

ENCEPHALARTOS

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SOUTH AFRICA

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COVER / VOORBLAD : *Cycas panzhihuaensis*

Female cone at stage when receptive to pollination. Life-size.
Recorded in the *Cycas* reserve in Panzhihua,
China, in May 1996.

Photo: Piet Vorster

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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

Thanks to all members who responded to the invitation extended in "Encephalartos" no. 46 regarding suggestions for the improvement of our financial position and hints about the contents of our journal. Regarding the financial position, several members suggested plant sales as a possibility for extra income whereby a portion of the profits of such a sale could be donated to the Society. Possible arguments against such a suggestion are the trouble and costs involved in carting the plants to and from the sale and to secure the safety of the plants during the sale, especially where scarce and valuable plants are involved. Another problem is the legislation regarding the selling of cycads, which at present is in the process of being revised. We will have to wait for the final drafts. Plant sales in other countries are common practice and one of our members from the USA writes that such a sale brought in more than \$100 000 which meant more than \$20 000 for that Society. This shows that plant sales can be a possibility and I hope that some of the regional branches would think about this.

Regarding suggestions about the journal, we also received some interesting suggestions, such as the idea of a "swop corner" where members can supply information about plants they have to swop for "whatever you may have to offer". Another very interesting suggestion is to present a column on "cycads in containers". This member writes that due to the lack of space, many members have to grow their cycads in containers but little information as to the best soil mix, fertilization and irrigation is available. As an experiment we are supplying, somewhere else in this issue, a few questions on this topic with the request to any member to respond.

Many new members joined the Society during the past year and the last numbers allocated to members passed the 2100 mark. Unfortunately we are losing members every year due to the fact that they do not renew their membership. The time for renewal of membership is closing in and I would like to extend a friendly request to all members not to forget to submit their renewal forms and money as soon as possible.

It is hard to believe that this issue of "Encephalartos" will be the last for 1996 and that the Festive season is coming. Customarily, I would like to thank all Council members and members of steering-committees of regional branches for their contributions of the past year. I would also like to thank each and every member for supporting the Society, since no society can exist without its members. May you all have a merry Festive season and may 1997 bring us all hope and peace.

Hannes Robbertse

VAN DIE PRESIDENT

Baie dankie aan al die lede wat gereageer het op die uitnodiging in "Encephalartos" nr 46 om wenke in te stuur vir die verbetering van ons finansies en wenke oor die inhoud van ons tydskrif. Wat die finansies betref, het 'n aantal lede voorgestel dat die Vereniging plantverkopings kan reël en dat 'n gedeelte van die winste dan aan die Vereniging betaal word. Moontlike besware wat geopper kan word, is dat dit moeilik en duur sal wees om plante na en van so 'n verkoping te vervoer en om die nodige sekuriteit te waarborg, veral as dit skaars soorte insluit. 'n Ander probleem is die wetgewing oor die koop en verkoop van broodbome wat tans hersien word. Ons sal moet wag om te sien wat dit presies gaan behels. Verkope van palms en broodbome word wel in verskillende lande aangebied en 'n lid uit die VSA skryf dat een so 'n verkoping byvoorbeeld \$100 000 opgelewer het, wat aan die betrokke Vereniging \$20 000 besorg het. Dit wys dat so iets wel moontlik is en dat van ons streektakke die moontlikhede kan oorweeg.

Wat voorstelle oor die tydskrif betref, het daar ook interessante voorstelle gekom, waaronder die gedagte van 'n "ruilhoekie" rubriek, waar lede plante wat hulle te ruil het kan aanbied "vir wat jy as teenaanbod het". 'n Ander goeie wenk is om 'n rubriek oor "broodbome in houers" aan te bied. Die lid skryf dat baie lede, by gebrek aan ruimte, hul broodbome in houers kweek, maar daar bestaan min inligting oor die grondmengsels wat gebruik kan word asook die bemesting en besproeiing. By wyse van 'n proefneming verskyn daar elders in hierdie uitgawe 'n paar vrae oor laasgenoemde onderwerp, met die versoek dat enige lid daarop kan antwoord.

Die Vereniging het die afgelope jaar weer baie nuwe lede bygekry en die laaste lidnummers trek nou al oor die 2100. Ongelukkig verloor ons elke jaar 'n klomp lede as gevolg van die feit dat hulle nie hul lidmaatskap hernu nie. Die tyd vir hernuwing van lidmaatskap kom nou vinnig nader en ek wil 'n vriendelike beroep doen op lede om tog nie te vergeet om u ledegeld so gou as moontlik aan te stuur nie.

Dit is moeilik om te glo dat hierdie uitgawe alweer die laaste van 1996 sal wees en dat die Kerseisoen voor die deur is. Soos gebruikelik, wil ek al die Raadslede en die bestuur van streektakke van harte bedank vir hul bydraes van die afgelope jaar. Ek wil ook elke lid van die Vereniging bedank vir u ondersteuning, want sonder lede kan die Vereniging nie bestaan nie. Mag u almal 'n vreugdevolle Feestyd beleef en mag 1997 vir ons almal hoop en vrede bring.

Hannes Robbertse

FOCUS ON ...

FOKUS OP ...

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

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

ENCEPHALARTOS WHITELOCKII Hurter

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INTRODUCTION

Plants of this species were formerly referred to by cycad collectors as the "Lake George" cycad, "Mpanga" cycad, and *Encephalartos "ruwenzoriensis"*.



Figure 1 *Encephalartos whitelockii*: plant growing in savanna habitat. Photo: Johan Hurter.



Figure 2 *Encephalartos whitelockii*: specimens with reclining trunks. Note the drooping persistent old leaf bases below the leaf crown. Photo: Johan Hurter.

Unaware of each other's intentions, both Johan Hurter and Piet Vorster described this species as a new *Encephalartos* species and had their descriptions

published in two separate botanical journals during 1995. Consequently the name *Encephalartos whitelockii* Hurter (June 1995) has priority being effectively and

validly published before the name *Encephalartos successibus* Vorster (December 1995) which is thus regarded as a synonym of *E. whitelockii*.

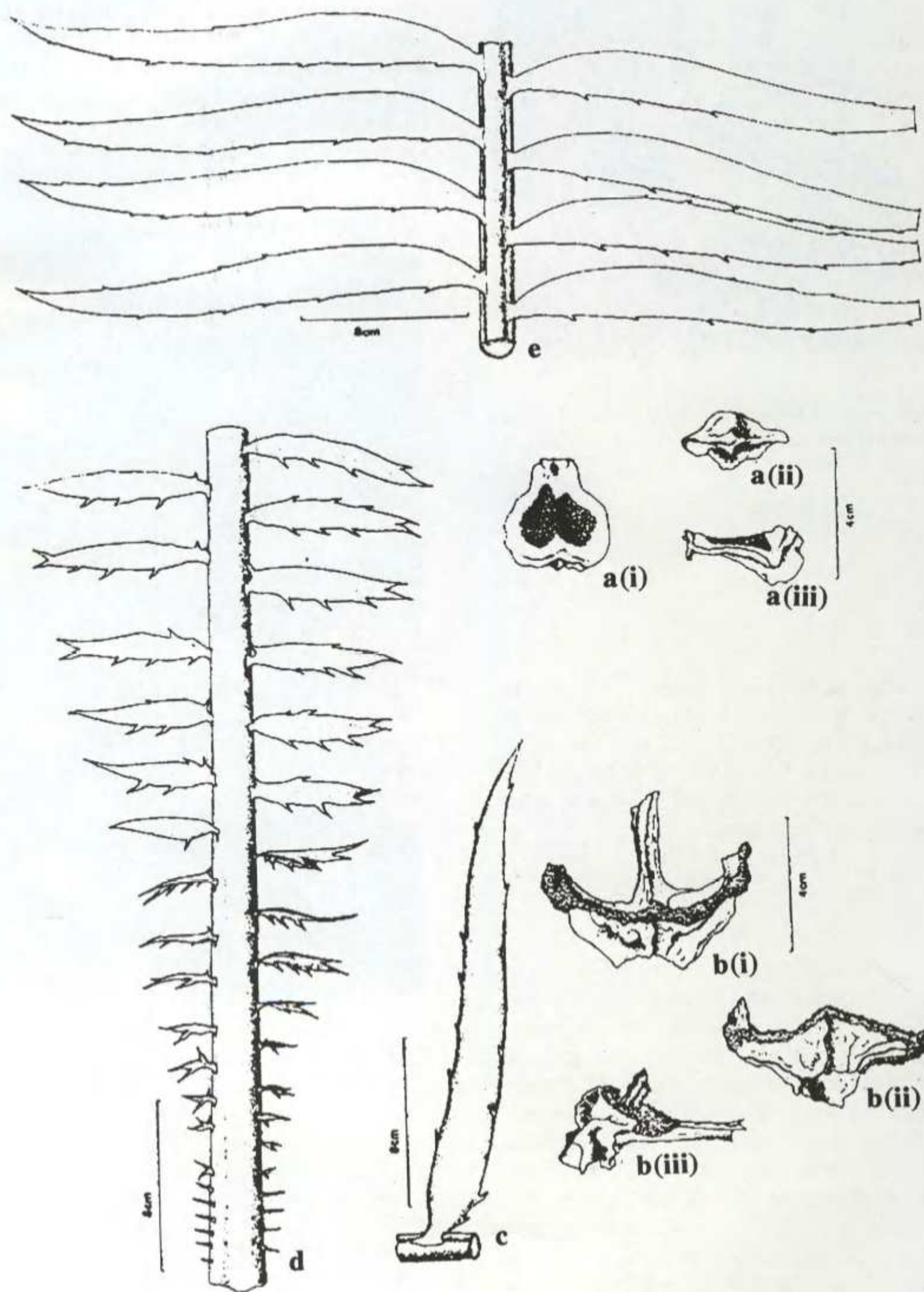


Figure 3 *Encephalartos whitelockii*: (a) median microsporophyll, (i) abaxial view, (ii) frontal view, (iii) side view; (b) median megasporophyll, (i) adaxial view, (ii) frontal view, (iii) side view; (c) median leaflet; (d) proximal leaflets; (e) median section of leaf. Delineator: S. Burrows.



Figure 4 *Encephalartos whitelockii*: male cones *in situ*, showing well-developed peduncles and successive maturation of cones. Photo: Johan Hurter.

DESCRIPTION

1. STEM

Plant arborescent, suckering from the base. Trunk (Figures 1, 2) usually up to 3.5 m long (rarely up to 8 m long), reclining when exceeding 2 or 3 m (Vorster & Heibloem 1995) (Figure 2), 350-450(-750) mm in diameter, leaf bases persistent (Figure 2), with little or no woolly indumentum at the apex.

2. LEAVES

The numerous leaves (Figures 1, 2), arranged in a dense crown, are fresh milky green when emerging and turning glossy green with age, sessile to subsessile, spreading-ascending, rigid and straight to apically recurved, 2.5-4.1 m long, slightly pubescent when emerging but glabrous at maturity. Rachis tomentose, becoming glabrous with age. Leaflets spreading, dentate, veins not raised abaxially, margins slightly revolute; median leaflets orientated at an angle of about 30° towards apex of leaf, opposing leaflets set at an angle of 160-180° towards each other; median leaflets 180-300 mm long and 20-30 mm wide, narrowly elliptic and very slightly falcate or S-shaped (Figure 3e), with teeth 20-70 mm apart on both margins, gradually acuminate apically, pungent and subsessile basally, apically somewhat turned towards the leaf apex, not or only slightly overlapping (succubously oriented), hard and rigid; proximal leaflets gradually reduced to a distinct series of prickles (Figure 3d).

