

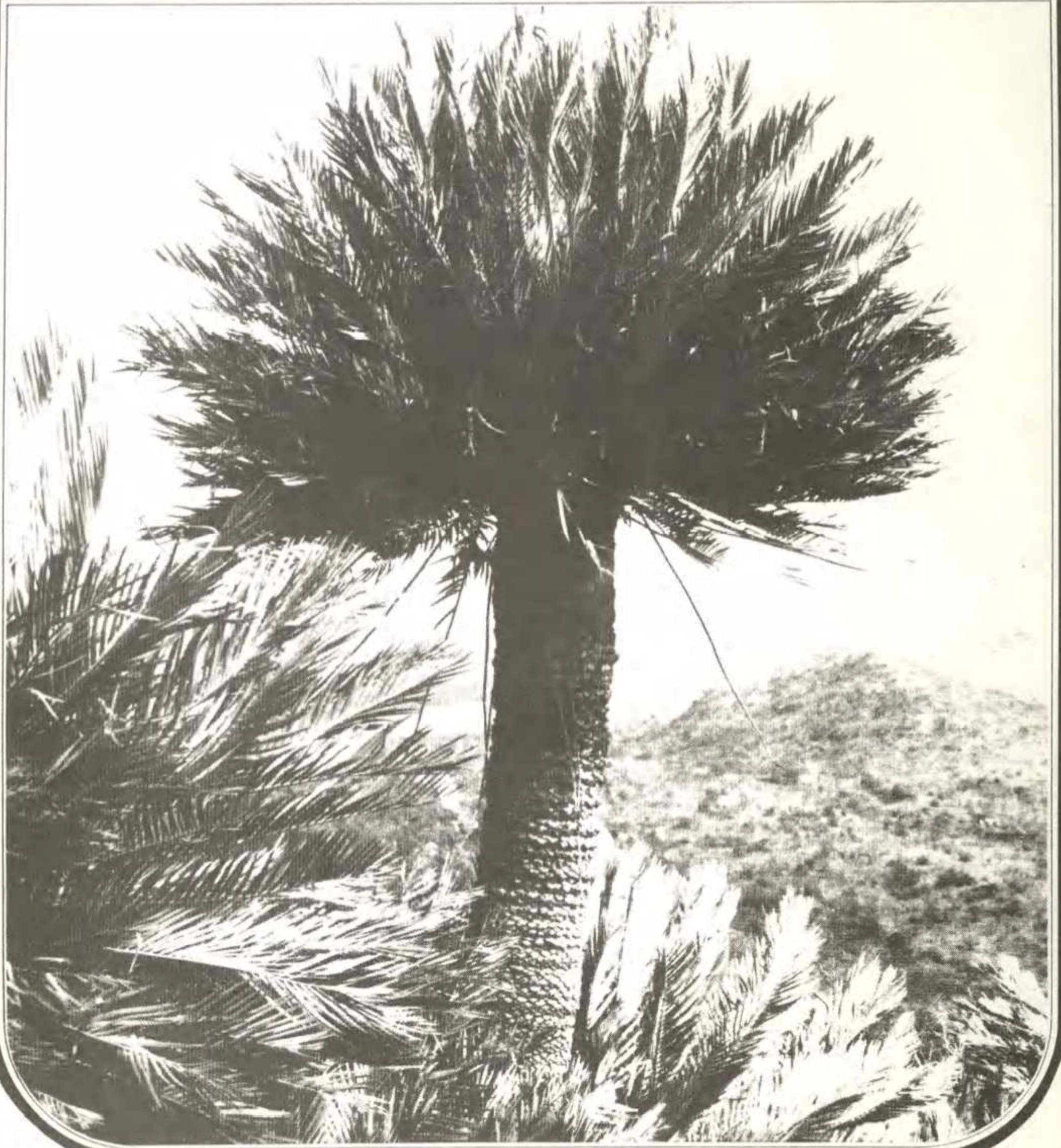
# ENCEPHALARTOS

JOURNAL OF THE  
CYCAD SOCIETY OF  
SOUTHERN AFRICA

TYDSKRIF VAN DIE  
BROODBOOMVERENIGING  
VAN SUIDELIKE AFRIKA

NO. 24

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## EDITOR/REDAKTEUR

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1610

## VOORBLAD/COVER

*One of the approximately 200 mature ENCEPHALARTOS dyerianus growing on a granite hill at the Lillie Private Nature Reserve in the Mica district of the Transvaal.*

*Photo : Neil Munro*

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## FROM THE PRESIDENT

Nat Grobbelaar accepted an invitation to act as guest lecturer in Taipei, Taiwan, until April 1991. Surely he will get an opportunity to see *Cycas taiwaniana* in its natural habitat. During his absence I will administer the Society, though no great upheavals are envisaged. The Executive Committee is still working on refinements to the constitution.

Our Society is becoming fairly deeply involved with the Wildlife Society's **Save the cycad** campaign. Our Society is not primarily a conservation society, although the conservation of cycads is one of our aims as envisaged in the constitution. Most of us would like to possess nice big plants rather than devote many years to nurture seedlings to maturity; and mature plants are only to be had by paying exorbitant prices or by pinching plants gratis, but at considerable risk, from the field. In both instances such accessions are contrary to conservation ethics. Is someone who purchases "fully documented" plants which almost certainly came from the field, less guilty than the person who removed them from their natural habitat? It places the committee in an embarrassing position if, while in consultation with conservation bodies, well-founded accusations are levelled at some of our members. It is even claimed that some of our committee members are trading with plants which were originally field-collected. It is unfortunately true that cycads are becoming so scarce in the field that the spectre of extinction has become real. Under these conditions we dare not be indifferent to the conservation aspect.

Cynthia Giddy has indicated that she can no longer run our pollen bank. Until a new pollen officer can be appointed, our pollen bank is therefore not functional.

*Piet Vorster*

PIET VORSTER

ACTING PRESIDENT

## VAN DIE PRESIDENT

Nat Grobbelaar het 'n uitnodiging aanvaar om tot in April 1991 as gasdosent in Taipei, Taiwan, op te tree. Sekerlik sal hy geleentheid kry om te gaan kyk hoe lyk *Cycas taiwaniana* in sy natuurlike tuiste. Tydens sy afwesigheid sal ek die bestuur van die Vereniging behartig, hoewel daar uit die aard van die saak geen groot veranderings teweeg gebring gaan word nie. Die Hoofbestuur werk nog steeds aan verfyning van die grondwet.

Ons Vereniging raak redelik diep betrokke by die Natuurlewevereniging se **Save the cycad**-veldtog. Ons Vereniging is nie primêr 'n bewaringsliggaam nie, hoewel bewaring van broodbome een van ons doelstellings is soos omskryf in die grondwet. Meeste van ons wil graag mooi groot plante hê eerder as om baie jare lank saailinge groot te maak; en groot plante is alleen te kry deur enorme pryse te betaal of om die plante kosteloos, maar teen aansienlike risiko, uit die veld te gips. In beide gevalle is sulke aanwinste in stryd met bewaringsetiek. Is iemand wat "volledig gedokumenteerde" plante koop wat feitlik sekerlik uit die veld kom, minder skuldig as die persoon wat hulle in die veld uitgegrawe het? Dit plaas die bestuur in 'n ernstige verleentheid wanneer ons met bewaringsliggame in gesprek is en gegronde beskuldigings teen van ons lede gemaak word. Daar word selfs beweer dat van ons bestuurslede handel dryf met plante wat oorspronklik uit die veld kom. Dit is ongelukkig so dat broodbome in die veld so skaars geword het dat die spook van uitwissing wesenlik geword het. Onder hierdie omstandighede durf ons nie onverskillig staan teenoor die bewaringsaspek nie.

Cynthia Giddy het aangedui dat sy nie meer ons stuifmeelbank kan behartig nie. Tot tyd en wyl dat 'n nuwe stuifmeelbeampte aangewys word, is ons stuifmeelbank dus nie funksioneel nie.

*Piet Vorster*

PIET VORSTER

WAARNEMENDE PRESIDENT

## FOCUS ON...

## FOKUS OP...

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

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

# ENCEPHALARTOS PRINCEPS

by Maans Kemp



Tall plants in habitat in the Komgha district (Photo: Roy Osborne)



Cluster of mature stems, Komgha district (Photo: Roy Osborne)

## INTRODUCTION

Specimens of Encephalartos princeps seldom fail to impress those fortunate enough to see mature plants of this species. The "stately habit" of these plants impressed Dr R.A. Dyer to the extent that it was partly responsible for the species name to be given to these plants. The fresh-looking, blue-grey colour of the new leaves and the absence of teeth on the leaflet margins give this striking Eastern Cape cycad an appearance of "neatness".

## DISCOVERY AND NAME

It is uncertain who "discovered" the first plants of what we now know as E. princeps. It is possible that European plant collectors in the eighteenth century may have taken material obtained from plants now known as E. princeps to Europe. Such material would have been classified in the early part of the nineteenth century as belonging to Zamia pungens (a species described by Aiton in 1813) or Z. lehmanniana (described by Ecklon in 1833). When Lehmann created the genus "Encephalartos" in 1834, the two species became known as E. pungens and E. lehmannii respectively. In 1933 J. Hutchinson and G. Rattray reduced these two species, together with a number of others, to E. lehmannii (see ENCEPHALARTOS no. 4, p. 12). They included in their description of this species plants known as E. princeps. They, for example, refer to herbarium specimens from known localities of E. princeps, such as the valley of the Black Kei River and places near Komgha. Field studies, as well as a study of plants in the Kirstenbosch Botanic Garden in Cape Town, revealed that the E. lehmannii concept included a wide variety of forms. M. R. Anderson, for example, in his revision of Encephalartos species in 1945, described a plant (which he called "Form B1"), which appeared to be a specimen of the current E. princeps.

In 1965 Dr R.A. Dyer cleared up the matter when he separated E. princeps and E. trispinosus from the then E. lehmannii group.

The species name, which is Latin for "first", was chosen by Dr Dyer "because it reflects the thought that E. princeps has had a longer history and has a more stately habit than its near allies, E. lehmannii and E. trispinosus..." Later, Dr Dyer wrote "E. princeps may well have been earlier in the evolutionary series than any of its Eastern Cape relatives, but this is a speculative idea".

