37 873	37 959
UNAPPROPRIATED SURPLUS 31.12.94		R 43 859	R 37 873

BALANCE SHEET AT 31.12.94

CAPITAL EMPLOYED:			
Unappropriated Surplus		R 43 859	R 37 873
EMPLOYMENT OF CAPITAL:			
FIXED ASSETS			
Educational & Computer equipment		9 923	1
NET CURRENT ASSETS		33 936	37 872
CURRENT ASSETS			
Bank	12 596		14 484
Fixed Deposits	23 900		21 500
Debtors	2 345		81
Stock - Back Issues	5 655		3 906
	44 496		39 971
LESS: CURRENT LIABILITIES	10 560		2 099
Prepaid Subscriptions	10 522		1 162
Creditors	38		937
NET ASSETS		R 43 859	R 37 873

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

I therefore certify that the attached Income and Expenditure Statement for the year ended 31st December, 1994, and the Balance Sheet as at that date, are in accordance with the information provided.

Pretoria, 16th October, 1995

N J Kachelhoffer

CYCAD SOCIETY OF SOUTH AFRICA - NATAL BRANCH

INCOME STATEMENT FOR THE YEAR ENDED 31.12.94

INCOME		645
Fund - raising	250	
Allocation from Head Office	395	
EXPENDITURE		645
Postage & Stationery	184	
Prizes	12	
Refreshments	202	
Sundry Expenditure	247	
SURPLUS FOR THE YEAR		R Nil

Signed: A MERESMAN — Chairlady

D P NEL — Treasurer

CYCAD SOCIETY OF SOUTH AFRICA - TRANSVAAL BRANCH

INCOME STATEMENT FOR THE ENDED 31.12.94

INCOME		1 950
Allocation from Head Office	949	
Donations	400	
Interest Received	51	
Seed Bank	550	
EXPENDITURE		373
Bank Charges	75	
Sundry Expenditure	298	
SURPLUS FOR THE YEAR		1 577
UNAPPROPRIATED SURPLUS - Prior Years		354
UNAPPROPRIATED SURPLUS at 31.12.94		R 1 931

Signed: M J FOURIE
Treasurer

LETTER TO THE EDITOR / BRIEF AAN DIE REDAKTEUR

Dear Editor

RELOCATING TO AUSTRALIA

Through the medium of your journal, Roy and Angela Osborne and family would like to advise all cycad friends that we are relocating permanently to Australia in January 1996. This move will inevitably mean that we have much less direct contact with the Cycad Society of South Africa, although we hope to keep in contact at least intermittently. In the meantime, I would like to say that it has been a great honour to have been involved with the Society; all who have participated in its development can be justly proud of its achievements. "*ENCEPHALARTOS*", in particular, has become a sought-after, authoritative and international journal far beyond the hopes of those involved in its commencement ten years ago. "Sterkte" and "alles van die beste" to you all.

Our good friends, Stan and Jane Walkley, have very kindly allowed us to pass on their address to anyone who wishes to contact us in the immediate future.

Roy & Angela Osborne
c/o Plantation 2000
281 Buckley Road, Burpengary
Queensland 4505
Australia

Roy Osborne.

Received 13 September 1995

[We wish the Osborne family all the very best on their new venture. The success of our journal can to a very large extent be attributed to Roy's zeal in either writing articles for the journal himself, or urging some of his many "cycad" friends and acquaintances to do so, and even more, emending or translating some of those contributions. It will be a sad day for our journal if Roy can no longer contribute in the same manner. - **Editor.**]

NEW SCIENTIFIC REPORTS

Hurter, P.J.H.* & Glen, H.F. 1995. *Encephalartos equatorialis* (Zamiaceae): a newly described species from Tropical Africa. *South African Journal of Botany* 61: 226-229. [The authors give a formal description of *Encephalartos equatorialis*, a severely threatened species from a single granite hill on the eastern shore of Thruston Bay, Lake Victoria, Uganda, its site being nearly on the equator (hence the specific epithet). The new species resembles *E. hildebrandtii* and *E. ituriensis* because of its stiff, dentate and pungent green leaves. It differs from these species on account of its ascending, succubous hard pinnae which become incubous and strongly imbricate towards the leaf apex. The new species is also not consistent with Melville's *E. hildebrandtii* var. *dentatus*, nor with Heenan's description (which is challenged) of apparently similar plants at Jinja.]

**Author's address: Lowveld National Botanical Garden, P.O. Box 1048, Nelspruit, 1200, South Africa.*

Skubatz, H., Svee, E.R., Moore, B.S., Howald, W.N., Tang, W. & Meeuse, B.J.D. 1995. Oleic acid and its positional isomer, *cis*-vaccinic acid, in the appendix of *Sauromatum guttatum* during anthesis. *Plant Physiology* 107: 1433-1438. [Despite the reference to *Sauromatum guttatum*, the Voodoo lily, in the title, the researchers in this project also studied the fatty acid profiles in the sporophylls from male cones of *Encephalartos ferox* and *Dioon edule* (both varieties) during their thermogenic stage. Although there was considerable variation in the results, a pattern emerged in which oleic acid and linoleic acid levels dropped during the period of heat production while the level of linolenic acid increased in the same period. These results give credence to the belief that lipid respiration and the production of volatile chemo-attractants are metabolic processes associated with thermogenesis in male cycad cones.]

Author's address: Although Hanna Skubatz is the corresponding author to this paper, readers of this journal may wish to address enquiries to Willie Tang, Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156, U.S.A.

*Compiled by **Roy Osborne**, Department of Chemistry, University of Natal, Durban, Private Bag X10, 4014 Dalbridge.*