3. CONES

The male cones (microstrobili) are seriate (emerging and maturing in succession), 4-8 per trunk, narrowly ovoid, up to 500 mm long and 85-95 mm across at pollen shedding stage, glabrous, milky green becoming yellow with age, each carried on a stout peduncle up to 320 mm long (Figure 4); median male cone scales (microsporophylls) rhombic, about 29 mm wide, 32 mm long and 14 mm high, exposed faces of male cone scales moderately projecting, slightly drooping at pollen shedding stage, terminal facet smooth (Figure 5).



Figure 5 *Encephalartos whitelockii*: portion of male cone at pollen shedding stage, showing drooping terminal facets of exposed faces of microsporophylls. Photo: Johan Hurter.

Female cones (megastrobili) 1-4 per trunk (Figure 6), ovoid, 300-450 mm long, 150-170 mm across, milky green, glabrous, appearing sessile but with peduncle (up to 100 mm long) cloaked by cataphylls in the trunk crown (Figures 6, 7) (Vorster & Heibloem [1995] describe the female cones as being sessile and it is presumed that Piet Vorster did not see any *in situ* photographs of female plants in cone with some of the leaves around the cones removed [see Figure 6], and based the description on the cut female cone provided by Heibloem who did the fieldwork); median female cone



Figure 6 *Encephalartos whitelockii*: female cones *in situ*, showing peduncles cloaked by cataphylls in the trunk crown. Photo: Johan Hurter.



Figure 7 *Encephalartos whitelockii*: close-up of female cone. Photo: Johan Hurter.

scales (megasporophylls) descending in appearance (Figure 7), rhombic, exposed faces of female cone scales moderately projecting, terminal facet centrally situated, median facet differentiated in most cone scales, ridges separating facets clearly differentiated and simple, facets more or less smooth (Figure 8).

About 400 seeds per cone, sarcotesta orange-red, seed with sarcotesta about 38 mm long and 25 mm across; with sarcotesta removed 30-35 mm long and 22-25 mm wide.

According to Vorster & Heibloem (1995) plants growing in more open situations have a very different general appearance from plants growing within the evergreen montane forest, in that they are more compact with straighter and more rigid leaves than the etiolated forest plants, and are also considerably smaller. Within the forest, plants attain stupendous dimensions with trunks up to 750 mm in diameter and up to 8 m long. The cones collected for study, including male cones at the pollen-shedding stage, retained their glaucous green pigmentation, but field reports indicate that they may sometimes turn pale yellow when maturing.

DIAGNOSTIC FEATURES AND AFFINITIES

Encephalartos whitelockii superficially resembles *E. hildebrandtii* because of its stiff dentate and pungent green leaves. However, even vegetatively it is easily distinguished from this species. In *E. hildebrandtii* the leaflets are ascending, succubously overlapping and falcate with the apices directed toward the base of the leaf. In *E. whitelockii* the leaflets are spreading, not overlapping, and falcate with the apices directed toward the apex of the leaf, and have teeth at regular intervals along both margins. Profound differences are also observable between the cones. Male cones of *E. whitelockii* are pendulous at maturity while those of *E. hildebrandtii* are erect. The male cone scales of *E. whitelockii* are spreading while those in *E. hildebrandtii* are strongly ascending. The female cone scales of *E. hildebrandtii* are spreading and the bullae are not drawn into descending structures as with those of *E. whitelockii*.

According to Vorster & Heibloem (1995) the following is intended to identify *E. successibus*, but is certainly not intended to infer phylogenetic relationships. When reading this, keep in mind that the name *E. successibus* is a synonym of *E. whitelockii* and should be replaced by the latter name.



Figure 8 *Encephalartos whitelockii*: portion of female cone showing more or less smooth facets of exposed faces of megasporophylls. Photo: Johan Hurter.

Encephalartos successibus is distinguished by its ovoid, sessile glabrous, glaucous green megastrobili of which the surfaces of the exposed faces of the megasporophylls are more or less smooth; its multiple and successively maturing, long-peduncled, glabrous, glaucous green microstrobili with smooth and slightly drooping exposed faces of the microsporophylls; and not- or only slightly overlapping leaflets which lack a concentration of 3 to 4 teeth at the base of the upper margin and instead have teeth at regular intervals along both margins.

It resembles *E. bubalinus* Melville in its green and ovoid megastrobili, but differs by the megastrobili being completely sessile instead of peduncled, and by the long-peduncled instead of almost sessile microstrobili. In *E. successibus* the leaflets taper gradually to their apices whereas in *E. bubalinus* they are uncinata.

It resembles *E. imbricans* Vorster (synonym of *E. equatorialis* Hurter) in its green, ovoid megastrobili, but is readily distinguished by smooth instead of somewhat wrinkled facets of the exposed megastrobilate faces, and the not or only slightly instead of strongly overlapping leaflets which also lack the concentration of 3-4 teeth near the base of the upper leaflet margin.

It resembles *E. laurentianus* De Wildeman with which it was confused, mainly by its large stature. It has similar ovoid megastrobili, but these are sessile rather than well-peduncled, and the facets of the exposed faces of the megasporophylls are smooth instead of somewhat wrinkled. Like *E. laurentianus* it bears a large number of long-pedunculate microstrobili, but is distinguished by the absence of a characteristic thin indumentum of reddish-brown trichomes, and green rather than greenish-yellow pigmentation of the strobili. Vegetatively *E. laurentianus* is a very different species, with much larger (up to 500 mm long and 50 mm wide) and softer textured leaflets.

It resembles *E. septentrionalis* Schweinfurth by its ovoid megastrobili and long-peduncled microstrobili, but differs in the sessile instead of very long- (up to 300 mm) peduncled megastrobili and the glaucous green instead of greenish-yellow pigmentation of the strobili. It also lacks the concentration of up to 4 teeth near the base of the upper margin of the leaflet. Despite being known for 125 years, *E. septentrionalis* is not well known, and in view of its unusually wide geographical distribution more than one species may be involved. In this respect it is worth noting that the very long megastrobilate peduncle depicted by Goode (*Cycads of Africa*, 1989: 239) is not mentioned elsewhere in the literature.

It resembles *E. sclavoi* De Luca, Stevenson & Moretti by the ovoid megastrobili, but differs in that the megastrobilus is sessile, both mega- and microstrobili are green with centrally placed terminal facets on the exposed faces of the megasporophylls instead of orange-yellow with terminal facets situated towards the proximal margins of the exposed faces of the megasporophylls, the long (up to 300 mm) instead of very short-peduncled (20-40 mm) microstrobili, and the narrower (up to 30 mm against up to 40 mm) leaflets.

Compared to *E. turneri* Lavranos & Goode, both species have sessile megastrobili but in *E. turneri* the megastrobilus is narrowly ovoid instead of ovoid, the exposed faces of the megasporophylls project more, and it bears fewer microstrobili (up to 3 versus 4-8) on shorter peduncles (up to 120 mm instead of up to 300 mm). In both sexes of *E. turneri* the cones are not green but yellowish with a conspicuous pink bloom. In *E. successibus* the leaflets are not or only slightly overlapping instead of strongly imbricate, and the apices taper to a fine point instead of being uncinata.

E. successibus resembles *E. ituriensis* Bamps & Lisowski by its long-peduncled microstrobili. However, in *E. ituriensis* the megastrobilus is shortly cylindrical and the strobili of both sexes are yellow instead of green. Moreover, the type collection of *E. ituriensis* leaves the impression of relatively soft-textured and flaccid leaflets as in *E. laurentianus*, in marked contrast to the hard and rigid leaflets of *E. successibus*.

Other east African arborescent species with which we compared *E. successibus* are *E. hildebrandtii* A. Braun & Bouché, *E. kisambo* Faden & Beentje, and *E. tegulaneus* Melville. From all these it differs by its glaucous green instead of yellow cones, and the ovoid instead of cylindrical megastrobili. Yet in various respects it resembles these species, which probably indicates a near relationship. Therefore, in all four species the microstrobili are borne on very long peduncles which can be up to 300 mm long. In both *E. successibus* and *E. hildebrandtii*, the microstrobili emerge and mature in succession rather than simultaneously. This trait is shared by *E. imbricans* Vorster (synonym of *E. equatorialis* Hurter), *E. gratus* Prain from Malawi and *E. ferox* Bertoloni from southern Mozambique and South Africa, and is suspected to be present in at least some other tropical African species including *E. septentrionalis* and *E. laurentianus*. In the South African species, in the *E. manikensis* Gilliland complex, the *E. poggei* Ascherson & Graebner group, and in *E. barteri* Miquel the cones emerge simultaneously. Leaflets of Kenyan material of *E. hildebrandtii* characteristically have 2 to 3 apical teeth; and though not common in *E. successibus*, occasional leaflets do show this trait which is also present in some (but not all) specimens of *E. laurentianus*."

GEOGRAPHICAL DISTRIBUTION AND HABITAT

At present this species is known only from one area along the Mpanga River, western Uganda. According to Vorster & Heibloem (1995) this "vigorous population around the Mpanga River falls occurs at altitudes of 1000 to 1300 m, but there are unconfirmed reports of other populations along the Mpanga River, which debouches into Lake George. Plants occur for 1 to 2 km upstream as well as below the falls, but were not seen further than about 250 m from the shore. They grow on almost sheer granite faces and on rocky slopes, in association with *Euphorbia dawei* N.E. Br. amongst tall grass in savanna where the foliage is annually destroyed



by fires, but also within dense evergreen montane forest. The forest habitat is so moist that the trunks and even the leaves are covered in lichens and mosses."

CONSERVATION STATUS

Quoting Vorster & Heibloem (1995): "The population visited was particularly healthy, consisting of at least 5 000 to 10 000 sexually mature individuals. Seedlings and small plants were noticeably absent from open habitats where they are presumably destroyed by the annual grass fires. This raises the question of whether the forest has receded in recent years, leaving the cycads marooned in the open. Underneath the forest canopy, seedling regeneration was found to be prolific, with thousands of seedlings and small plants in evidence, probably because fires do not penetrate into this moist habitat."

ACKNOWLEDGEMENTS

The senior author (Johan Hurter) named this species for Loran M. Whitelock, horticulturist and cycadologist, who has made most of Johan's recent exploration of central and east Africa possible and who has devoted a life time to cycads.

Quoted passages from Vorster & Heibloem reprinted from the *South African Journal of Botany*, Vol. 61, No. 6: 347-351, December 1995, with permission from the editor.

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 VORSTER, P. & HEIBLOEM, P. 1995. *Encephalartos successibus* (Zamiaceae): a new species from Uganda. *South African Journal of Botany* 61(6): 347-351.



ENCEPHALARTOS APLANATUS VORSTER : THE WEEVIL PERSPECTIVE

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Received 27 July 1996

In *Encephalartos* 46 (June 1996), Prof. Nat Grobbelaar commented on the recent description of *E. aplanatus* by Dr Piet Vorster (Vorster 1996) and expressed some doubts about its validity as a species distinct from the similar and rather variable *E. villosus*. In the same issue of this journal, Piet Vorster discussed *E. aplanatus* in the "Focus on ..." section and referred to the weevils that inhabit both *E. villosus* and *E. aplanatus*, and to our joint poster delivered on this very aspect at the recent International Conference on Cycad Biology held in China (Vorster & Oberprieler 1996). Since the information on this poster is very brief and technical and also presently not readily available to the South African cycad enthusiast, I would like to explain the entomological evidence pertaining to this case in a little more detailed but less technical way here.