## DISTRIBUTION

E. princeps occurs in the catchment area of the Great Kei River, which forms the boundary between the Republic of South Africa and the Republic of Transkei. It grows mainly on dolerite cliffs and rocky outcrops along the valleys of the Great Kei River and its tributaries, such as the Kubusie. Its distribution range includes parts of the districts of Queenstown, Cathcart and Komgha in the RSA, and Butterworth and Tsomo in Transkei.

The vegetation in this area is characterised by thick, low bush which includes a number of Euphorbia and Aloe species. Plants of E. princeps usually grow in positions exposed to open sunlight, but some plants, including prostrate stems, sometimes grow in shady positions. In such circumstances the leaves tend to be longer and the growth more luxurious.

The climate in the distribution area of E. princeps is cool to cold winters. The rainfall ranges between 400 and 520mm per year.

## DESCRIPTION

### 1. STEM

Individual stems of *E. princeps* may reach heights of 3 to 4 m, and may occasionally reach 5 m. Such tall stems usually recline. Single-stemmed plants are unusual, however, most plants occur in the form of clusters consisting of as many as 10 to 15 stems of varying length and age, growing from the same rootstock. Older stems may reach a diameter of 30 to 40 cm. When plant clusters grow among rocks, the lower parts of individual stems may curve under the soil surface, from the rootstock, through the narrow passages between the rocks. Such stems may be as thin as 5 to 10 cm. Where the stem appears above the rocks, it thickens abruptly to its full 30 cm diameter.

Stems which branch or fork high up are occasionally found. This is usually the result of damage to the stem or the crown of the stem.

### 2. LEAVES

Apart from the tall stems, the feature of *E. princeps* which often attracts attention, is the very attractive, silvery blue colour of the new leaves. As the leaves get older, they change to a duller green. Leaves with different colours may therefore occur on the same plant. The rachises of the old, dead leaves remain attached to the plant for a number of years.

The leaves are 1 to 1,3 m long and fairly straight or with a slight downward curve at the tip. The leaflets at the middle of the leaf are approximately 15 cm long and 1,3 m wide. The leaflets are sharply pointed and without teeth long the edges. Occasionally a single tooth may occur on the lower margin.

The leaflets are well spaced in the lower half of the leaf, but they overlap closely upwards towards the tip of the leaf. The leaflets become smaller towards the base of the leaf, but do not become priceless.

The petiole is 12 to 20 cm long and is attached to the stem by means of a collar which usually has a pale brown colour.

### 3. CONES

One to three dull olive-green cones are borne by male as well as female plants.

Male cones are roughly cylindrical in shape, 20 to 25 cm long and 8 to 10 cm in diameter. The male cone scales project outwards into a beak about 1,5 cm long, which give the cone a prickly appearance.

The barrel-shaped female cones are 30 to 40 cm long and 20 to 25 cm in diameter. The terminal facet of the female cone scale protrudes and has a coarse, pimped and warty appearance. It is sparsely covered by fine brown hairs. The bright red seeds are approximately 4 cm long and 2 cm in diameter.

## AFFINITIES

It is accepted that *E. princeps* is closely related to *E. trispinosus*, *E. lehmannii* and *E. horridus*. Its appearance is sufficiently distinct from that of *E. horridus* and most forms of *E. trispinosus* to avoid confusion. The absence of teeth on the leaflet margins of *E. princeps* contrasts with the strongly lobed leaflets of the other two species.

No confusion can occur in nature between E. princeps and E. lehmannii, as the former is limited to the catchment area of the Great Kei River, whereas the latter occurs much further to the south-west, in the districts of Willowmore, Steytlerville, Uitenhage, Pearston and Bedford.

it can be very difficult to distinguish cultivated specimens of the two species, however, unless cones are present. Some characteristics which distinguish the two species are:

- E. princeps is a more robust, taller-growing species than E. lehmannii, of which the stems seldom grow taller than 1,5 m.
- The leaflets of E. princeps are more densely spaced and overlap more closely towards the tip of the leaf than those of E. lehmannii, which are well-spaced.
- The leaf-base of E. princeps is smaller and less prominent than the large, brown-collared leaf base of E. lehmannii.
- E. princeps bears up to three cones, whereas E. lehmannii bears a single cone.
- The colour of E. princeps cones is a dull green, while those of E. lehmannii are blackish-red or blackish-green.
- The female cone scales of E. princeps are pimpled and warty, while those of E. lehmannii are smooth.

#### HYBRIDIZATION

When Prof. C.J. Chamberlain toured the Eastern Cape in 1912, he visited the area where the Black Kei and the White Kei Rivers join to form the Great Kei River. In his book "The Living Cycads", he wrote: "Three cycads are abundant on Junction Farm, Encephalartos Friderici Guilielmi, E. Lehmannii and E. villosus" (E. princeps was then still included in E. lehmannii).

In the Cathcart area, localities of E. princeps are still fairly close to those of E. friderici-guilielmi, but no hybrids have been recorded. I am also not aware of any artificial hybrids involving E. princeps.

#### CONSERVATION

E. princeps must have been quite numerous in the past. It is obviously no longer the case. There are many mature specimens in cultivation, which indicates that many plants have been removed from their habitat over the years. In some localities the species still occurs in fair numbers, however natural reproduction still takes place. If these colonies are left alone, the survival of the species in nature seems assured.

Like all the other cycad species in the Cape Province, E. princeps is classified as endangered plants in the provincial nature conservation ordinance. Specimens may therefore not be removed from nature without a permit. It is understood that no such permits are being issued any longer. Regulations similar to those in the Cape Province are in force in Transkei.

Leaves of plants in nature are attacked by caterpillars of the leopard moth, while porcupines damage the stems to such an extent that the whole stem sometimes dies. Fire does not appear to be a problem in the natural habitat of this species.

#### CULTIVATION

E. princeps grows well in cultivation and there are many fine specimens in botanical and private gardens. It is a hardy species which needs full sun and good drainage.

Mature plants in cultivation cone regularly and seedlings are freely available from nurseries.

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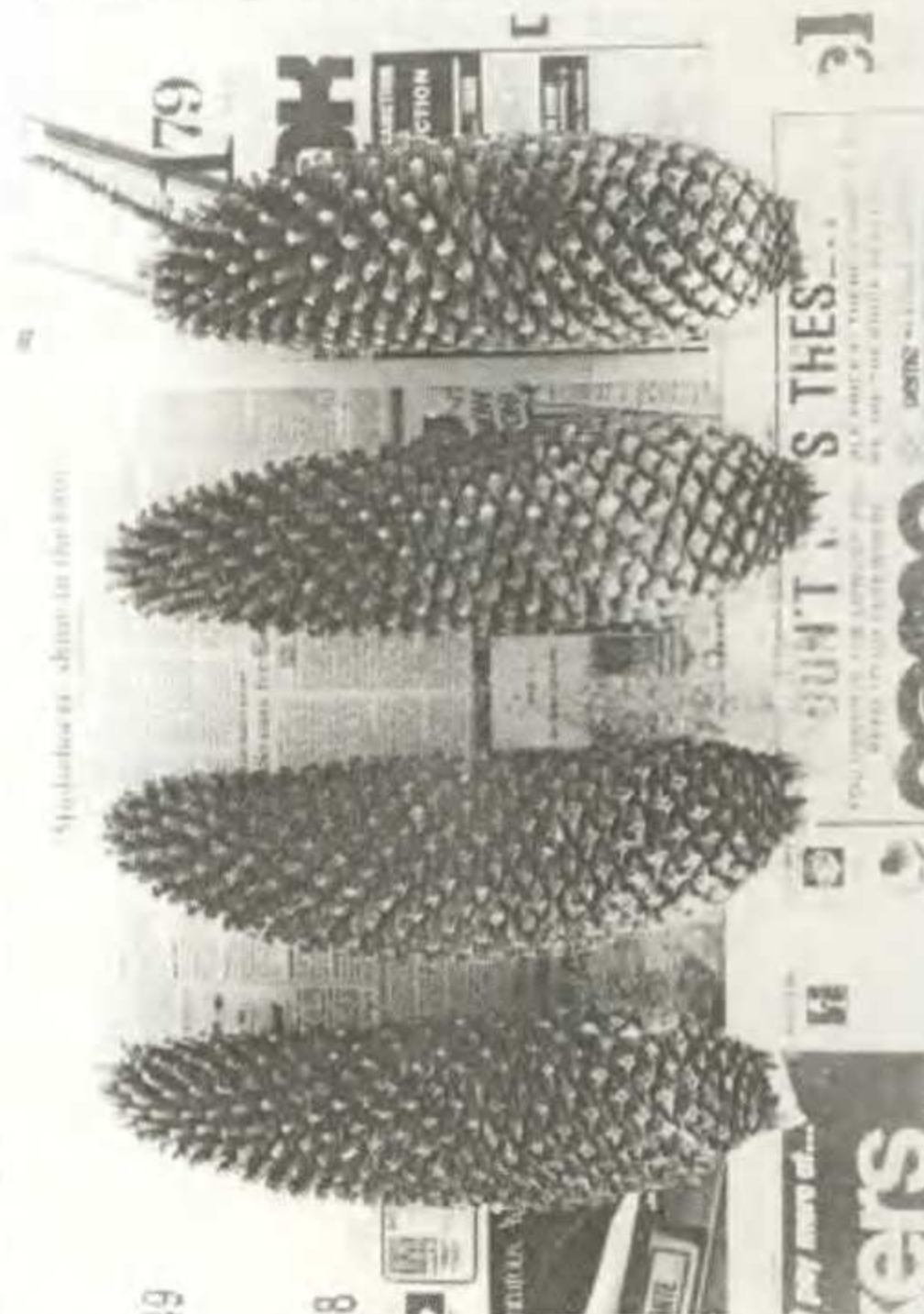
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Plants in bushy habitat in Great Kei River Valley near Cathcart (Photo: Maans Kemp)



Female Cone, showing warty scale surfaces (Photo: Roy Osborne)



Collecting pollen from excised male cones of *E. princeps*.

Photo: Roy Osborne

## THE TEMPERATE HOUSE KEW GARDENS LONDON

By : CRAIG MUNRO

Craig Munro presently on a working holiday to London had the opportunity to visit Kew Gardens and sent in this report.

Tucked away in a corner of the Temperate House of the Royal Botanic Gardens Kew, is the world's oldest pot plant. An E. altensteinii is housed in a gigantic green house among various other endangered species and has been there since 1775. The mammoth 4m cycad was originally thought to be an E. longifolius, but recent studies have shown it is an E. altensteinii (average growth rate 25mm per year). This plant has a number of suckers growing at the base and a few along the stem. However, it has only produced cones once since being potted and that was in 1819. The leaves are relatively short for this plant being only 1.8m long. Surrounding this ancient plant are various other Encephalartos species, right next to the E. altensteinii is the rare E. woodii which as most people know only male plants exist. This handsome specimen is approximately 2m tall with leaves almost 2.5m long.