It is probably well known to most cycad growers in South Africa by now that quite a number of weevils (superfamily Curculionoidea) inhabit particularly the cones of *Encephalartos*, as of nearly all other cycads in the world. Apart from the notorious long-snouted *Antliarhinus zamiae* and *A. signatus*, whose larvae destroy the seeds of cycads, the most common weevils inhabiting cycad cones in South Africa belong to the genera *Amorphocerus* and *Porthetes*. The *Amorphocerus* weevils are shiny black and stout and develop predominantly in decaying female cones (without destroying the seeds!), while the more delicate *Porthetes* weevils are brown and sparsely hairy or scaly and develop mostly in the sporophylls of the male cones (see Oberprieler 1996a). Of all the weevils associated with *Encephalartos*, it is *Porthetes* that is the most likely candidate to effect the pollination of these plants, and thus a truly "good" weevil.

In a recently completed systematic revision of the tribe Amorphocerini (which includes *Amorphocerus*, *Porthetes* and a new, ancestral genus), I have come to recognize 16 species of *Porthetes* (12 of them being new to science) and also that (with a single exception) all of these are strictly host-specific and only develop in the cones of one particular cycad species. Furthermore, closely related *Porthetes* species nearly always occur on closely related cycad species (as far as their phylogenetic relationships are currently understood; a rigorous analysis is still

outstanding) and form species groups that are generally in very good agreement with those of the cycads. This also applies to the group that inhabits the *E. villosus* group of cycads.

The presence of *Porthetes* weevils on *E. villosus* has been known since Alice Pegler's first collectings and observations at Kentani in the Eastern Cape/Transkei nearly a century ago and Pearson's (1906) subsequent publication thereof. Pearson (1906) clearly illustrated not only this weevil but also the fact that it carries cycad pollen on its body, and, largely based on this evidence, he provided the first suggestion that at least *E. villosus* was pollinated by insects and not by wind. Experimental proof for this weevil pollinating *E. villosus* is still outstanding, but we now know for certain that it also visits female cones (even breeds in them to some extent) and must at least play some part in the pollination of this cycad species.

The precise identity of this weevil has unfortunately been very confused. Pearson himself started this when he had Alice Pegler's weevil identified by Dr L. Péringuey of the South African Museum in Cape Town as *Phloeophagus hispidus* - both these names are wrong. *Phloeophagus* is quite a different genus, belonging to a different group of weevils altogether and not occurring in South Africa at all, while *hispidus* is indeed a *Porthetes* but a smaller species that occurs in *E. friderici-guilielmi* only. Rattray (1913) and Marloth (1914) then confused this weevil with *Antliarhinus* and thereby utterly obscured its true habits and indicated role in pollination, and this uncertainty surrounding its identity and biology was extended into several more recent publications citing these early investigations. As it turned out, this *Porthetes* weevil is in fact undescribed, and in my revision I have now named and described it *P. pearsoni*, in recognition of Pearson's first and only largely correct assessment of this species so far. The name and description of *P. pearsoni* is, however, not yet officially published. In the eastern Cape Province, a close relative of *P. pearsoni* occurs on *E. caffer*. This species is darker and more robust with stouter but similarly strongly clubbed antennae and was also described in my recent revision.

As presently known, *P. pearsoni* occurs along the

eastern Cape coast from about Port Elizabeth to Kentani and along the southern Natal coast as far north as Durban. It has also been introduced into Pretoria, where it is now very common on *E. villosus* and regularly breeds in its male sporophylls. It also visits the male cones of many other species in Pretoria (which probably has major consequences in respect of contamination by foreign pollen), but it has not been found to breed in the cones of any species but *E. villosus*. The 1390 specimens of *P. pearsoni* I have examined from all these localities show a small degree of morphological variation but nothing definite and consistent that would permit a division into several species or even subspecies.

However, when I examined some similar specimens collected by Piet Vorster in 1992 in the male cone of an *E. villosus* plant in the garden of Rev. Hennie Basson in Siteki, Swaziland, it was apparent that their differences in crucial characters of the rostrum, sculpture and antenna fell outside the spectrum of variation as displayed by all the other populations of *P. pearsoni* that I have examined. Knowing the narrow host specificity of *Porthetes*, the habits of *P. pearsoni* to visit male cones of other cycads in cultivation, and that the Siteki plant in question was planted in a garden, I could entertain only two explanations for the presence of such a different weevil on this plant: either it was only visiting this *E. villosus* plant but breeding on a related species in the vicinity (*E. umbeluziensis* being the most likely candidate), or the Siteki Plant was not *E. villosus* but a closely related species. The second alternative became the more plausible one when Rev. Basson subsequently sent me parts of an old male cone of the same plant, from which I could extract a dead but intact weevil from a pupal chamber in a sporophyll, proof that this weevil was indeed breeding on this plant.

At that stage (December 1995) I turned to Piet Vorster to obtain a botanical opinion on the status of the Siteki population of *E. villosus*, sketching my entomological problem to him. To my surprise, he told me that he had just recently described this population as a new species distinct from *E. villosus* and that the description of this *E. aplanatus* was to be published soon. He was as delighted that my weevils supported his conclusion as I was that his decision regarding the plants concurred with mine about the weevils. We have thus reached our respective conclusions quite independently and only afterwards combined our data to produce the poster for CYCAD 96.

There is therefore little doubt that the Siteki plants and their weevils differ from typical *E. villosus* and its weevil; the question is just how to interpret these differences and how to express them taxonomically. As far as the weevils are concerned, the differences between the Siteki weevil and *P. pearsoni* are smaller than those between the latter and its eastern-Cape relative on *E.*

caffer (a mirror of the situation pertaining to their hostplants), which indicates *P. pearsoni* and the Siteki weevil to be very closely related. The difficulty is to decide whether this closeness represents conspecificity or not, i.e. whether the spectrum of morphological variation of *P. pearsoni* is in reality wider and includes the Siteki weevil as well. Although these two taxa are currently separated by a long distance (Durban - Siteki), populations of *E. villosus* do occur in between these areas (Goode 1989), and it is therefore possible (indeed likely) that these intermediate cycad populations may also harbour such weevils. If such geographically intermediate populations of weevils are also morphologically intermediate, they would obliterate the differences currently visible between *P. pearsoni* and the Siteki weevil and indicate the latter to represent only the northernmost population (form) of a morphological and geographical cline. The taxonomic interpretation of such clinal end populations is notoriously difficult and thorny; as a rule they are regarded as conspecific when continuous populations and gene flow can be demonstrated, but as separate species when this is apparently not the case. Treating them as subspecies is a third alternative but, in my opinion, the least satisfactory one because of the totally arbitrary nature of the subspecies concept, both in theory and in practice (that's another subject altogether).

For the moment therefore, I have to assume not only a morphological distinctness for the Siteki weevil but also a geographical one, the latter both because no intermediate weevils are known and because *E. aplanatus* is seemingly rather isolated from the nearest population of *E. villosus* (Goode 1989, Vorster 1996). Under these circumstances, the most appropriate taxonomic treatment of the Siteki weevil is therefore to regard it as a distinct species, as I have done in my recent revision of the Amorphocerini. Whether I will have to rescind this at a later stage when and if intermediate weevil populations are found, remains to be seen. Species descriptions and similar taxonomic decisions are only scientific hypotheses like all other biological dictums; they are erected to provide a falsifiable postulate and can only be accepted if (or as long as) falsification is not achieved (since proper verification is impossible).

Whether the botanical evidence currently available supports the recognition of *E. aplanatus* as a distinct species or not I cannot judge since I am not a plant taxonomist. All I can say is that Piet Vorster's description of *E. aplanatus* is in clear concord with my (completely independently derived) conclusion to treat its *Porthetes* weevil as a distinct species, too. Furthermore, the taxonomic closeness of this weevil to *P. pearsoni* correlates very well with the closeness of *E. aplanatus* to *E. villosus*, which provides good evidence that both *E. aplanatus* and its weevil became isolated from *E. villosus* and *P. pearsoni* together and also speciated in tandem. Such proper cospeciation on

species level is evident in several other species pairs of *Porthetes*, too, as it is in some *Amorphocerus*. As I explained in more detail elsewhere (Oberprieler 1996b), I would argue that such cospeciated plants and weevils should generally be given the same taxonomic rank, reflecting their joint speciation and evolutionary history. Therefore, if *E. aplanatus* is given specific rank, the same should apply to its cospeciated weevil (in any case, even if not independently derived). On the other hand, if this weevil turns out to be conspecific with *P. pearsoni* in a clinal fashion, the same should hold true for *E. aplanatus* and *E. villosus*.

Under these circumstances and from a weevil perspective, I can thus only support Piet Vorster's separation of *E. aplanatus* from *E. villosus*; in fact this is the only recent description of a new *Encephalartos* species that is supported by some independent evidence and therefore makes evolutionary sense. Whether this evolutionary event is best reflected by treating both the plants and the weevils as distinct species is, of course, a matter of conjecture (and convention perhaps), but it is the most appropriate scientific hypothesis we can erect at present. Come and falsify it, that's what it is there for and that's what scientific research is all about!

From this it should be clear that I don't cast my decision to regard the *E. aplanatus* weevil as a distinct species in stone, and I presume neither will Piet Vorster as far as the cycad is concerned. If further weevil specimens contradict this my current hypothesis, I will gladly abandon it in favour of a better one. To this end and to test the hypothesis, I therefore welcome any further specimens of *Porthetes*, particularly from the Natal populations of *E. villosus* and from related taxa such as *E. ngoyanus*, *E. cerinus* and *E. umbeluziensis*. I know that certainly *E. umbeluziensis* also harbours a species of

Porthetes in its male cones, I have seen the larval tunnels and pupation chambers in the sporophylls but not yet found the actual weevils. The identity of such *Porthetes* weevils living on these three cycad taxa would be of great assistance in further reconstructing the evolution of this lineage of *Porthetes*, as of the *E. villosus* group.

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LEPIDOZAMIA HOPEI (ZAMIACEAE), THE WORLD'S TALLEST CYCAD

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Lepidozamia hopei Regel is an attractive and commonly cultivated cycad that eventually develops a trunk. It is endemic to north-eastern Queensland in the area known as the "Wet Tropics" and is thought to occur in many separate populations between Bloomfield in the north to Dallachy Creek near Cardwell in the south (Bosworth 1993). The Queensland Herbarium (BRI) has twelve specimens of this cycad with the most northerly coming

from Whyanbeel and the most southerly from the Bellenden Ker massif. Despite it being a common plant, it remains poorly collected and additional herbarium vouchers are required to document its known range.

Very little is known about either the natural history or demography of *L. hopei*. There is no published information on insects associated with the cones nor

Table 1 Local Aboriginal Names for *Lepidozamia hopei*

| given as | corrected spelling* | source |
|----------|---------------------|------------------------------|
| Arumba | Ngarumba | Bailey (1902) |
| Binggera | Binggira | Meston (1904) |
| Bingehr | Bingir | Hinxman (1992) |
| Wunuh | Wunu | Hinxman (1992) |
| Julbin | Julbin | Roberts <i>et al.</i> (1995) |

* as given in Hinxman (1992)

Table 2 Heights of *Lepidozamia hopei* reported in the literature

| Source | Comment |
|------------------------------|--------------------------------|
| Bailey (1886) | "to 60 ft high" |
| Bailey (1902) | "to 60 ft high" |
| Chamberlain (1919) | "height of sixty feet" |
| Thieret (1958) | "to 18 meters" |
| Johnson (1959) | "up to 20 m" |
| Cribb & Cribb (1974) | "reaching a height of 18 m" |
| Everist (1974) | "up to 10 m" |
| Butt (1984) | "reaching twenty metres high" |
| Morris (1984) | "possibly reaching up to 20 m" |
| Whitelock (1985) | "more than twenty meters" |
| Krempin (1990) | "10-20 m" |
| Butt (1991) | "reaching 20 metres" |
| Dowling & McKenzie (1993) | "up to 20 m tall" |
| Jones (1993) | "to 20 m tall" |
| Osborne (1993) | "reaching 20 m in height" |
| Cooper & Cooper (1994) | "to 20 m" |
| Stewart (1994) | "2-20 m" |
| Roberts <i>et al.</i> (1995) | "20-25 m" |

those that may feed on the foliage. Given the mass of swarming *Tranes* beetles that is associated with pollen shedding in *L. peroffskyana* Regel (Kennedy 1991; Forster *et al.* 1994), observers are encouraged to investigate whether a similar phenomenon also occurs with *L. hopei*. In comparison with many other cycads, populations of *L. hopei* often consist of greatly scattered individuals and "cycad groves" appear infrequent. This could possibly indicate that seed dispersal for this species is more effective than in many other species where distribution is often clumped.

The seeds of *L. hopei* were harvested by aboriginal people in the times when traditional culture was still practised in the "Wet Tropics" region. There are few detailed records of this use, but the plant was known by several local names (Table 1). Individuals of *L. hopei* were climbed to harvest the seed prior to the female cones disintegrating and the seed being scattered by animals, especially white-tailed rats (Bosworth 1993)

that eat the fleshy red sarcotesta (Cooper & Cooper 1994). The climbing of tall plants was facilitated by the cutting of footholds (Bosworth 1993) and was undoubtedly a dangerous occupation due to the distance from the ground in some instances. A single cone may have as many as 350 seeds so despite a tedious preparation technique, they were evidently worth collecting. The Kuku Yalanji describe their technique thus - "You first cook the seeds in that earth oven. We then crush the kernels to make them into flour. We then wash the toxins out by putting the flour in a dilly bag. You have to line it with leaves to stop the flour washing out. You wash the toxins out in running water. That takes a long time. Maybe up to 3 days. When the poisons are washed out, we cook bread or damper with it." (Roberts *et al.* 1995). This method is similar to that for the preparation of seeds of *Cycas* spp. (Beck 1992; Roberts *et al.* 1995). Whether or not there is any cumulative toxicity from consumption of this species is unknown.



Figure 1 *Lepidozamia hopei* at Pine Creek, Malbon Thompson Range. The individual in the foreground is 12.5 m high and the one in the background is 17.5 m high. Photo: P.I. Forster.

Lepidozamia hopei has often been mentioned as one of the tallest known cycads, not only for Australia but perhaps for the world (Chamberlain 1919; Jones 1993; Osborne 1993; Forster 1995). Chamberlain (1919) stated "The tallest of all cycads is *Macrozamia hopei*, of northern Queensland, which occasionally reaches a height of sixty feet; *Dioon spinulosum*, with an occasional specimen fifty feet in height, comes next". This reputed height of 20 metres (c. 60 feet) is repeatedly mentioned in the literature (Table 2) and appears to have originated with the account of Bailey (1886). It is doubtful if Bailey (1886) or later Chamberlain (1919) actually measured any plants and their 60 feet specimens are probably estimations. The only accurately measured individuals of *L. hopei* appear to be those mentioned by Bosworth (1993) who measured one that was 13.7 m tall and 2.36 m circumference at 1 m from the base. If giant (i.e. 20 m or more tall) individuals of *L. hopei* could be found, these would be of obvious interest because they would not only be the tallest individuals for this species, but also the tallest living cycad. Recent accounts of *Dioon*



Figure 2 Trunk base of 17.5 m high individual of *L. hopei* at Pine Creek, Malbon Thompson Range. Photo: P.I. Forster.

spinulosum suggest that it doesn't grow beyond 16 m tall (Sabato & de Luca 1985) and none of the cycad taxa described subsequent to Chamberlain's account are recorded as growing to a comparable height (Jones 1993 and subsequent accounts of new taxa).

Enquiries were initiated in north Queensland as to the location of large individuals of *L. hopei*. Bob Jago of Cairns soon responded with reports of several individuals that may be "20 m". The first of these so-called "giants" grows on the packtrack to the East Mulgrave River Falls past the upper headwaters of Babinda Creek. This individual was measured by Bob Jago, Regel Jensen and John Hunter using a string-line shot by shanghai. This plant (a female) is 14.9 m tall and 1.64 m diameter at 1 m from the base. While this is an impressive plant it is a good 5 m short of 20 m.

Not to be outdone by this, Tony Irvine and Andrew Graham of CSIRO at Atherton claimed that a plant "20 to 22 m" grew adjacent to a study plot near Pine Creek in the Malbon Thompson Range near Yarrabah. They

mentioned that this individual and another somewhat smaller plant were present in a grove of this species. In February 1995, this grove was investigated by Bob Jago and the author. After some searching the plants were located and in spite of some difficulties with canopy access, Bob Jago was able to measure both individuals, once again using a string-line shot by shanghai. The smaller plant was 12.5 m high and the larger one 17.5 m (Figures 1, 2). Certainly not "20-22 m" tall, but getting closer to this mythical height. If *L. hopei* can grow 2 m in 80 years (cf. Bosworth 1993), then this tallest plant could be in the region of 700 years old. Needless to say there is no rigorous way that this estimate may be confirmed.

Consequent to this, Bruce Gray of CSIRO at Atherton has reported a "20 m" individual at Windin Falls, but this remains uninvestigated at this stage. Further reports of giant *L. hopei* would be appreciated so that accurate measurements can be undertaken.

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ENCOUNTERS WITH CHINESE CYCADS

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Attendance of the CYCAD '96 conference in China presented a tantalizing opportunity to see Chinese *Cycas* species in natural habitat as well as in gardens, and

several of us went on pre- or post-congress tours to this end.



Figure 1 Map of southern China, showing the author's travels. Base map: National Geographic Society.

The tour on which we report here, was the shortest of the three offered by our hosts (Figure 1). This meant that cultural features such as Beijing and the Great Wall were not included, but on the positive side it provided a concentrated cycad-orientated tour. When going to China, we thought the Chinese *Cycas* flora to consist of about ten species, only to learn that the experts at Shenzhen recognise no fewer than 27 (see review of *Cycads in China*, *Encephalartos* 47: 29-31). We had the prospect of seeing only three of these in natural habitat, but hoped to see more grown in botanical gardens.

At the conference centre in Panzhihua a number of potted specimens of different species were exhibited. These were definitely not for sale. During the congress we were taken to a mountain on the outskirts of Panzhihua where a substantial population of *Cycas panzhihuaensis* is preserved. *Cycas* in China are in danger, perhaps even more so than *Encephalartos* in Africa, and for much the same reasons. It appears that in recent years large numbers were utilized as "famine food", but bush clearing for agriculture and removal for selling as ornamentals have also made grave inroads. Like *Encephalartos*, Chinese *Cycas* species don't grow in dense and extensive colonies. In the far south,



Figure 2 The imposing gateway to the *Cycas* reserve in Panzhihua. Photo: Edgar Wohlberg.

near Jinghong, the landscape is very mountainous, but unlike in Africa the slopes consist of loose friable soil without rocks, merely held in place by the roots of the tropical forest cover, including bamboo. These soils are attractive for a variety of agricultural crops, and bush-clearing is taking place at a considerable rate. Any cycads which happen to be in the way, are removed with the bush, whereas species with underground trunks do not long survive once the bush cover has been removed.

Writers so often glibly blame urban sprawl or civil engineering activities for the decline of cycads, but in my experience there are very few examples of this happening. However, at Panzhihua, *Cycas panzhihuaensis* is in real danger of eradication by open-cast mining. Chinese engineers don't play, and they simply grind up and level mountains containing valuable products such as coal, vanadium, and iron, as is the case all round Panzhihua. They were already at work on the lower slope of the spur on which hundreds of *C. panzhihuaensis* grow, when the Chinese botanists rallied to protect these plants. It took a gargantuan effort to halt the mining of this spur and protect the cycads. They spent a fortune on this effort, fencing the whole colony with a wall about 2 m high and constructing a system of paved paths for visitors. Their fund-raising efforts must have been quite successful, because after having done all this, they erected an imposing gateway to the complex (Figure 2).



Figure 3 Surface mining just outside the *Cycas* reserve in Panzhihua. The gateway is visible to the right, and part of the surrounding wall to the left. Note heavy industrial haze over the town in the background. Photo: Piet Vorster.



Figure 4 Habitat of *Cycas panzhihuaensis* in *Cycas* reserve in Panzhihua. Photo: Piet Vorster.

As it happened, the surface mining of the mountain is



Figure 5



Figure 6



Figure 7

Figures 5-7 *Cycas Panzhihuaensis*: plants in habitat, in *Cycas* reserve in Panzhihua. Photos: Piet Vorster.

continuing right to the border of the cycad reserve, and to an ecologist the denuded mountain slopes present an alarming aspect. Due to the heavy industries conducted in the city, the air is thick with industrial haze, and it is not inconceivable that this could have had a damaging effect on cycad-associated insects (see Figure 3).

The vegetation associated with the cycads was a low and open savanna, in superficial appearance not unlike that found on the sandstone ridges round Pretoria. The climate is probably only slightly hotter. The rocks, however, were weathered limestone which is apparently much harder and less prone to weathering than the dolomite found in South Africa. The cycads grew scattered in this vegetation, on grassy slopes or between boulders, but not really on cliffs (Figure 4).

The plants were spaced about as densely as *Encephalartos lanatus* near Middelburg, and bore an uncanny resemblance to them. They grow in direct sunlight, although some have been overtopped by small trees growing up next to them (Figures 5-7).



Figure 8 *Cycas panzhihuaensis*: male cone, about 450 mm long. Photo: Piet Vorster.

We were lucky to find fresh cones of both sexes. The male cones are pretty conventional (*sic*), up to about 450 mm long, more or less hairless and yellow, with the tips of the sporophylls each carrying a very short erect spine (Figure 8). The cones emitted a noticeable odour, but no insects apart from a few ants could be detected in them. A planned nocturnal visit to look for night-active insects unfortunately did not materialize. I should mention that the Chinese botanists believe that these



Figure 9



Figure 10

Figures 9, 10 *Cycas panzhihuaensis*: female cones at different stages of development. Top: opening when receptive to pollination and about 150 mm across; bottom: closed, presumably after pollination and about 170 mm across. Photos: Piet Vorster.

plants are mostly wind-pollinated and to a lesser extent ant-pollinated. In spite of the large number of plants, seed-set is said to be very low.

The female cones (Figures 9, 10) are of the compact type as found in *Cycas revoluta*. They are slightly wider than long with the sporophylls covered with a short buff-coloured indumentum. When receptive to pollination, the sporophylls open in spiral layers reminiscent of the opening of male cones of *Lepidozamia peroffskyana*, again emitting a noticeable odour.



Figure 11 *Cycas panzihuaensis*: seedling plants in a grove for seed production, in a botanical garden in Panzihua. Photo: Piet Vorster.

We also visited two botanical gardens in Panzihua, in one of which groves of seed-grown *C. panzihuaensis* are grown for seed production. This is a serious effort to safeguard the species against extinction and to make plants available for horticulture (Figure 11).