The only Encephalartos specimen presently in cone is an E. ferox, it has 2 young female cones which are bright red. The other Encephalartos species which are of interest on display are E. eugene maraisii and an interesting lebomboensis x villosus hybrid as well as a lovely E. bubalinus from the Masai District of Tanzania which was discovered as recently as 1944. The smallest cycad on display is the size of a golf ball with a message which states that most cycads are now threatened in the wild.

In the Temperate House Dioon spinulosum (Mexico) and Cycas thouarsii (Madagascar) are also found and to be admired.



Kew's most famous building was designed by Decimus Burton and built between 1844 and 1848. Since its restoration was completed in 1989, the interior has been landscaped to provide a rainforest in miniature, including palms cycads and tropical flowering plants many of which are useful to mankind.





The oldest pot plant in the world E. altensteinii brought to Kew Gardens by Francis Masson in 1775

Photo: Craig Munro



E. woodii the most enigmatic species of Encephalartos growing alongside the E. altensteinii.

Photo : Craig Munro

# Recent advances in the cultivation of cycads.

by Cynthia Giddy

Cycads have an undeserved reputation of being slow growing and hence seedlings have in the past had little attraction for collectors or commercial nurseries. Research and recent advances in horticultural technology are however proving that cycads grown under optimum conditions can achieve growth rates on a par with other foliage plants such as Tree Ferns and Palms.

A lot of research is currently in progress to determine the best methods of germinating and growing these rare and endangered plants. Observation in the field has shown that only a very small percentage of seed germinates under natural conditions. Some seed losses are no doubt due to natural conditions. Some seed losses are no doubt due to natural predators such as rodents, baboons and birds. In the case of *E. princeps* the author observed that baboons eat the flesh of the seeds and then spit out the kernels. Examination of these showed that in many cases the sharp teeth of the baboons had penetrated the hard outer testa of the seed and this damage had led to desiccation of the seed as well as the ingress of fungi and other bacteria.

Low germination percentages of fertile seeds can also be attributed to poor germinating conditions. Recent work by Dr. Bijan Dehgan of the Department of Ornamental Horticulture at the University of Florida USA has shown that high storage temperatures after the seed is shed, leads to drying out of the endosperm and embryo loss. Working with *Cycas revoluta* seed he found that 92% of the seeds survived when stored at 5°C but only 42% of those stored at 22°C were viable after 24 weeks as the result of desiccation.

*Encephalartos* seed should be stored for 3-4 months under cool conditions prior to planting. In the habitat *Encephalartos* cones break up at the beginning of summer (November onwards). They are therefore subjected to our high summer temperatures for several months. This could be one of the reasons for the low germination percentages often seen in the habitat.

Research has also shown that the fleshy covering or sarcotesta contains chemical inhibitors which prevent germination. Removal of the fleshy covering will assist germination. However more research and in particular, species specific research needs to be done as some species are known not to conform to this dormancy pattern eg. fertile seed of *E. princeps* when cut open at the time the seeds are shed, often show no sign of embryo development while seeds of *E. transvenosus* often have a fully developed radicle visible at this stage. The dormancy period and dormancy factors may therefore vary from species to species.

At our nursery seeds are stored under cool conditions for several months prior to planting. This also enables a more accurate assessment to be made of their fertility. The water test is not accurate immediately after the seeds are shed. At that stage it only identifies the parasitised seed, after 3-4 months they are again water tested as the endosperm of the infertile seeds will have shrunk and many of those that initially sank when the seeds were fresh will now float. Valuable space in a germinator will be saved if only the fertile seeds are finally planted.

The seeds are placed on a sterile growing medium and kept at a constant temperature of 25°-28°C by means of soil warming cables. Sterile media such as sand or a sand/peatmoss mixture should be used as the warm, moist conditions provide optimum encouragement for fungal and other diseases if unsterilised soil is used. The growing medium is kept moist by hand watering. Misting units are not necessary but the medium should at no stage be allowed to dry out completely. Seeds are placed at an angle with the micropyle end pressed into the medium. This means that as soon as the radicle appears root development commences.

Previously seedlings were left in the germination bed until they had produced 1-2 leaves before transplanting them. However, the young taproot is very vulnerable to injury and transplantation losses were unacceptably high. We found that if the seed was removed as soon as the radicle emerged and 15-20 germinated seeds were planted in a community pot, losses dropped to almost nil. These community pots are now offered for sale as a grow-on line and have proved very popular in that both hobbyists and commercial growers find that germination losses are eliminated in this way should their facilities not be adequate for germinating seed.

Community pots should have a minimum depth of 25cm to allow for good root development over the next 6-12 months. At that stage (2-3 leaves) the seedlings can be carefully shaken out of the pots with their taproot and hair roots intact. The growing medium used in the community pots is composted pine bark and they are fed regularly with a balanced nutrient mixture. A basic 3-1-5 (NPK) mixture in a dilution of 1:1000 will give excellent results if alternated with a mineral and trace element supplement. A regular nutrient feeding program should be followed if any of the non-soil growing mediums based on bark/peatmoss/perlite and/or vermiculite are used. Cycads have an undeserved reputation for being slow growers but with balanced feeding much faster growth rates can

be achieved with tuber weights of 250-300g and 6-8 leaves within 2-3 years. The nutrients are applied to the root zone. Foliar feeding, because of the waxy coating of cycad leaves is less effective.

Once the seedlings have been transplanted into individual containers they are transferred to plastic tunnel houses where a controlled environment in a temperature range of 26°-30° C with a relative humidity of 60-70% will ensure optimum growth. In addition to the plastic covering the houses are also covered with 40% shade cloth. Higher shade densities should be avoided as this will produce longer leaves with unnaturally spaced leaflets. The only exceptions are the Australian *Bowenias* which require a shade density of 80%. As they are rain forest plants they will not thrive under garden conditions in most parts of South Africa but make stunning and luxurious indoor or atrium plants.

Recent experiments in the USA have shown that more leaves are produced under high light conditions than low light. If young cycad seedlings are subjected to an additional 3-4 hours of artificial light of 250-2000 foot candles per day the caudex develops rapidly and produces leaves more frequently.

To a lesser extent this can also be achieved by planting the caudex well above the level of the growing medium. Higher light intensities (1000 ft candles and higher) also prevent the yellowing and premature death of the lower leaves which occurs under natural conditions when the light is reduced by the density of the new crown. Cycads grown under these conditions are more compact and the additional foliage has more customer appeal.

Cycad seedlings require good drainage if an accelerated growing program with frequent irrigation and feeding is followed. All our plants are grown in composted pine bark which has been put through a 1 cm screen. As a growing medium it provides the necessary air-filled porosity and drainage while retaining moisture and nutrients.

The pH of the growing medium for the majority of *Encephalartos* should be in the range of 6.5-7.00. Some species such as *E. ghellinckii*, *E. cycadifolius*, *E. horridus*, *E. trispinosus*, *E. lehmannii* and *E. princeps* prefer a more alkaline medium. Adding horticultural lime to acid soils will raise the pH. As far as trace elements are concerned, more research is needed to establish whether there are any species specific requirements. It appears that *E. lanatus* requires higher aluminium levels and the addition of aluminium sulphate to the fertilising program for these seedlings has resulted in better leaf colour and growth.

The unbranched taproot of *Encephalartos* seedlings is prone to damage on transplanting and such damage can retard growth for several weeks. Dr. Bijan Dehgan of the Department of Ornamental Horticulture at the University of Florida USA has reported that by cutting the taproot just below the leaf crown and dipping it in a growth hormone based on indolybuteric acid, a callus is formed and several branched lateral roots then develop. These additional roots can then better utilise the increased water and nutrients and plant growth is increased considerably. Careful attention must however be paid to plant hygiene and a sterile growing medium. The regular use of fungicides is necessary as under warm moist conditions root rot losses can be high. Previously the long taproot required very deep containers. The laterally branched roots produced under the above method has meant that standard 25 cm nursery containers can now be used for several years growth.

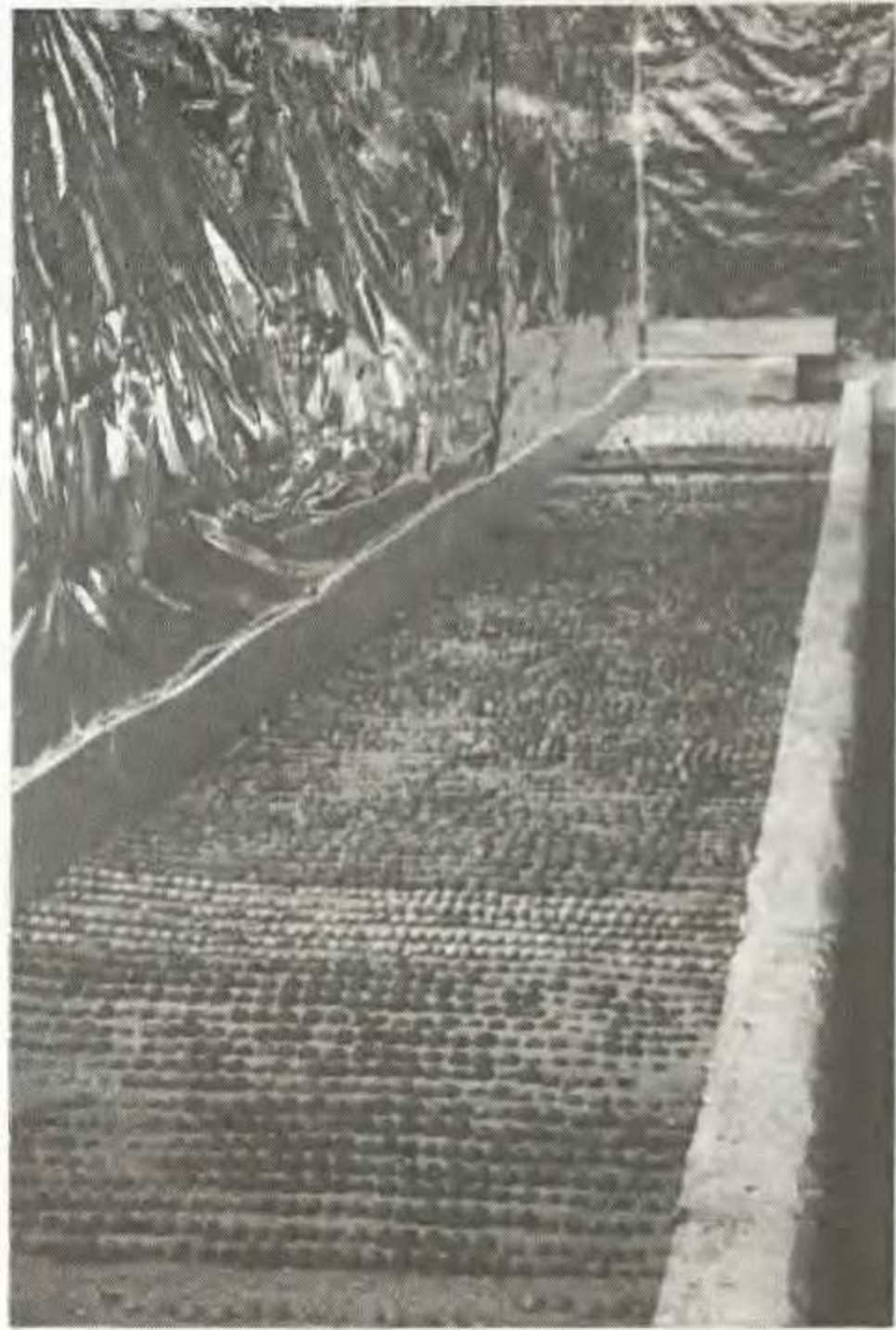
Seedlings of several genera may be deciduous for the first few years. Unless the grower is aware that the plant is entering a natural dormant stage, he might be tempted to increase watering as soon as the yellowed leaves are noticed. Water should be withheld until growth starts again. *Encephalartos* species such as *E. caffer*, *E. friderici-guilielmi*, *E. humilis*, *E. lanatus* will lose their leaves in cold areas with the onset of winter. *Zamia integrifolia* and *Z. pumila* likewise, will even as mature plants in relatively mild climates, lose their leaves in winter.

The Australian Cycas on the whole are difficult to grow in South Africa unless their very specific growth habits are known. These species are all from the warm and wet tropics and extremes of cold are relatively unknown in their habitat. Their dormant period is triggered by dry conditions and not by cold conditions. Even as mature plants these Australian Cycas are deciduous and their dormant period coincides with the "dry" season. In the nursery lifting them for mail orders or merely replanting into larger bags may trigger off a deciduous phase. However, they are magnificent specimen plants in maturity and it is worth persisting with them as juveniles. Some of the very exciting new, blue leaved Cycas are among this group.

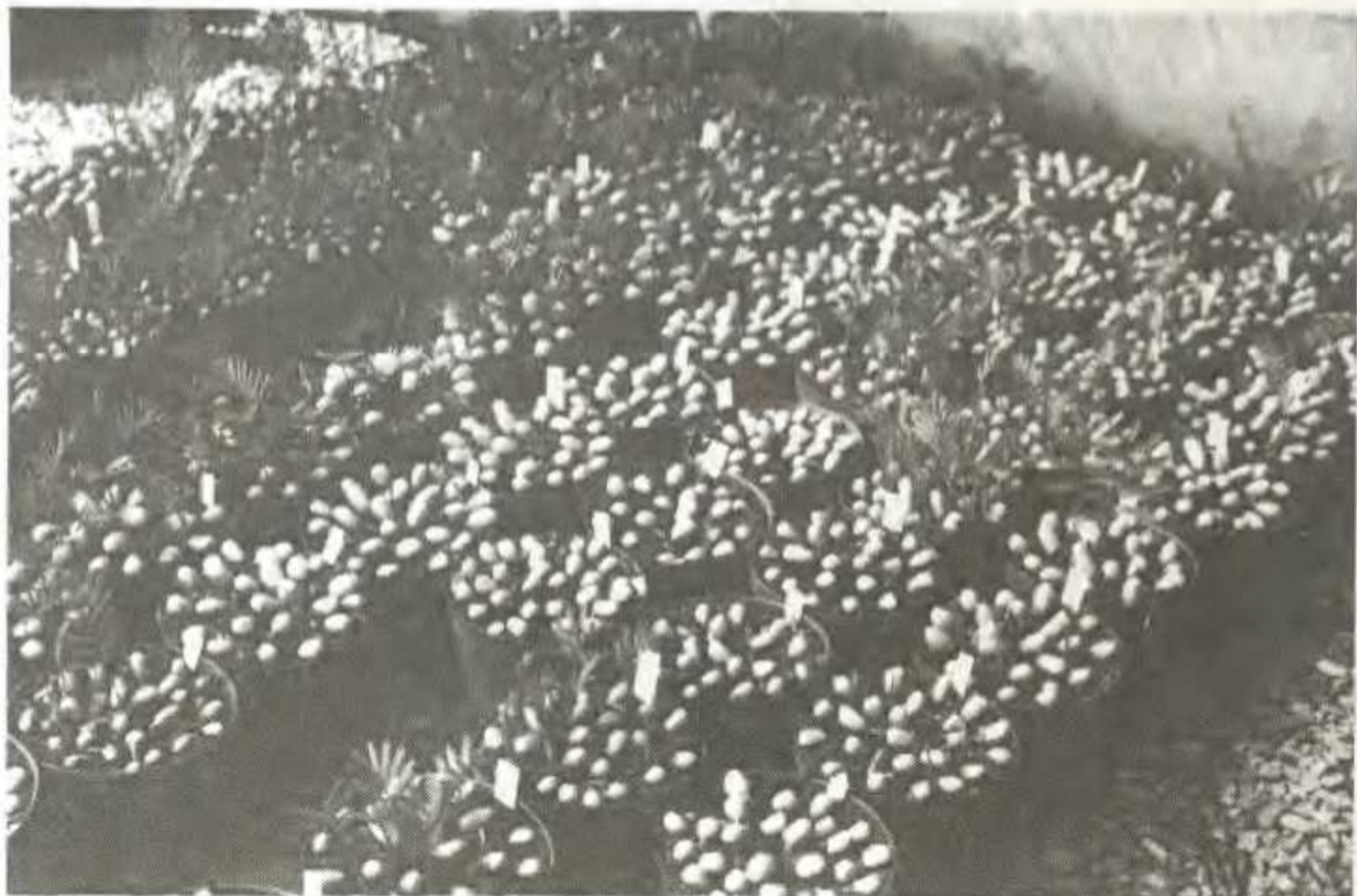
To satisfy the growing demand from an ever increasing number of collectors and gardeners, conservationists are agreed that an increased availability of artificially propagated plants is necessary. Commercial cultivation from seed has to date attempted to address this problem but the ultimate conservation strategy for the more endangered species will be tissue culture. Not only will this make more cycads commercially available and so ease the collecting pressure on wild populations, but tissue culture can also be used to select and produce plants with a specific plant character based on horticultural criteria eg. more attractive leaf forms within a species, genetically faster maturing clones and those plants with cones of an aberrant cone colour eg. yellow coned *E. ferox*.

Conservation through cultivation will ensure the survival of the cycads for future generations.

Footnote: As I am researching frost hardiness in cycads, I would be grateful for any comments in this regard based on your experience as a cycad grower. Information is required as to species, both local and foreign, degree of cold experienced in general terms (frost, black frost, snow, cold wind) and damage occasioned. Please write to Cynthia Giddy, P.O. Box 45, P O Umlaas Road 3730. Tel. 03325-478 (from Jan. 1991, new number 0332-510478).



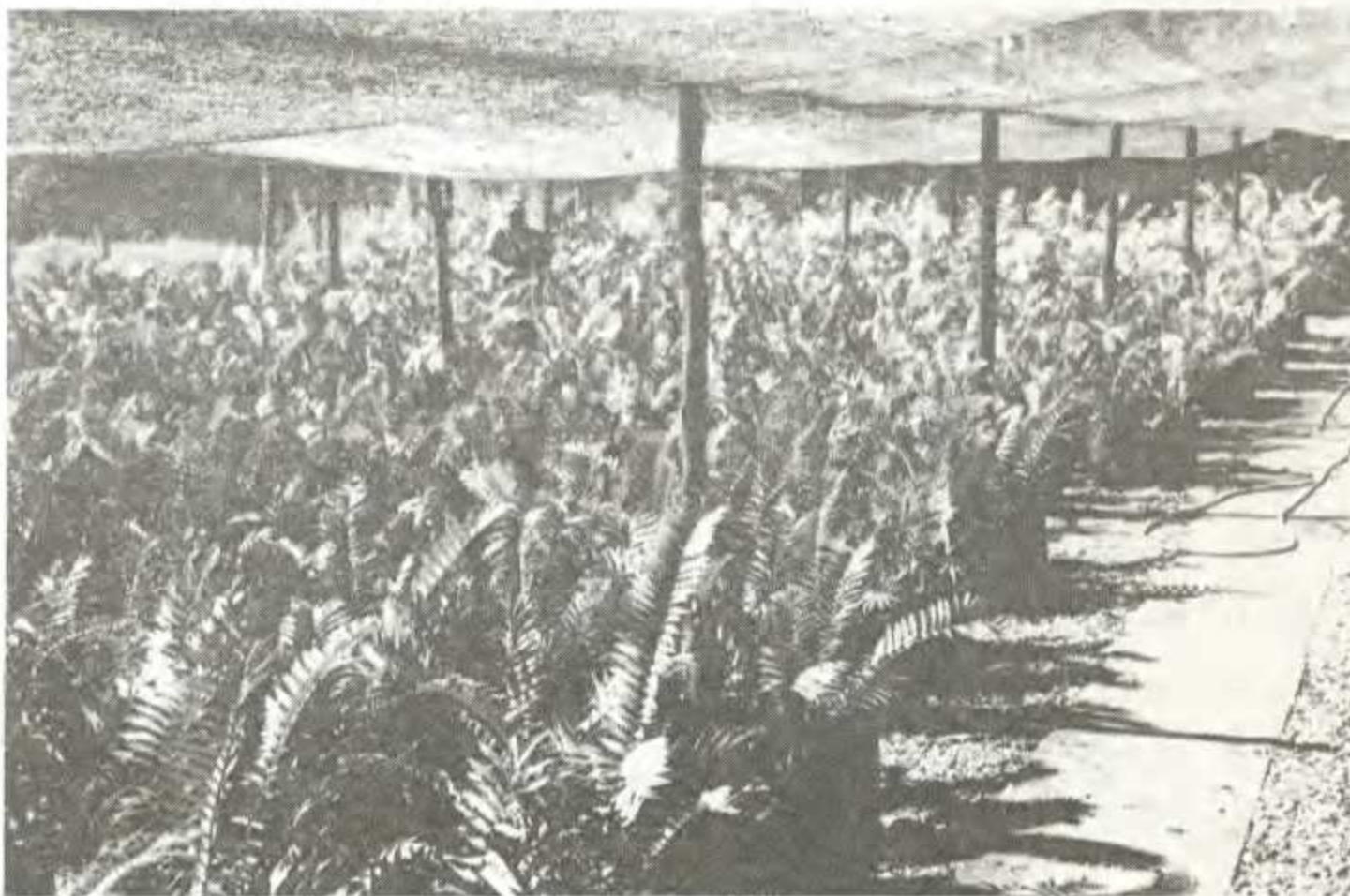
Seeds are planted in sand and kept at a constant temperature of 25°C by means of soil heating cables. The aluminium foil on the walls reflects light and prevents the growth of fungi on the walls.