Our first stop on the post-congress tour was the town of Kunming, built on the shore of a large but shallow lake which is intensively utilised for aquaculture, including

farming with freshwater pearls. At the far end of the lake is a sheer mountain of limestone with caves still used by Buddhist monks, with a wonderful view over the lake. At Kunming our party visited the botanical garden, but I was indisposed on that day and am unable to report on it.

From Kunming we travelled to Jinghong in the far south, to my regret by air rather than by road. Jinghong is in the humid tropics. At the time of our visit it was before the onset of the monsoon rains, yet the air was hot and humid. Tropical palms, including *Cocos nucifera* and the African Oil Palm, *Elaeis guineensis*, were everywhere in evidence (Figure 12). The town is situated on the bank of the Mekong River, and we were quartered in a splendid resort-like hotel set in a landscaped garden. From here we made three day trips.



Figure 12 *Elaeis guineensis* (African Oil Palm) lining a street in Jinghong. Photo: Piet Vorster.



Figure 13 *Cycas pectinata* in the Xishuangbanna Botanical Garden. Photo: Edgar Wohlberg.

The first trip was to the Xishuangbanna Tropical Botanical Garden, east of Jonghong. This is only about 75 km by road from Jinghong, but seems to be much further as the rather narrow and winding road follows a

river. For many kilometers this road is lined with *Elaeis* palms. The ground beside the river is steep mountain, here and there still covered with tropical forest but mostly with secondary growth and agricultural crops, including rubber. The floodplains are invariably covered with rice paddies, usually with the obligatory water buffaloes. The Xishuangbanna Tropical Garden is literally in the middle of nowhere, yet it seems to be a popular tourist destination. The garden is associated with an agricultural research station of the Chinese Academy of Sciences, and constitutes a splendid landscaped garden with collections of cycads, palms, Araceae, Zingiberaceae, orchids, and ferns, amongst others. The cycad section contained some very big plants of *Cycas pectinata* (Figure 13) which occurs wild in the vicinity, as well as smaller specimens of several other Chinese species.



Figure 14 *Cycas balansae* in deciduous riverine forest at Guanping. Photo: Edgar Wohlberg.

In the afternoon we travelled further along this road to a spot in the deciduous forest where we viewed *Cycas balansae*. This forest, again on a reasonably steep slope, must be quite wet for much of the year because leeches were much in evidence. *Cycas balansae* has an underground stem which in nature seems to be mostly solitary. The leaves are carried more or less erect, were up to 1.2 m long, and looking for all the world like those of *C. thouarsii*. The plants did not look particularly

vigorous, having only about 6 leaves which were broken and battered at the time of the visit. I got the impression that the plants were not happy in these forest situations, and we saw no cones. The next day we travelled westwards to Guanping where there is a herd of working elephants, where we examined *Cycas balansae* growing in apparently deciduous forest bordering a river (Figure 14).

These plants had the same tattered appearance as those we saw the previous day, but here we found both male and female cones. The males were quite unremarkable, about 250 mm long, but crawling with beetles of which Willie Tang collected a sample for Rolf Oberprieler. Hopefully Rolf will eventually report that these beetles are related to beetles already suspected to be involved in the pollination of *Cycas*. Unfortunately the photograph was destroyed in an accident.

The female cones were compact, spherical structures 100-120 mm across, and the sporophylls were deeply dissected into finger-like segments (Figure 15).



Figure 15 *Cycas balansae*: immature (?) female cone, about 100 mm across, at Guanping. Photo: Piet Vorster.

Our last trip to a natural population again took us eastwards, past the Xishuangbanna Botanical Garden to the Mengla Nature Reserve, only a few kilometers from the border with Laos. Our aim here was to see *Cycas pectinata*. This entailed climbing a very steep mountain slope in which thousands of steps had been cut by our Chinese hosts. The vegetation comprised deciduous secondary forest with numerous large bamboo clumps, the latter forming at a certain altitude a pure bamboo belt. Again rocks were not in evidence, and one can only think how much of this beautiful friable soil gets washed away by the monsoon rains once the vegetation has been cleared. Soon we started seeing beautiful specimens of *C. pectinata*, 1.5 to 4 metres tall (Figure 16). Usually these were unbranched, but some evidently had their crowns damaged at some stage in the past (probably snapped off in storms), and consequently sported several branches.



Figure 16 *Cycas pectinata* in bamboo forest at Mengla, with Ian Turner for scale. Photo: Edgar Wohlberg.

The plants seldom suckered from their bases like *Encephalartos* do. We did not find fresh cones, but seedlings were seen. Finally we reached a neck on top of the slope, where we saw what must surely be the grandmother of all *Cycas pectinata*, a branched plant estimated to be 13 metres tall. (Figures 17, 18).

From Jinghong we travelled by air to Guangzhou, which



Figure 17 *Cycas pectinata*: an enormous specimen, estimated to be 13 metres tall, at Mengla. Photo: Edgar Wohlberg.

lies about 80 km north-west of Hong Kong on the Xun (Jiang) River delta. Here we visited the botanical

Garden maintained by the Chinese Academy of Sciences. Judging from the vegetation, this is high rainfall area, and lying at about 22°N near sea level, pretty tropical. This is another well-maintained, beautifully landscaped garden. Their cycad collection consists mostly of Chinese species (although the seedling collection in the nursery contains a representative selection from elsewhere). We were particularly intrigued by a large collection of similar-looking plants bearing different names including *Cycas balansae*, *C. fairylakea*, *C. guandongensis*, *C. guizhouensis*, *C. multiovata*, *C. segmentifida*, and *C. szechuanensis* (Figures 19-21). To me they all looked like *C. balansae* which we saw in habitat, but these plants growing in exposed situations on a lawn were suckering profusely and carried large clumps of beautiful intact leaves.



Figure 18 *Cycas pectinata* with *dramatis personae* Ken Hill, Dennis Stevenson, Willie Tang, and Chia-Jui Chen in Jinghong. Photo: Piet Vorster.



Figure 19 *Cycas balansae*-like plant in the Guangzhou Botanical Garden, clumped with underground trunks, and with leaves about 2 metres long. Photo: Piet Vorster.

Our hosts pointed out that their megasporophylls exhibited subtle differences, and they considered these differences to have taxonomic significance.



Figure 20 *Cycas segmentifida*: female cone, about 200 mm across, in the Guangzhou Botanical Garden. This species is characterized by the repeatedly segmented sporophylls. Photo: Piet Vorster.

Here also we saw plants which are labelled *Cycas revoluta* but in profile looked like *Encephalartos friderici-guilielmi*, having opposing leaflets arranged in a V-shape and the leaves conspicuously recurved (Figure 22). The female sporophylls seem to become hairless quite early in life. To me these plants suggest that *there may be* truth in the Chinese supposition that *C. revoluta* occurred naturally on the Asian mainland until at least recently, because these plants definitely look different from those grown elsewhere in the world and presumably originating from the Japanese Ryukyu Islands.

On our last day in China we travelled by bus on a multi-lane highway to Shenzhen. Shenzhen is only ten years old, but it is a modern city of skyscrapers and wide streets, easily dwarfing Hong Kong. Here our destination was the Fairy Lake Botanical Garden. This is a very large botanical garden, spectacularly landscaped round a lake in a deep basin between hills (Figure 23).

It is also a very scientifically-orientated botanical garden where much original research takes place, including that reflected in the monograph *Cycads in China* (see *Encephalartos* 47: 29-31). Unlike many of the other botanical gardens which we visited, every single plant is labelled with a name and accession



Figure 21 *Cycas fairylakea*: male cone, about 400 mm long, in the Guangzhou Botanical Garden. Photo: Piet Vorster.



Figure 23 Part of the cycad collection at the Fairy Lake Botanical Garden in Shenzhen. Photo: Piet Vorster.



Figure 22 *Cycas revoluta*: a form with curved leaves and conspicuously V-shaped arrangement of opposing leaflets, photographed in the Fairy Lake Botanical Garden. Photo: Piet Vorster.



Figure 24 Nong Nooch Botanical Garden: landscaping with palms and cycads, still under construction. Photo: Piet Vorster.



Figure 25 *Cycas taitungensis*: a female cone, about 200 mm across, in the Fairy Lake Botanical Garden in Shenzhen. Photo: Piet Vorster.

number. The cycad collection was the most comprehensive which we saw anywhere in China. All the plants were growing exposed to full sunlight on a slope planted with fine grass, including species occurring in nature only in forest, like *C. micholitzii*, and doing very well (Figure 25).

After taking leave of my companions, I spent another fortnight in the Far East, during which I visited the Nong Nooch Garden near Chon Buri in Thailand (Figure 24). This is likely to be the venue for the 6th Conference on Cycad Biology in 2002. It is a very large private garden, spectacularly landscaped, with a very good collection of palms. The cycad section was still in the process of being landscaped, and the plants appeared to comprise mostly Thai species. I was also able to view the nursery which contains a very comprehensive collection of seedlings from all over the world, and, in view of the warm climate and high rainfall, will be quite presentable plants in six years' time.



SHORT COMMUNICATIONS / KORT MEDEDELINGS

ANTLIARHINUS SPP. EN BESTUIWING

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Ontvang 25 Julie 1996

Ek het al baie negatiewe kritiek oor sekere insekte wat broodbome aanval gehoor. En dit wil voorkom asof versamelaars probeer om hierdie sogenaamde peste soveel as moontlik te bestry. Dit verbaas my egter nie, omdat groot skade aan materiaal aangerig word.

Maar daar moet op 'n habitat as 'n geheel gefokus word, om werklik te verstaan hoe dit funksioneer. Ek het ook met ander versamelaars gepraat om meer inligting te kry

oor hierdie kwessie. *Antliarhinus* spp. word dikwels op die keëls van *Encephalartos* spp. aangetref. Ek is ook vertel dat tydens bestuiwing dit wemel van hierdie insekte op die keëls. Hierdie snuitkewerwyfie boor deur die megasporofil en testa tot in die megagametofiet waar sy dan haar eiers lê. Maar daar is ook bewys dat sy eerder sal wag tot die vroulike keëls sal open en dan ingaan en direk in die saadknop in boor. In die soeke na 'n geskikte vroulike keël sal sy met vele ander keëls

in aanraking kom, en heel moontlik met stuifmeelkorrels bedek word. As sy dan later op 'n geskikte vroulike keël afkom sal sy moontlik help met die verspreiding van die stuifmeel en/of reeds afgesette stuifmeel dieper in die vroulike keël versprei.

Al sou daar op die manier baie sade vernietig word, mag sy ook bydra in die moontlike sukses. Dit is 'n duur prys om te betaal, maar dit is nodig vir oorlewing. In die habitat kan hierdie verhouding tussen plant en insek voordele inhou, siende dat dit nou al bewys is dat broodbome byna geensins afhanklik van wind is vir bestuiwing. As windbestuiwing by broodbome voorgekom het sou *Encephalartos equatorialis* vrugbare saad geproduseer het (kyk *Encephalartos* 44: 4-9). Hierdie insekte kan tot 90% van die sade vernietig, maar dit is beter as 0% vrugbare saad. Ek glo dat dit dus nodig is om dieper na die ekologie te kyk, as wat dit direk gesien word. In die tuin kan hierdie insekte egter meer as net die keëls benadeel, maar ook 'n probleem skep in kruisings wat mag voorkom as hierdie insekte stuifmeel uit 'n manlike keël van een spesie na die vroulike keël van 'n ander spesie versprei. Selfs al word daar met die hand bestuif en word die manlike keëls verwyder. Insekte beweeg en 'n kruising is altyd moontlik. Dit sal dus seker die beste wees om die manlike keëls te verwyder voordat die stuifmeel versprei, en om na handbestuiwing die vroulike keëls met plastiek te isoleer tot hulle nie meer ontvanklik is nie.