As soon as the seeds germinate they are transferred to community pots.



Once they have reached the 2-3 leaf stage the seedlings are planted out into individual bags.

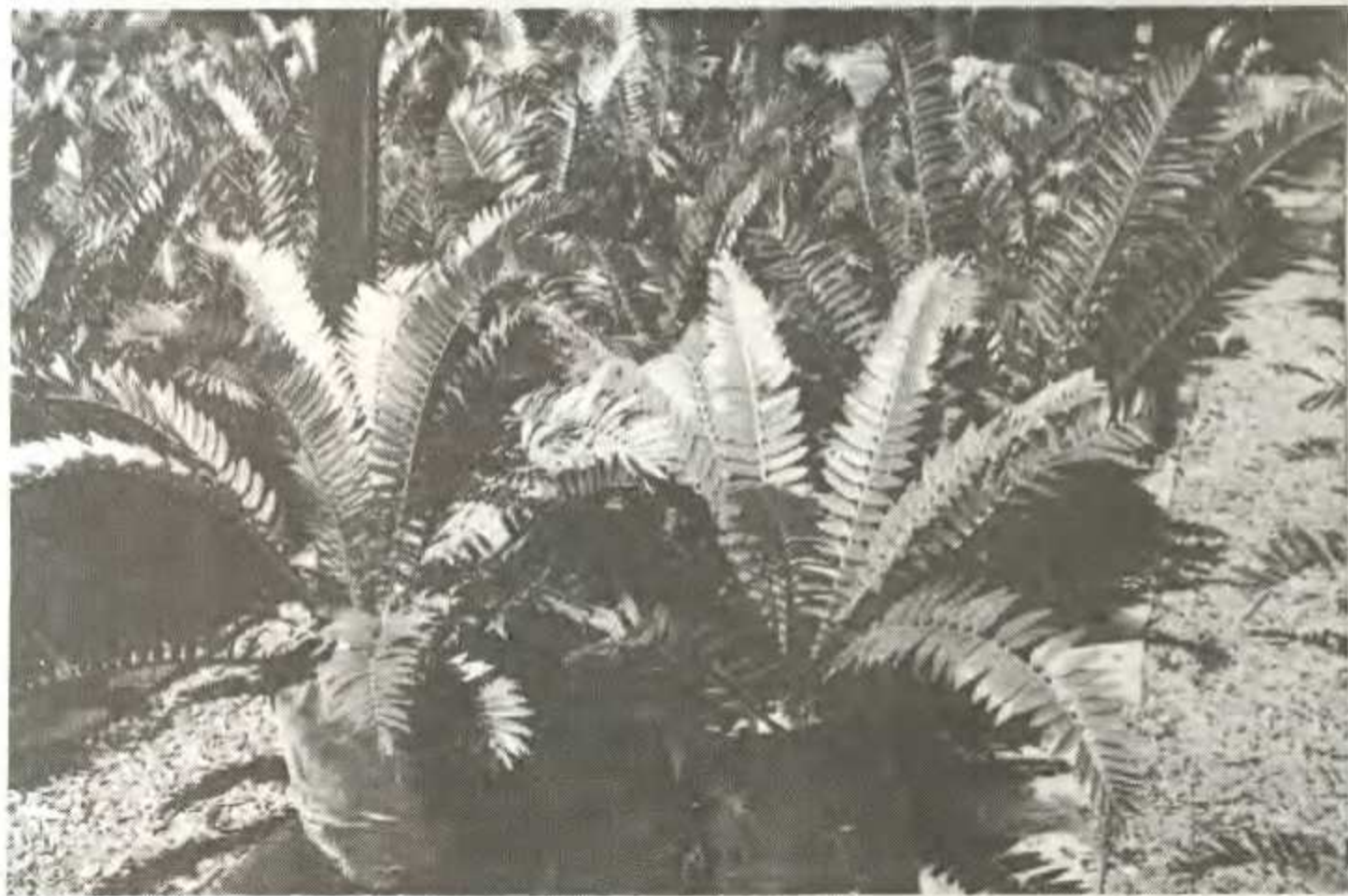


From the controlled environment of the tunnel houses, 3-4 year old seedlings are moved outdoors under 40% shade cloth and hardened off prior to sale.



(Photographs-Giddy's Nursery)

A 4-5 year old plant of *E. natalensis* with 60-75cm leaves.



With modern horticultural technology 5-6 year old cycad seedlings such as these are not only garden worthy but a worthwhile venture for a commercial grower.

# BESOEK AAN LILLIE NATUUR RESERVAAT

DEUR NICO SMUTS

Die Eugene Marais Tak van die Broodboomvereniging van Suid-Afrika wil met die plasing van die artikel net sê : Drie Hoeras! vir Natuurbewaring. Eerstens vir 'n Reservaat soos Lillieflora. Tweedens vir manne soos Dr. Piet Mulder en Dr. Feltus Brand. Hulle maak natuurbewaring werklik hul erns, maar besef ook dat ons lede deel daarvan uitmaak. Baie dankie dat u lede van die Vereniging die geleentheid gebied het om die streng bewaarde gebied van Lillie te besoek. 'n Spesiale dankie ook aan Mnr. Koos Oosthuizen wat die toer aangebied het, wat ons nog lank sal onthou.

Die Lillie Reservaat is naby Mica geleë en beslaan sowat 57 Hektaar. Hierdie is die tuiste van die E. dyerianus spesie. Die Reservaat is ryk aan natuurlewe en kom diere soos Jagluiperds, Leeus, Wildehonde, Olifante, Slang en Dassies voor. Die sondebok is egter die Geelpoot Ekoring Paraxerus cepapi. Dië vreet natuurlik die keels van die plante wat 'n groot verlies aan saad veroorsaak.

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# BESOEK AAN LILLIE NATUUR RESERVAAT

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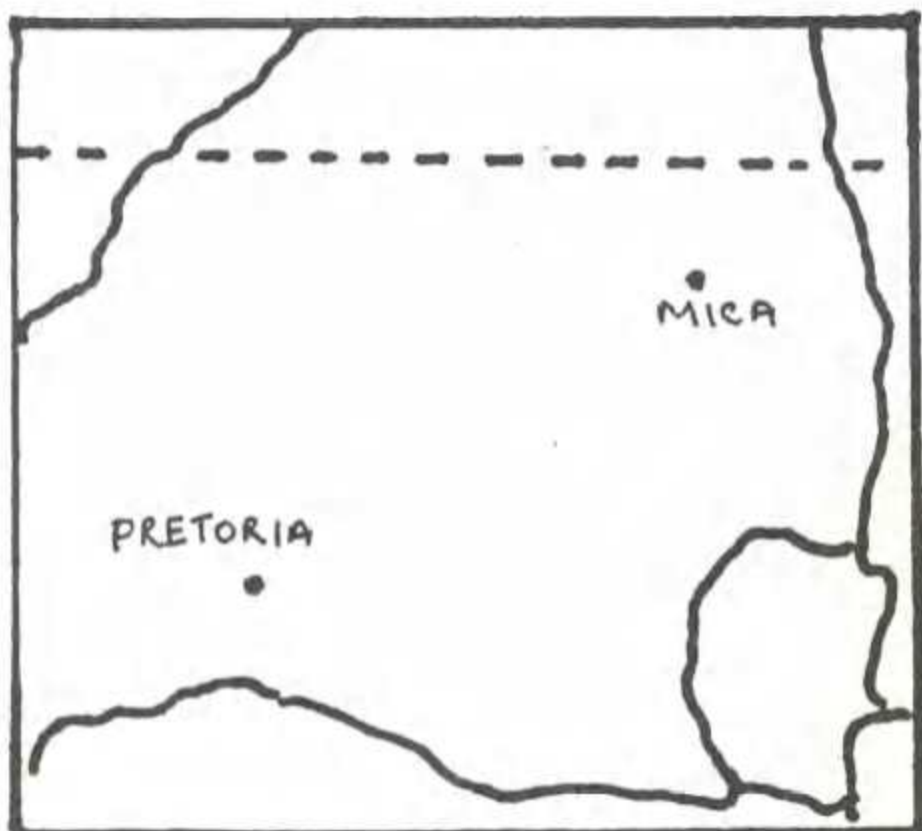
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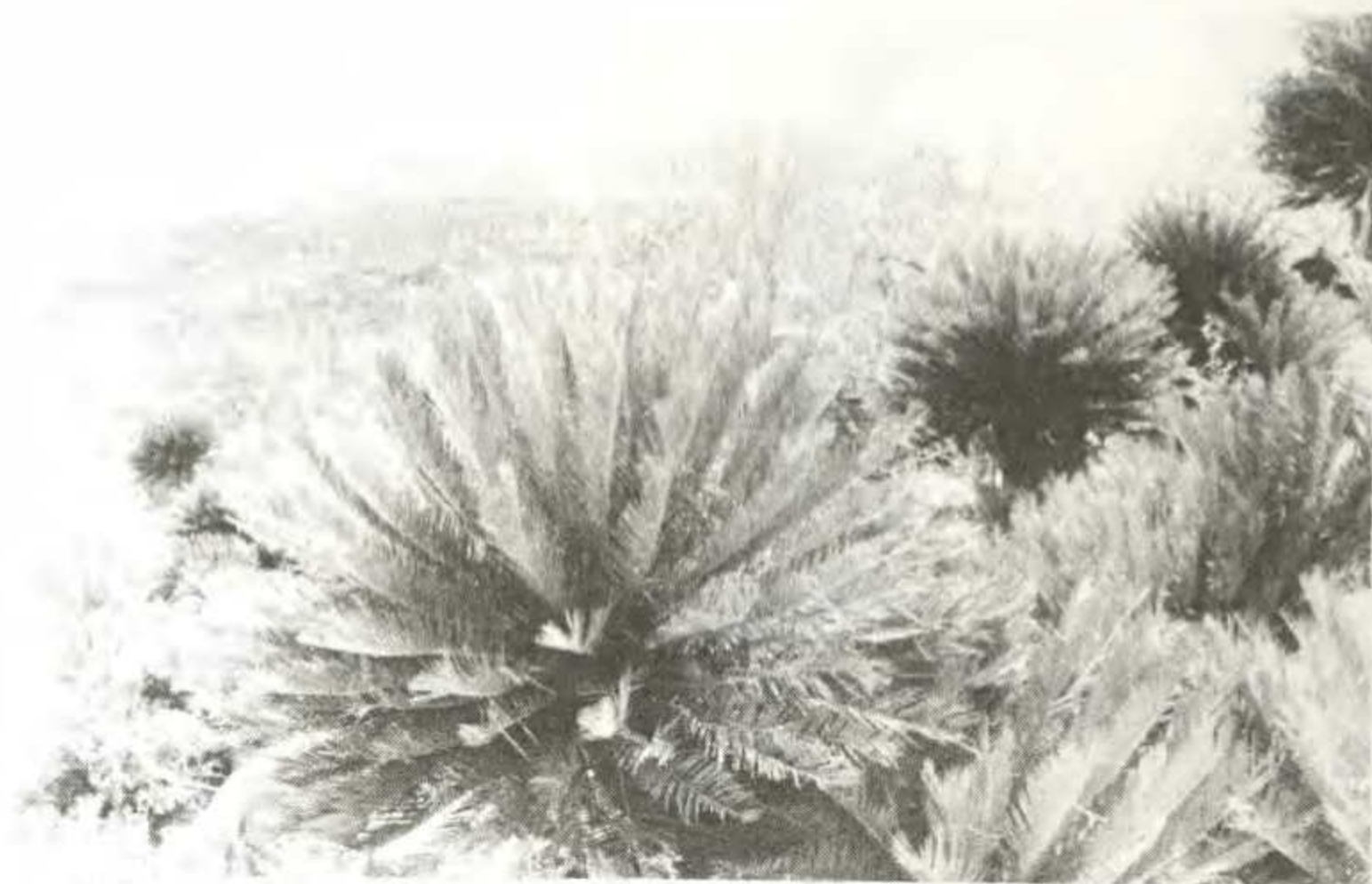
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Mnr. Koos Oosthuizen. Beampte van Natuurbewaring wat die uitstappie meegemaak het.