Ek wonder wat sou die gevolg wees as ons 'n insek soos 'n vlieg in die vroulike keëls plaas of inlok, en dan die vroulike keëls isoleer met plastiek of 'n fyn net. Gaswisseling sal dus plaasvind en die onskadelike insekte aan die lewe hou. Ons kan ook voeding aan so 'n insek beskikbaar stel om hom langer aan die lewe te hou. Ek wil glo dat die stuifmeelkorrels baie dieper in die vroulike keël sal versprei en meer sukses behaal sal word. Dit moet ook 'n insek wees wat nie die plant sal skaad nie, maar tog redelik aktief is.

ENCEPHALARTOS LEBOMBOENSIS

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Ontvang 14 Augustus 1996

Encephalartos lebomboensis is 'n pragtige spesie wat beperk voorkom in Noord-KwaZulu-Natal, en in die suidelike dele van Mpumalanga. Dit is egter alreeds goed verteenwoordig in die versamelings van baie versamelaars. Dit het my laat wonder oor die status van

[Uit eie waarnemings in my tuin is ek van mening dat indien snuitkewers van 'n *Antliarhinus* sp. in 'n vroulike keël voorkom wanneer die keël met die hand bestuif word, die kewers die stuifmeel suksesvol deur die keël versprei, maar dat hulle nie self stuifmeel vanuit 'n manlike keël na 'n vroulike keël oordra nie. Dat die kewers egter binne-in vroulike keëls ingaan, is waar. Ek het op 'n keer 'n vroulike keël nat bestuif, daar was net 'n paar van die snuitkewers buite op die keëlshubbe te sien maar toe ek die water met stuifmeel by die openinge in die keël ingespuut het, het die kewers letterlik bo by die keël uitgeborrel. Verder het ek ook gevind dat in my tuin die manlike keëls begin stuifmeel vrystel enigiets van 2-5 weke voordat die vroulike keëls van dieselfde spesie reg is om bestuif te word. Dan het ek ook uiters selde *Antliarhinus*-kewers in manlike keëls gevind wanneer ek die stuifmeel uitskud, terwyl baie van die kewers op en in die vroulike keëls voorgekom het wanneer die betrokke keëls bestuif word. Op 3 April 1995 het ek 'n enkele *Antliarhinus*-manneling gevind toe ek die stuifmeel uit twee manlike keëls van 'n *E. lebomboensis*-plant geskud het. Die afgelope keëlseisoen was hier 31 manlike keëls in my tuin en in slegs een daarvan (*E. arenarius*) het ek 'n enkele klein *Antliarhinus*-wyfie gevind toe ek die stuifmeel op 28 Maart 1996 uitgeskud het. Op en in my vroulike *E. arenarius*-plant se keël was daar egter heelwat van die kewers toe dit twee weke later reg was om bestuif te word. Vroeg in April 1995 het ek 'n vroulike keël van 'n *E. lebomboensis*-plant bestuif en buitengewoon baie kewers het voorgekom, selfs weke nadat die keël bestuif is. Die keël het 311 sade geproduseer waarvan agt onderontwikkel was. Van die res het 200 sade in water gesink en 103 het gedryf. Van laasgenoemde was 102 deur die kewers verwoes en een nie. Voorheen het ek gevind dat net ongeveer 20 sade in 'n keël deur kewers verwoes was. Dit hang dus waarskynlik van die graad van kewerbesmetting af hoeveel sade verwoes word. - Redaktrise.]

hierdie spesie, en dus het ek self ondersoek ingestel.

Ek het op die 13de Junie 1996 saam met 'n goeie vriend van my in die habitat gaan stap. Ons het met 'n pad op die plato gery tot naby die kolonie, en daarvandaan het

ons verder gestap. Die omgewing was ontsaglik mooi en ek het my verstom aan al die verskeidenheid organismes wat ek gesien het. Die plato word op 'n hoogte van ongeveer 1300 m aangetref. Hierdie deel is baie nat en is in die somer dikwels gehul in digte mis. 'n Paar rotsriwwe loop vertikaal oor hierdie plato en die wit sandsteen het duidelik gekontrasteer met die vars afgebrande gras. Die beskutting wat die rotse bied skep 'n ideale habitat vir kleiner bome en struie en hulle word ook selde deur vuur beskadig. *Aloe suprafoliata*, *Aloe marlothii*, *Bequaertiodendron magalismsontanum* (stamvrug) en ander plantsoorte kom op die plato voor.

Nadat ons oor die plato gestap het, het ons die pragtige riviervallei 1000 m onder ons gesien. Die terrein is baie steil, en met die afgaan het ons ons meer as een keer teen die loodregte kranse vasgeloop. Die idee was om onder die kranse te kom, en dan van onder af na die kranse te kyk waar die meeste *E. leomboensis*-plante sou wees. Dit sou in elk geval te gevaarlik gewees het om van bo af te probeer loer. Teen hierdie tyd het die temperatuur gestyg namate ons 400 m laer afgeklim het. Hierdie gedeelte was bedek met meer bome en struie wat die afwesigheid van vuur beklemtoon het. *Euphorbia* spesies het op talle plekke tussen die kranse uitgetroon in die ruwe terrein. Ek moes mooi loop om nie verstrengel te raak in die takke van *Acacia*'s nie. Die wortels van wilde vye (*Ficus* spp.) wat in die skeure verstrengel was, het my gou laat verstaan dat ek sou moes klou in die ruwe terrein wat byna onbegaanbaar geword het.

'n Paar meter verder het die gedruis van 'n waterval ons aandag getrek, en het ons verder oos beweeg. Die volgende oomblik het 'n lieflike gesig ons begroet, en was ons verstom oor die toneel. Groot broodboomplante het langs die waterval uitgetroon, en lieflike groen lower was oral te sien. Plante met groot stamme was stewig vasgeanker in die steil terrein. Ek kon megastrobili (vroulike keëls) sien en die kleur daarvan was al redelik geel. Volgens 'n plaaslike inwoner word van die megastrobili al in Julie ryp.

Onder die kranse was dit dig begroei met talle inheemse bome en kleiner struie. Al die broodbome was egter beperk tot die steil kranse en was stewig in skeure geanker. Ek kon sien dat dit maar 'n stryd om oorlewing was, omdat die grond maar vlak en klipperig is. Ek het baie klein saailinge onder die kranse gesien (omtrent 350), omdat die meeste saad tot daar rol en dan onder gunstige toestande kan ontkiem. Grond onder die kranse is baie diep en vrugbaar, en ek het gewonder hoekom die broodbome nie gevestig raak nie. Ek het eers gedink dat dit vuur was wat die saailinge beskadig het, maar die plantegroei was net te dig in hierdie gedeelte. Ander boomsoorte was goed gevestig en geen skade deur vuur was aangerig nie. Later het een van die inwoners my vertel dat ystervarke (*Hystrix africae-australis*) redelik aktief was in hierdie gebied.

Ystervarke is al bekend daarvoor dat hulle groot skade aan die plante veroorsaak. Ek kon maar net glo dat die saailinge 'n maklike maaltyd sou wees. Dit is jammer dat soveel saailinge vernietig word en nooit gevestig sal raak nie.

Die broodbome in die kloof word op die westelike en suidelike hange aangetref. Plante aan die suidelike hange het langer pinnas gehad, maar minder keëls. Ek kan aflei dat die rede hiervoor die tekort aan sonlig is, en die tempo van fotosintese is minimaal. Dus sal daar nie genoeg organiese reserwes wees om te gebruik vir voortplanting nie. Plante op die westelike hange het kleiner pinnas wat waterverlies behoort te bekamp, en meer keëls word aangetref. Baie van die broodbome aan die westelike hange het begin spruit na die kort periode van rus. By tye het ek goed berou gehad wanneer ek in my haas na *Obetia tenax* (bergbrandnetel) gegryp het en die verblindende pyn deur my geskiet het. Bergbrandnetels het eintlik 'n goeie funksie en beskerm die broodbome teen hulle grootste vyand (mense). 'n Groot manlike plant wat byna in die helfte gekap was het bewys dat daar al weer medisyne nodig was. Maar dan moet ons besef dat die inwoners nie naastenby soveel skade as baie versamelaars aanrig nie, en leef hulle in harmonie met die natuur.

Die sagte stam van broodbome het belangrike medisinale waardes vir die plaaslike inwoners. In die meeste gevalle word dit gebruik as 'n lakseermiddel, omdat die giftige bestanddele bevat wat purgering veroorsaak. Ek was ook verbaas toe 'n enkele eksemplaar van *Warburgia salutaris* (peperbas) aan my uitgewys is. Dit was tot dusver 'n baie skaars boom en word juis bedreig omdat dit gesog is vir medisinale gebruike. Peperbas word aangewend teen borskwale, malaria en gebruik vir purgering. Die aktiewe bestanddele is tannien en mannitol. *Sclerocarya birrea* (maroela) kom ook voor in hierdie gebied, hierdie bome is egter bladwisselend. Dit kan dus nie te koud word in die habitat nie, alhoewel die sneeu van 10 dae tevore nog indrukwekkend 40 km noord op die bergtoppe te sien was. Nie dat dit enige skade sou veroorsaak as dit wel gesneeu het nie. Bome soos *Pterocarpus angolensis* (kiaat) en *Combretum* spp. word ook aangetref, maar is beperk tot die baie warm valleie.

Knaagdier kom ook voor en help met die verspreiding van die sade van broodbome. Dikwels word sade in hopies opgestapel gesien in skeure en onder struie. Die sarkotesta word gevreet, alhoewel ek heelwat sade gesien het wat totaal vernietig was. Bobbejane word ook gereeld gesien en hulle verwyder die vroulike keëls voor dit ryp word. 'n *Antliarhinus* sp. word ook gereeld op die keëls gesien, en help moontlik met die bestuiwing van die vroulike keëls (kyk my artikel "*Antliarhinus* spp. en bestuiwing" op bl. 24-25 in hierdie uitgawe).

Hierdie kolonie broodbome is redelik goed

verteenwoordig, slegs sowat 10% van die plante is al verwyder. Ons het 'n baie groot stomp gesien wat verwyder was en net daar gelos is, dit was seker te swaar om te dra. My vriend moes ook al baie moeite doen om by ander kolonies plante weer terug te plant. Die toekoms lyk egter vir hierdie kolonie verseker omdat die terrein so onmoontlik is, en die spesifieke kloof nie maklik raakgesien word nie. Die getal volwasse plante

is ongeveer 150 en saailinge 350, met die in die kranse sowat 40. 'n Mens kan maar net hoop dat in die toekoms die kolonie tot sy oorspronklike getalle sal groei.

(Alle name van inwoners, plekke en paaie word anoniem gehou om verdere beskadiging te voorkom.)

VREEMDE BROODBOOMSIEKTE

Maans Kemp

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Ontvang 18 September 1996

'n Vreemde siektetoestand wat 'n broodboomversameling in die Oos-Kaap al vir 'n paar jaar teister, het onder my aandag gekom. Ek kon tot dusver nie enigiets in geskrewe bronne kry wat naastenby na hierdie siekte verwys nie en navrae by tuinboukenners het net verbasing opgelewer. Ek kon tot dusver nog nie iemand kry wat so iets al tevore teëgekome het nie. Miskien is daar lesers van "*Encephalartos*" wat lig op die probleem kan werp en wat raad aan die hand kan doen om die versameling te red.