Volgroeide plante wat op die koppie groei met uitgestrekte bosveld in die agtergrond.

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Wag se hut. 'n Permanente wag in radioverbinding voorsien  
permanente beskerming.



Jong plante deur Natuurbewaring aangeplant verseker  
die voortbestaan van Lillie Flora.



Bewys van eekhorning teenwoordigheid. Merk dat saad nie alleen skoongevreet is nie, maar duidelike tandmerke toon eekhorings se pogings om self die binne gedeeltes ook te vreet.



Oogies-draad om keëls om ape en eekhorings weg te hou.



Bewys van diewe. Afgekapte stam an volgroeiende plant.



FOTOS: NEIL MUNRO

Skade aan stam veroorsaak deur toordokters.



Duidelike bruin kraag om die basis van die 1.25m blare.

## MASTING BY CYCADS

By: N Grobbelaar  
P O Box 15357  
Lynn East, 0039

Masting is a well-known phenomenon amongst many species of woody plants. The high reproductive intensity in certain years that are interspersed by several years of very low reproductive intensity, is said to be a strategy used by the plant to prevent the continual large scale parasitism and predation of its seeds.

Mr Oosthuyzen, of the Transvaal Department of Nature Conservation told me that the population of E. dyerianus growing near Mica in the N.E. Transvaal, cones profusely about once every five years with very few cones being produced in the intervening years.

I have been monitoring nearly 700 individuals of E. transvenosus at the Modjadji Nature Reserve for coning since 1987. During 1987 and 1988 only 14% and 8% respectively of the plants coned. During 1989 and 1990 on the other hand no fewer than 69% and 66% of the plants produced cones although the climatic conditions over the four years did not differ significantly. With this species, the masting therefore appears to last for at least two successive years.

Because the female cones are borne for about 18 months before they disintegrate, no fewer than 55% of the plants that produced female cones in 1989 produced new female cones on the very same stem apices in 1990. In almost all cases the new set of cones were of the same number as the 1989 set. It therefore was quite common to see 6 or 8 female cones on the apex of a single stem this year (see Figure 1)!! The production of a new set of vegetative leaves by a stem that produced female cones the preceding year is also quite common for E. transvenosus (see Figure 2).

Figure 3. Depicts a situation at the Modjadji Nature Reserve that caused much excitement until excavations revealed that the female "sucker" of the male plant was in fact a separate plant.



Figure 1. E. transvenosus at Modjadji Nature Reserve with six female cones on the apex of a single stem. The three large cones arose in 1989 whilst the three smaller ones were developing in 1990 when the photograph was taken.



Figure 2. New leaves emerging from the stem apex of an *E. transvenosus* stem which still bears the female cones that developed the previous year (Modjadji Nature Reserve).

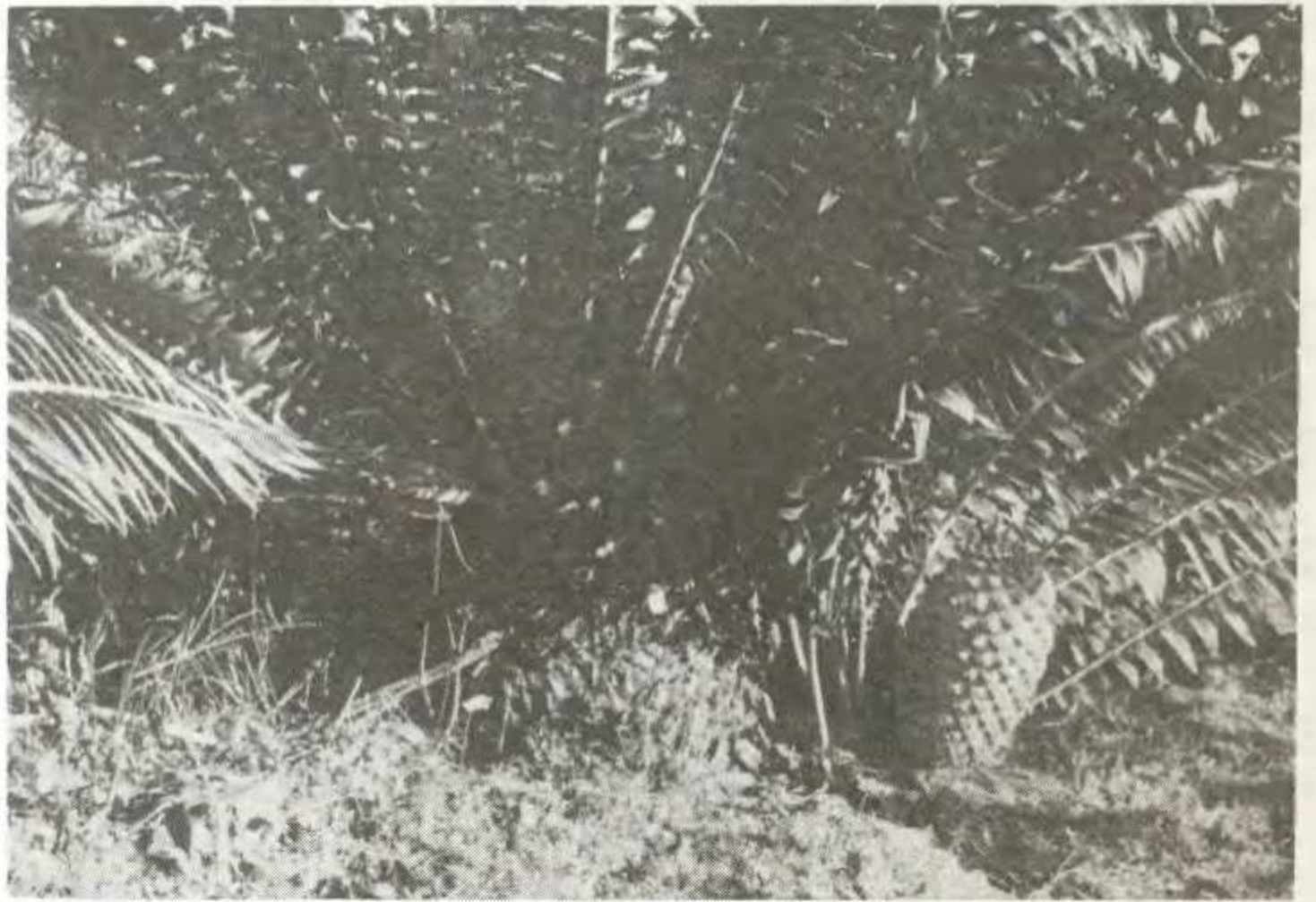


Figure 3. The "sucker" with the solitary female cone was found to be a separate plant from the adjoining taller *E. transvenosus* male plant (Modjadji Nature Reserve).

ENCEPHALARTOS EMBRYO'S

By: N Grobbelaar  
P O Box 15357  
Lynn East, 0039

In response to Piet Vorster's letter concerning the phenomenon of viviparity in cycads (Encephalartos No 22 p 26), I wish to note that this is not very uncommon in certain Encephalartos species. I have observed it on several occasions while cleaning the seed kernels of E. transvenosus and E. manikensis.

Although it is commonly stated that the embryo's of Encephalartos are very immature at the time of seed dispersal, this is true only for those species which shed their seed 3 to 7 months after pollination - which represents most Encephalartos species whose female cones do not disintegrate or dry out for at least 9 months after pollination, the embryo's are usually fully developed by the time the seed is shed. Such seed will often start to germinate while still inside the cone or after seed dispersal, but before the sarcotesta has decayed. If the seed kernels of these species which have not yet germinated are cleaned and are immediately set out to germinate, they usually start doing so within a week or two.

I have had the most experience with the seed of E. transvenosus for which the above is common. The female cones are usually ready to be pollinated about 6 months after first becoming visible. They disintegrate spontaneously about 12 months after pollination time.

The female cones of E. manikensis appears to be very variable in this regard. I have had female cones which disintegrated 11 months after they were pollinated and in that case the embryo's were also fully developed with some seeds being viviparous. In other cases, the female cones of E. manikensis disintegrated after about 8 months when the embryo's were still relatively immature.

This seems to be another indication (in addition to the variation in male cone forms) that what is commonly regarded as E. manikensis is indeed a complex of apparently different species.

I do not have much experience with female cones of E. arenarius but it can also take at least 9 months after pollination for these cones to disintegrate spontaneously. In such cases, the embryo's also was found to be fully developed.



E. transvenosus seeds. Top to Bottom:  
Normal seed from central cone region;  
longitudinal section through a freshly  
harvested seed kernel to show the fully  
developed embryo; seed kernel shortly  
after monkeys have removed the sarcotesta  
from the original seed; normal seed from  
the apical region of the cone.

# MATURITY IN CYCADS

By Willie Tang

Cycads are extremely slow growing and consequently mature only at great age... or do they? When I first started studying cycads 11 years ago I believed this bit of plant folklore. After a decade of observing wild and captive cycads, from temperate to tropical zones, however, my view of cycad growth rate has changed completely.

In temperate climates, when cultivated cycads do not receive adequate warmth and moisture, it is often true that cycads grow slowly or not at all. Instead of dying, however, as most plants do when abused, a stressed cycad persists for many years in near stasis. The cycad grower often mistakes this condition for normal growth! But, take heart, there is hope even for abused plants. To quote C.J. Chamberlain on Bowenia serrulata: "The subterranean stem has a remarkable hold on life... a stem just beneath the beaten path under the house had not produced a leaf for 20 years, but when the old house was abandoned and the path no longer used, the stem, so long dormant, produced a fine display of foliage."(2). If given the proper conditions cycads can grow rapidly.

How fast can cycads grow? To answer this question I surveyed cycad growers in Africa, Australia and the U.S.A. (Table 1). The findings indicate that cycads can reach maturity from seed in as little as 2 years! For most, maturity may be reached in 5-15 years from seed. Maturation, the time when a cycad first produces a cone, is strongly linked with plant size as an adult (6). The dwarf zamias, whose stems may not reach more than a few centimeters in width, hold the record for youngest age at maturity. Medium sized genera like Ceratozamia and Stangeria are close behind, maturing in as little as 5 years. The large arborescent species with their larger cones take the longest to reach maturity, not because they are slower

growing, but because they must reach a greater size before coning is possible. There are, of course, exceptions to these patterns. A specimen of Lepidozamia hopei, one of the largest species, in Hawaii produced a stout trunk and cone in 7 years from seed (Fig. 1)!

## Secrets of Cycad Cultivation

Appallingly little research has been done on techniques to increase cycad growth rates. One approach has been to observe them in the wild and then mimic their habitats in cultivation. Conditions in the wild, however, are rarely optimal. Because of competition from other plants and the limitations of soil and climate, cycads persist in the wild where they can and not necessarily in conditions where they grow best. To quote Loren Whitelock: "Under cultivation it is possible for (cycad plants) to grow many times faster than the same plants in the wild. This is due to the improved soil condition, fertilization and constant availability of water.... Trunks can develop two or three times their normal diameter and leaves will be produced not only in greater numbers, but also longer and broader than in nature."(8).

In the wild most cycads suffer periods of drought or stress where they must remain nearly dormant. When conditions are right, however, they exhibit a rapid flush of growth. Clearly, a focus for future horticultural work with cycads would be to explore methods of minimizing dormancy and maximizing growth during flushes. The most promising technique I have found for potted cycads is to grow them in a rapid draining soil mix with as much as 50-75% perlite. The plants are sprinkled automatically for 15 minutes, 2-3 times a day. Given 60% shade and the warmth and humidity of the South Florida climate tropical cycads like Ceratozamia robusta (Belize), Encephalartos gratus and Zamia furfuracea potted in this manner experienced explosive growth (5). Under such conditions the roots are constantly moist but always well aerated. Roots

quickly fill the pot, forming a dense mass so that these plants are in essentially hydroponic conditions (Fig. 3). Stems puff up like balloons with every flush of leaves and scale leaves. A young plant of *Ceratozamia* under such conditions had 4 successive flushes of leaves in a year and the cross sectional area of its stem increased more than 10 times in 2 and 1/2 years (4, 5). I fertilized only occasionally; undoubtedly with heavier fertilization even more rapid growth could have been achieved.

### Conclusion

The maturation times listed in Table 1 were achieved mainly by garden plants that received no unusual treatment besides water and moderate fertilization. With the application of rapid growth techniques I believe that many of these maturation times can be cut in half. With the development of such horticultural techniques cycad growers may raise many generations of cycads in only a decade or two from the seeds they sow now.

### Acknowledgements

I dedicate this paper in large part to Cynthia Giddy whose love and labour for cycads has inspired many including myself. In preparing the list of maturation ages I am especially indebted to Marion Debruyne, whose years of diligent observation provided much of the data. Many thanks are also due to Bijan Dehgan, P. G. De Villiers, Chuck Hubbuch, Leland Miyano, Roy Osborne, Bart Schutzman, Piet Vorster, Stan Walkley, and Loren Whitelock.

- 1) Anonymous 1989. Nursery news. *Encephalartos* 20: 40.
- 2) Chamberlain, C. J. 1912. Two species of *Bowenia*. *Botanical Gazette* 54: 419-423
- 3) Small, J. K. 1921. Seminole bread - the conti. *Journal of the New York Botanical Garden* 22: 121-137
- 4) Tang, W. 1985. Cycad propagation notes. *Cycad Newsletter* 8(3): 9.

- 5) Tang, W. 1986. Cycad seeds and seedlings. *Cycad Newsletter* 9(2):4-8
- 6) Tang, W. 1989. The teenage cycad. *Cycad Newsletter* 12(4): 14-16.
- 7) Tucker, R. 1989. *Bowenia* in North Queensland. *Palms & Cycads* 25: 2-6.
- 8) Whitelock, L. 1975. Cycads- age and growth rate. *Cactus & Succulent Journal (U.S.)* 47: 71-81.

The author's address: Fairchild Tropical Garden, 10901 Old Cutler Road, Miami, Florida, 33156 U.S.A.



Fig. 1. A seven year-old *Lepidozamia hopei* with a female cone at Ho'Ho Botanical Garden, Oahu, Hawaii.



Fig. 2. An eleven year-old male *Encephalartos lebomboensis* that coned at 10 years of age in the garden of P. G. De Villiers on the Witwaterstrand, South Africa. Altitude: 1500 meters. Photo by P. G. De Villiers.

### CYCAD HALF - TRUTHS ?

The Durban Botanic Gardens is presently offering packets of cycad seeds to visitors at the moderate price of R 3.00 per packet. Each packet is issued with a pamphlet on cycad propagation, which includes a note that the viability of cycad seeds can be determined by slicing the seed in half longitudinally and seeing if an embryo is present. One somewhat puzzled customer (who will remain anonymous) has written back to the gardens as follows:

"I was recently supplied .... with some of the above-mentioned seeds together with a pamphlet to advise me that they can easily be grown if fertile. To ascertain this, it is necessary to slice the seeds in half longitudinally and study the spring [suspensor] and its attachments [the embryo]. In all the seeds I found embryos were in fact present. Your pamphlet, however, does not advise how to get them together again before planting!! Please advise."

Editors Comment : How about the new adhesive called "Gro-Stix"?



Fig. 3. An *Encephalartos gratus* with a 23 cm wide stem produced under the nearly hydroponic conditions described in the text. Notice the dense tangle of roots. Stem cross sectional area increased more than 12 times in 3 years.

### CYCAD 90 - WHO TOOK THE CYCAS SEEDS FROM QUEENS GARDENS?

Robert Tucker, Botanic Collections Officer for the Townsville Parks Department, has asked us to publish the following notice:

"I took two Australian people [from the CYCAD 90 tour group] to Queens Gardens [in Townsville] on Friday 27 July, to show them our three *Cycas circinalis* ssp. *seemannii* [plants], one female and two males, and get some seeds for them as exchange material. Two weeks previously, I had looked at the seed crop, which was quite good. When we arrived on that Friday we found that the entire crop has been taken! The gardeners told us that they had "chatted" people for taking the seed "all week" and that many had an "American accent" whilst some were Australians!"

"Could you inform the participants [to CYCAD 90] of the identity of the stolen seeds, so that they may be correctly labelled?"

We share Mr Tucker's chagrin over this incident: it is a pity that those concerned did not make a request through the correct channels. Under the circumstances, Mr Tucker's helpful attitude is quite remarkable!