So ver as wat ek kan vasstel, is die volgende die belangrikste kenmerke van die siekte:

- Dit is aansteeklik. Dit het ongeveer vyf jaar gelede by een spesifieke plant begin en het geleidelik na naasliggende plante versprei. Die manier van verspreiding is nie duidelik nie, maar wat opval is dat die hoofstam van 'n hele aantal plante met basale suiers aangetas is, terwyl die suiers nie geaffekteer is nie.
- Die siekte maak nie die plante vinnig dood nie. Geen plant in die versameling is nog in sy geheel dood nie.
- Dit is nie spesie-spesifiek nie. Die siekte het by 'n *Encephalartos altensteinii*-plant begin, maar het versprei na plante van die spesies *E. villosus*, *E. princeps*, *E. natalensis*, *E. paucidentatis*, *E. lehmannii* en *E. horridus*.
- Dit lyk of die siekte in die kroon van die stam gesetel is, waar nuwe blare en keëls wat verskyn dan aangeval word.
- Geen insekte of ander sigbare lewende organismes

is nog op of naby die aangetaste dele van plante waargeneem nie. Die siektetoestand het voortgeduur nadat die plante met insek- en swamdoders bespuit is.

- Aangetaste blare word gekenmerk deur een of meer van die volgende verskynsels (die simptome verskil soms van plant tot plant en nie almal kom altyd gelyk voor nie):
 - Die blare het 'n ligter groen kleur as normale blare en kom blekerig voor.
 - Die blare is slap en die blaarsteel ("petiole") bors, sodat dit maklik afbreek.
 - Die blare wat wel verder ontwikkel het dikwels fyn gebroke donker lyntjies wat in die lengte van die blaartjies ("leaflets") loop, klaarblyklik met die are langs (Figuur 1).
 - Die blaartjies ("leaflets") van blare wat wel ontwikkel, is dikwels abnormaal verdraai en vervorm (Figuur 2).
 - Baie blare ontwikkel net 'n klein entjie, word donker-pers of swart en verskrimpel - 'n hele kranse blare kan op een slag verlore gaan (Figuur 3).
 - Volle kranse blare word nie gevorm nie. Dikwels verskyn net 'n paar blare of selfs net een (Figuur 4).
- Aangetaste stamme word deur die volgende simptome gekenmerk:



Figuur 1 Aangetaste blare met donker strepies.



Figuur 2 Verwronge aangetaste blaartjies.

- Slegs die kroon van die stam word aangetas terwyl die res van die stam ferm en gesond bly (Figuur 5).



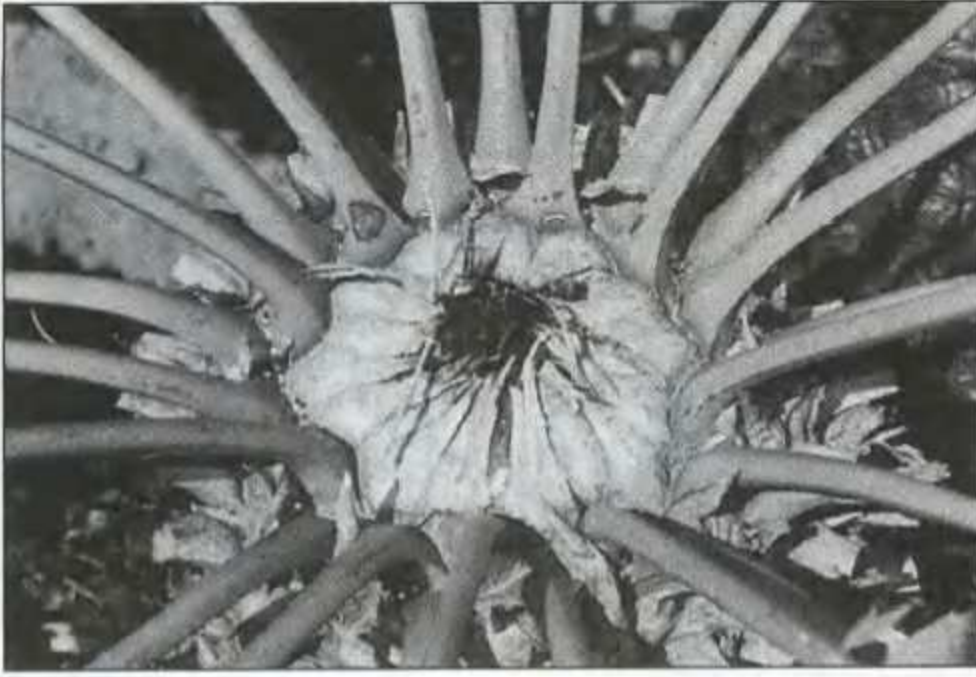
Figuur 3 Blare wat sag en donker van kleur geword het en wat besig is om te verdroog.



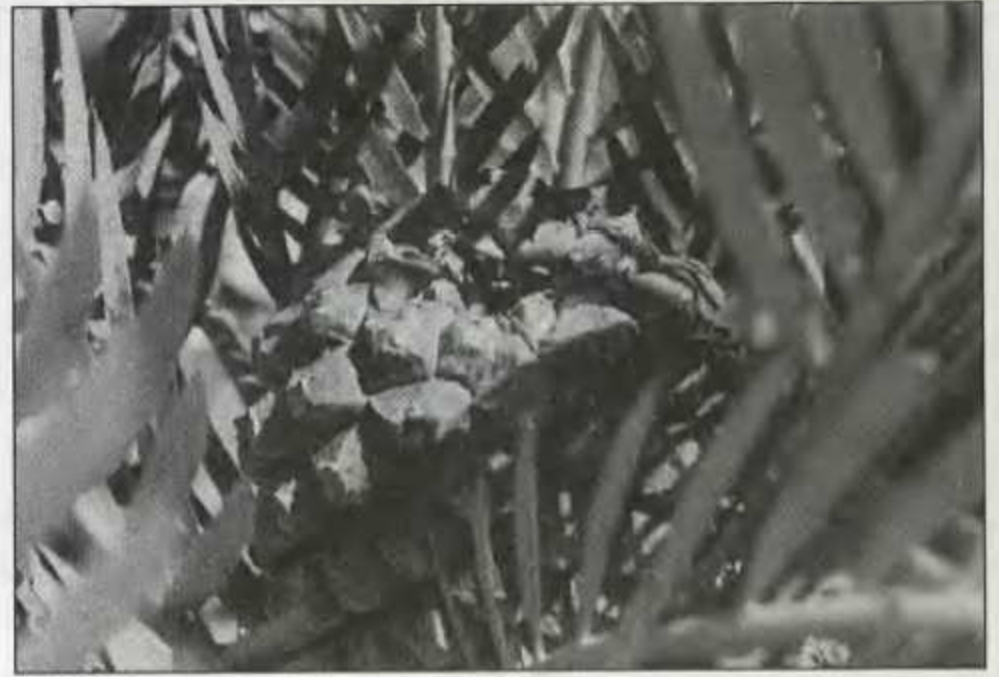
Figuur 4 Slegs enkele blare het gevorm en dié is besig om te verskrimpel.



Figuur 5 'n Aangetaste stam waar die verdroogde nuwe blare afgesny is.



Figuur 6 'n Aangetaste stam met donker gom in die kroon.



Figuur 7 'n Aangetaste keël waarvan die boonste gedeelte nie ontwikkel het nie.

- Die groeipunt word klaarblyklik in sommige gevalle vernietig aangesien nuwe (soms veelvuldige) groeipunte gevorm word.
- In baie gevalle word groot hoeveelhede gom in die groeipunt gevorm wat later verhard om 'n donker koek in die kroon van die stam te vorm (Figuur 6). Aangetaste kroon vertoon dikwels swart.
- In sommige gevalle is die kroon van die hoofstam ernstig aangetas terwyl kroon van basale suiers totaal onaangesig is.
- In minstens een plant is die kroon heeltemal dood, maar leef die plant voort aangesien dit 'n suier gevorm het.
- Aangetaste keëls word as volg geaffekteer:
 - Die bopunt van die keël word beskadig terwyl die basis en steel van die keël normaal

ontwikkel. Soms word net die heel boonste puntjie van die keël aangetas, maar in ander gevalle die boonste derde of selfs helfte (Figuur 7). In een geval het net die steel en die onderste paar keëlskubbe en sade ontwikkel.

- Die manier van aantasting is dat die skubbe nie ontwikkel nie. Soms ontwikkel hulle gedeeltelik sodat die sade kaal is.
- Daar is soms 'n afskeiding van gom aan die bopunt van die keël wat later verhard en swart word.

[Party foto's herinner mens aan swamskade -- L.W. daar is nie 'n swamdoder wat teen alle swamme effektief is nie. Ander foto's dui op infeksie deur myte. Dit sal waardeer word indien lesers wat die siektes kan identifiseer en weet hoe om dit te bekamp van hulle sal laat hoor. - Redaktrise.]

WHY DOES ONE COLLECT CYCADS?

Piet Vorster

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

Received 18 September 1996

I was prompted to write this note by a phonecall telling me that a plant of *Encephalartos brevifoliolatus* is being offered for sale by a private collector. This is an extremely rare species. In an intensive aerial survey,

only five plants were located, all on crown land, and females are still unknown. It is not represented in the living collections of any scientific institution or public botanical garden. It seems to be neither a vigorous

grower nor does it profusely increase vegetatively, so that it can be considered a good deal more rare than *E. woodii*, and in real danger of extinction.

I have increasingly come to the conclusion that most of us do not sufficiently pause to reflect on what we are doing, and I am sure that many of us have too many plants for comfort which inevitably leads to neglect. Furthermore, we are collecting wild plants to extinction.

In the *Cycad Society* one meets a great variety of people, all collecting cycads, but differing vastly in their approach and aims. While I would not like to say that some of us are right and others wrong, it nevertheless seems as if the subject itself dictates a certain approach.

There are the collectors who collect for the sake of collecting. Some of them collect these plants with the aim of compiling "complete" collections. My question is, whether this aim is worth pursuing. Collectors are a breed of their own, often collecting for the sake of collecting items such as postage stamps, match boxes, sand samples, or milk bottle tops, to name only a few. Most of these can be left unattended for long periods, but plants need constant care simply to keep them alive, which is often more than one can handle if a collection has expanded rapidly, leading to neglect and loss. Contrary to a common myth, cycads do not thrive on neglect. Cycads are remarkably adaptable and resilient, yet I doubt whether there is any one place where one can grow all the species in the world, or even all the species in a particular genus, successfully. Thus one simply has to accept that *Encephalartos horridus* is unlikely to succeed in the humid tropics, *E. ghellinckii* where summers are not cool and moist, many Australian species of *Cycas* outside their native areas, or certain highly tropical species of *Zamia* outside the humid tropics. Of course one doesn't know in advance how a previously untested species will react to cultivation under local conditions, and the only way to find out is by trying. Thus a variety of tropical *Cycas* species from close to the equator do remarkably well at Stellenbosch, at 34°S, as do *Encephalartos kisanbo* from equatorial regions, yet *E. umbeluziensis* and *E. cupidus*, hailing from much less tropical areas, afford me no pleasure at all and are to me extremely difficult to keep alive. I cannot see the sense in keeping plants which are more of a liability than an asset.