**Table 1.** Time elapsed from seed germination to the production of the first cone for 10 genera of cycad. Accuracy within  $\pm 0,5$  years.

| SPECIES                                      | AGE AT FIRST CONING | SEX | SOURCE              |
|----------------------------------------------|---------------------|-----|---------------------|
| <i>Bowenia spectabilis</i>                   | 3 yrs.              | M   | Giddy               |
| <i>Bowenia</i> (in general)                  | 5                   |     | Tucker(7)           |
| <i>Ceratozamia hildae</i>                    | 5                   | M,F | Tang                |
| <i>C. mexicana</i>                           | 5                   | M   | Giddy               |
|                                              | 6                   | F   | "                   |
| <i>C. robusta</i> (Belize)                   | 13*                 | F   | Tang                |
| <i>Cycas chamberlainii</i>                   | 13                  | M   | Tang-FTG***         |
| <i>C. circinalis</i> (Ceylon)                | 9                   | M   | Dehgan, Schutzman   |
| <i>C. revoluta</i>                           | 13                  | M   | Vorster             |
|                                              | 14                  | F   | Giddy               |
| <i>C. wadei</i>                              | 13                  | M,F | Tang-FTG            |
| <i>Dioon edule</i> var. <i>angustifolium</i> | 10-12**             | M   | Walkley             |
| <i>Dioon mejiae</i>                          | 14*                 | F   | Tang-FTG            |
| <i>Encephalartos altensteinii</i>            | 12                  | M   | Debruyne            |
| <i>E. cupidus</i>                            | 15                  | M   | "                   |
| <i>E. eugene-maraisii</i>                    | 12                  | M   | "                   |
| <i>E. ferox</i>                              | 11                  | F   | "                   |
|                                              | 10                  | M   | Whitelock           |
| <i>E. horridus</i>                           | 14                  | M   | Debruyne            |
| <i>E. humilus</i>                            | 15                  | F   | "                   |
| <i>E. inopinus</i>                           | 12-15               | M   | "                   |
| <i>E. laevifolius</i>                        | 12-15               | M   | "                   |
| <i>E. lebomboensis</i>                       | 12                  | F   | "                   |
|                                              | 10                  | M   | De Villiers         |
| <i>E. lehmanii</i>                           | 15                  | M   | Debruyne            |
| <i>E. longifolius</i>                        | 18                  | M,F | "                   |
| <i>E. manikensis</i>                         | 10-12               | M,F | Osborne,(1)         |
| <i>E. natalensis</i>                         | 14                  | F   | Debruyne            |
|                                              | 16                  | M   | Giddy               |
| <i>E. paucidentatus</i>                      | 18-19               | M   | "                   |
| <i>E. transvenosus</i>                       | 11                  | M,F | Debruyne            |
| <i>E. villosus</i>                           | 10-12               | M,F | (1)                 |
| <i>Lepidozamia hopei</i>                     | 7                   | F   | Miyano              |
| <i>L. peroffskyana</i>                       | 24*                 | M   | Tang-FTG***         |
|                                              | 25*                 | F   | "                   |
| <i>Macrozamia communis</i>                   | 8                   | M   | K. Boyer via Giddy  |
| <i>Microcycas calocoma</i>                   | 12                  | M   | D. Hull via Hubbuch |
| <i>Stangeria eriopus</i>                     | 4                   | M   | Walkley             |
|                                              | 6                   | F   | "                   |
| <i>Zamia fischeri</i>                        | 2                   | M,F | Hubbuch             |
| <i>Z. furfuracea</i>                         | 3                   | M   | Dehgan, Schutzman   |
|                                              | 4                   | F   | "                   |
| <i>Z. muricata</i>                           | 5                   | M,F | "                   |
| <i>Z. pumila</i> (Florida)                   | 2                   | M   | "                   |
|                                              | 3                   | F   | "                   |
| <i>Z. pumila</i> (Florida)                   | 2-3                 | M,F | Small(3)            |
| <i>Z. debilis</i> (Dominican Republic)       | 4.5                 | M   | Giddy               |
|                                              | 6.5                 | F   | "                   |

\*Grown under conditions that were known to be less than ideal. \*\* Obtained as a seedling, estimated to have been 1-3 yrs old. Maturity was reached in 9 years. \*\*\* FTG - Fairchild Tropical Garden

## NATAL UNIVERSITY MOUNTAIN CLUB TO THE RESCUE AT MONTESEEL

The Monteseel cycads - specimens of *Encephalartos natalensis* - are well-known to Natal members (see ENCEPHALARTOS 3: 18). Disturbing news recently was that the large plant on the cliff face had been badly attacked by ants, particularly at the stem bases; the consequence being that two of its giant 13 stems had fallen from the main rootstock onto a ledge below. The Cycad Society was quick in its response: damaged leaves were all trimmed off, the stems and rootstock were treated with ant-poison, but the two fallen trunks were just too much of a job for us to deal with. We were grateful therefore to have the offer of assistance from the University of Natal Mountain Club: on 10 October 1990 their members Doug Heher, Peter Seitz and Alex Wallis excavated two new sites on the cliff and, using ropes and brute strength, manhandled the fallen trunks to new homes just below the parent plant, the operation being supervised by Roy Osborne. All being well, the trunks have at least some chance of re-rooting and surviving. We also thank the landowner and the Natal Parks Board for their co-operation in approving the rescue plans.



Right: University of Natal Mountain Club members replanting one of the two salvaged *Encephalartos natalensis* trunks at Monteseel (Photo: R. Osborne).

With best wishes for a joyful Christmas and peace throughout the New Year

FROM THE PRESIDENT , EDITOR , NATIONAL AND REGIONAL COMMITTEES



n Wens van vreugde en vrede aan u met Kersfees  
en deur die Nuwe Jaar

VAN DIE PRESIDENT, REDAKTEUR, NASIONALE EN STREEKKOMITEES

## NATAL SECTION NEWS - THE NATAL WILDLIFE EXPO

As part of a public awareness campaign, the Natal Section of the Society exhibited at the Sappi-Saiccor WILDLIFE EXPO in Durban over the period 6 - 9 September 1990. The Society's stand was an eye-catching cycad plant display together with informative posters, copies of ENCEPHALARTOS and demonstrations of pollination and propagative techniques. Plants were kindly loaned by the Durban Botanical Gardens and Society members who also manned the exhibit throughout the event. The stand attracted a great deal of public interest and several new members were recruited.

A fund-raising raffle competition, with plant prizes kindly donated by Cynthia Giddy and Escom, drew about 450 entries. Winners of the plants were: J.C. Buys, G. Camp, G. Everitt, N. Ndlovu and R. Shooter.

The Natal Committee thanks all those who assisted in the Expo arrangements, especially Bob Steyn (Montlands Orchids), Ken Wyman and Ann Lambert (Durban Botanic Gardens), Andrew Gray (Escom) and the hardworking team of Society members involved in the organisation.

The Cycad Society's stand at the Natal Wildlife Expo.  
(Photo : R. Osborne)



## CYCAD - INSECT INTERACTIONS

A new report on the subject of cycad-insect interaction has appeared. Prof D D Pant and Dr Rita Singh of the University of Allahabad (both members of the Society) have been studying various *Cycas* species in the Roxburgh Botanic Garden of their University for some time. Their research indicates that **only the male cones harbour insects**, which feed on the pollen and then complete the various stages of their life cycle - without ever leaving that structure. Thus these insects **cannot** play any role in pollination of the females. These results, published in an article entitled "Preliminary Observations on Insect-Plant Relationships in Allahabad Plants of *Cycas*", appear in *Palms & Cycads* (No 28, July-Sept 1990, pp 10-14), the magazine of the Palm and Cycad Societies of Australia. The results are in stark contrast to those of American workers Knut Norstog and Willie Tang, who have shown convincingly that the insects pollinating *Zamia* visit both the male and female cones. Pant & Singh suggest that the *Cycas*-insect relationship in the male cone may be an early evolutionary stage towards some ultimate pollination process.

We draw the attention of readers to the fact research into this subject has also been carried out locally and several articles on *Encephalartos*-insect relationships have been published in this journal. [See ENCEPHALARTOS 12:9, 17:12, 17:32-33, & 19:43-44.] In due course, some consolidation of all these various research efforts is desirable.

# Funds of famed botanic garden are withering

LONDON — The Royal Botanic Gardens at Kew, south-west London, the world's oldest and most respected botanical institution, says its financial situation has deteriorated from "difficult" to "desperate".

Without a large injection of money — as much as £20 million (about R100 million) — international projects that could help to stem the destruction of the environment will not get off the ground, a spokesman for the RBG said this week.

The RBG's financial difficulties are likely to have worldwide repercussions, for its research, conservation, development and exploration activities now extend to 59 countries.

One of the first projects to feel the pinch could be a plan to establish two major seed banks in the northern and southern hemispheres. The destruction of rainforest plants, set by some botanists at one species a day, emphasises the urgency of the project.

## Promoted

But the cost of despatching collectors around the world and building the banks is estimated at R100 million, and the RBG's entire government grant is R66 million this year.

Another potentially revolutionary conservation programme, "habitat management" — returning specimens to their natural habitat — is being promoted by the RBG as so many species exist only in cultivation.

With this in mind, the RBG plans to host an international conference on the subject in September next year — at a cost of at least R500 000.

Spurred into action by the urgency of its financial position, the RBG has decided to follow the example of museums and

**A funding crisis at the Royal Botanic Gardens in London threatens worldwide research and conservation projects, writes DALYA ALBERGE.**

public galleries by actively seeking sponsorship.

McDonald's, the fast food chain, has contributed R600 000, making possible a three-year study of the palms of Madagascar — crucial to reforestation programmes — and Shell International has provided R500 000 to employ a leader for a five-year project in north-east Brazil to examine the sustainable use of semi-arid land, with the aim of encouraging people to inhabit the area, rather than move to the Amazon.

A further R10 million is needed to run the project.

Scientific research into natural resources is another area threatened by lack of financial resources. Laboratory studies in molecular biology, which drew on a reference library of six-million dried trees, have already isolated a compound which inhibits the spread of the Aids virus. Without money, however, such research could come to an end.

Professor Ghilleen Prance, director of the RBG, said: "As the world's most important botanical garden, our mission is to better life on earth through the study of plants. We are deeply frustrated that we cannot do as much as we'd like to."

To increase awareness of its situation, the RBG this week launched a Friends of Kew organisation, with the aim of attracting 35 000 members within five years, each paying an annual subscription of R150. — The Independent, London.

## Probe into E Cape cycad smuggling

PORT ELIZABETH. — The Department of Nature Conservation in the Eastern Cape is conducting a nation-wide investigation into one of the biggest illegal consignments of cycads from that region.

Millions of rands are involved, a report said.

The chief nature conservation officer, Jaap Pienaar, says the investigation is being conducted in conjunction with the police special unit for endangered species and the Department of Nature Conservation in the Transvaal.

It is suspected a large number of cycads have been sold illegally to buyers in the Transvaal. — Sapa.

THE CITIZEN  
Tuesday 16 October 1990

## Cycads

A minimum of R500 000 is needed to launch an effective campaign to save South Africa's cycads. More than half of the 160-odd cycad species in the world are already on the threatened list and an international ban on trade in cycads taken from their natural habitats introduced by CITES has virtually eliminated the international trade in cycads from the wild.

Although South Africa boasts a remarkable concentration of 32 cycad species, the plundering of rare cycads from their natural habitat continues and prices as high as R30 000 are known to have been offered for a single specimen.

Two cycad species in South Africa have already been plundered to the point of extinction, four are on the verge of extinction in their natural habitat and seven more are on the endangered list. Apart from four fairly common varieties, the rest of the cycad species are rare and have a limited distribution.

To help save South Africa's cycads, Swissair has pledged R100 for each booking on their summer Alpine tours to the Wildlife Society's cycad campaign. For each booking made until the end of October 1990, the airline will donate R100 to the Wildlife Society's cycad fund.

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