A true collector can either be a catalogue-collector, who collects according to names on check-lists; or he can strive to have desirable and unusual subjects. In the former case one is limited to the estimated 300 species world-wide (a daunting enough aim); but when striving for the unusual which no-one else has, selective hybridizing can be an effective way of creating "one off" individuals which can be strikingly beautiful.

Many people grow cycads because they *can be* very

decorative landscape subjects. However, I would like to let loose a cat amongst the pigeons by asking you, dear reader, how many really nice cycad specimens you have in your collection. A privileged few of us live in warm, frost- and hail-free areas with good soil and adequate rainfall, and consequently their plants are beautiful. The truth is, however, that most of us live in places where our plants get broken by hail or wind, and burnt by frost or heat waves, and where our plants have hardly healed before the next natural disaster strikes. Is it really worth growing these plants as ornamentals when they never look good? Then, some species are intrinsically decorative, including *Cycas revoluta*, *Dioon mejiae*, *D. spinulosum*, *Encephalartos inopinus*, *E. horridus*, *E. kisanbo*, *E. paucidentatus*, and *E. transvenosus*; but others are much less appealing including *E. altensteinii*, *E. trispinosus*, and *E. umbeluziensis*; and others are outright ugly such as *E. humilis*, *E. ngoyanus*, and some species of *Macrozamia*. Unless one lives in exactly the right climatic zone, species like *E. lanatus* and *E. laevifolius* never amount to anything and are hardly worth growing. It also depends on local conditions whether a species can be grown to the desired degree of perfection: *Encephalartos gratus* and *E. chimanimaniensis* can be gloriously beautiful in warm, windless places, but in the south-western Cape will never amount to anything because their foliage is too prone to wind damage; and *E. ferox* can never be grown to perfection where it gets winter frost.

Some people collect cycads for an investment. In the current economical climate, characterised by high inflation and personal taxation, is it certainly attractive to generate extra income, preferably tax-free. A great many people believe that vast amounts of money can be made by growing cycads from seed. I doubt whether this assumption is valid. Production costs, including the necessity of greenhouses or shade houses and the slow growth rate, are high, perhaps higher than the eventual selling price. Unfortunately the faster growing species of which seed is readily available, are also common and don't command commensurate prices. The really rare species are very difficult to get seed of, by any means, and are slow and difficult to grow. Not surprisingly more than one commercial nursery are not doing well, and several have closed down in recent times. People are easily impressed by high prices demanded and attained at auctions and through private sales, but forget that this market is very limited. If one suddenly wants to convert cycads into cash, one may well find that it is not easy at all.

There are also "investment collectors" who buy sizeable plants with the explicit aim of re-selling at a profit. I have met a number of such persons, and am sorry to say that I have no empathy at all with them. In my experience they are almost invariably not sufficiently interested in the plants themselves to master the art of caring for them, and consequently losses are high. Their

activities contribute much to the excessive monetary value placed on these plants. I know of at least two such persons who possess(ed) beds containing at least 30 large plants of such rarities as *Encephalartos inopinus*.

Even worse in my eyes are "investor-dealers" who actively collect specimens from nature, whether for private possession or for re-sale. The laws protecting these plants have been in force for a very long time, yet large plants still vanish with monotonous regularity from nature, and one commonly encounters large specimens, often with the trunks charred to their apices by veld fires, in private collections. I am invariably told that the documentation of these specimens is in order, but how can the conservation authorities condone this? Particularly onerous is the collection from nature of plants which are, by reason of their rarity, simply too valuable to be in private hands. These plants belong to the people of South Africa, and it is criminal for individuals to acquire them for personal gain. Examples which spring to mind, are *Encephalartos latifrons*, *E. dolomiticus*, *E. heenanii*, *E. cerinus*, and *E. inopinus*, which have been collected close to extinction. *E. laevifolius* is going the same way, and in the last five years almost half the known plants have been taken from nature - these plants are in private collections, but the conservation authorities seem powerless to act. If such plants cannot be in nature, they should be in the care of a public botanical institution. As it happens, some of our foremost botanical gardens do not have plants of these rare species. It has been suggested that these public institutions should purchase from private individuals specimens illegally obtained and which in the first place belong to the citizens of this country, but I find this totally preposterous.

Collecting is often held forth as a conservation measure, but I put forth a plea to leave conservation in the hands of experts who are paid for out of our taxes. No private collection is permanent, and as plants change hands, so records are lost and the plants become largely valueless to conservation and to science. We have also learnt, only recently, that almost every species is pollinated by its own insect species which cannot survive unless its environment (including a sufficiently large population of the host cycad species) remains intact. It will be futile to re-establish cycads in nature, whether from seed-grown plants or from individuals temporarily conserved in private collections, unless the pollinating insects can also be re-established. Unfortunately we still know almost nothing about the life cycles and population dynamics of these insects.

What then is left to the cycad collector? Firstly, one should clearly understand why you want to collect cycads. Secondly, one should calculate how many plants you can accommodate on the available land, and not acquire more than one has place for or can conveniently care for - they certainly don't just look after themselves.

Thirdly, one should define the limits of your collecting activities, be it Eastern Cape species, tropical African species, or *Dioon*. I sincerely believe that too many of us overreach ourselves trying to collect all cycads. Fourthly, in order to retain one's self-respect it is essential to formulate a code of conduct. Laws are formulated for the common good, and transgression for personal gain can never be condoned. This includes resisting the temptation to buy laundered but obviously wild-collected plants from someone else. Lastly, I think it is emotionally immature to become maniacal about these matters, and to try and acquire items missing from your collection regardless of cost or method. In such cases capital investments are likely to push up prices and perceived monetary value, but little else, and sooner or later one is likely to bend the law ever so slightly, which sours the whole exercise and gives all collectors and enthusiasts a bad name.

CORRECTION

This photograph of the special postage stamps issued to commemorate the CYCAD 96 conference in China, appeared in *Encephalartos* 47: 11; but was printed in negative for some reason known to the printer alone. We therefore present the photograph again, in positive this time. - Piet Vorster.]



Postage stamps featuring *Cycas panzhihuaensis*, *C. revoluta*, *C. pectinata* and *C. multipinnata*.

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0039 Lynn-oos

Ontvang 7 Oktober 1996

Op Saterdag 6 September 1996 het sowat 25 lede van die Transvaalse Streektak by Kaapsche Hoop bymekaar gekom om 'n *Encephalartos laevifolius*-kolonie in habitat te besoek. Die besoek waarna ons so uitgesien het, is egter tot 'n groot mate deur die aktiwiteit van plantdiewe bederf. Hulle het kort tevore meer as 300 broodbome uit die gedeelte van die lokaliteit waarheen ons sou gaan gesteel. Aangesien die polisie se ondersoek nog nie afgehandel was nie en hulle bang was dat ons dalk onwetend nuttige leidrade met ons besoek sou vernietig, was ons verplig om na 'n ander gedeelte van die lokaliteit (met minder plante) en 'n baie moeiliker roete te gaan.

Na 'n moeilike klim wat hierdie keer selfs vir die fikse 79-jarige Jack van der Merwe te veel was, kon ons egter lekker gesellig saam verkeer en ook later by 'n "watergat" in Kaapsche Hoop ons dors gaan les. Baie dankie weer eens aan Ian Davidson en spesiaal aan Richard Green wat sy Saterdag opgeoffer het om ons uitstappie te lei.

Toekomstige aktiwiteite:

18 Jan 1997: Rolf Oberprieler van die Nasionale

Insekversameling in Pretoria sal 'n geïllustreerde praatjie oor die insekte (veral snuitkewers) lewer wat ten nouste met broodbome verbind word. Die voordrag sal om 14h00 in die hoofgebou van die Nasionale Botaniese Instituut, Pretoria aangebied word.

9 Maart: Besoek aan tuine van lede in Groblersdal (die besoek aan tuine van lede in Stilfontein en Klerksdorp, beplan vir 1 Maart, is kanselleer). Skakel asb. met my vir meer besonderhede.

3 Mei: Charles de Kock sal vir ons 'n video van die Broodbome van Sjina vertoon en ons ook een en ander vertel oor die "CYCAD 96" belewenis.

5 Julie: 'n Besoek aan 'n *E. transvenosus*-kolonie naby Louis Trichardt word gereël. Meer besonderhede sal later voorsien word.

As u plante of sade het om uit te stal of te verkwansel, kan u dit gerus na die byeenkomste op 18 Januarie en/of 3 Mei bring. T-hemde en dasse met die Streektak se embleem daarop sal by die byeenkomste te koop aangebied word.

VARIEGATED FORMS OF *CYCAS REVOLUTA*

Hajime Tomiyama
66-2 Oki, Yomitan-son, Okinawa 904-03, Japan

Received 7 October 1996

In August 1996 I went to a small island near Okinawa where I photographed the Golden *Cycas revoluta* in nature (Figures 1-4), and on Ishigatu Island I photographed some more specimens in the collection of Mr. Ishigaki (Figures 5, 6). The variegated forms of *C. revoluta* show a colourful contrast between the sulphur yellow and dark green parts of their foliage and

are much sought after by Japanese enthusiasts.

[This communication was compiled from a letter by the author to Mr. J.O. Heyns of Groenkloof, Pretoria. We thank Mr. Heyns for making the letter and photographs available. It is, however, a pity that we cannot print these photographs in colour. - Editor.]



Figure 1



Figure 4



Figure 2



Figure 5



Figure 3



Figure 6

Figures 1-6 Variegated forms of *Cycas revoluta*. 1-4 In the wild. 5, 6 In a private collection.

Dear Editor

CYCAS REVOLUTA: HOW COLD HARDY?

In response to the letter on this subject by George Carroll in *Encephalartos* 43: 22-23 (March 1996), I wish to report that I saw large specimens of *Cycas revoluta* in Yokohama, Japan, where they regularly get snow in winter. I was also surprised to see beautiful specimens of the palm *Livistona chinensis* nearby. It would be informative to know how these plants are protected against winter cold, if at all.

Piet Vorster, Botany Department, University of Stellenbosch, Private Bag X1, 7602 Matieland.

Received 22 July 1996

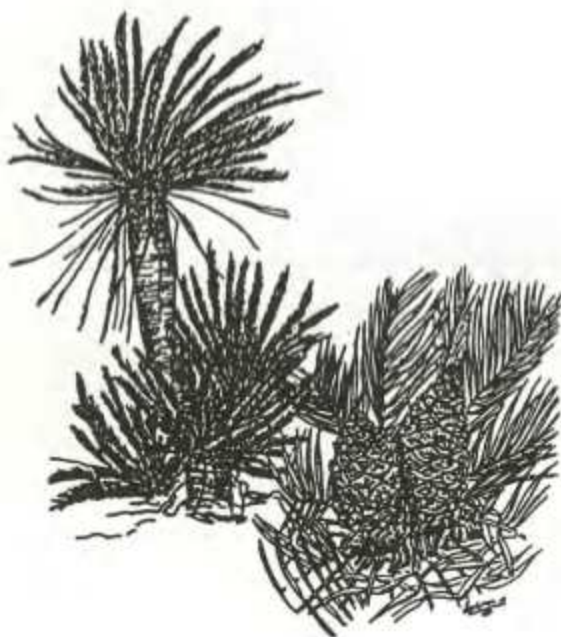
Dear Editor

CROSS POLLINATION SUCCESSFUL

Thank you for bringing out my article on cross pollination of my *Cycas siamensis* and *C. rumphii* (*Encephalartos* 46: 22-23). Incidentally, one of the seeds has germinated in my garden. I have also heard from a friend in Australia to whom I had sent some of these seeds that out of five, one has germinated at his end also.

Shri Dhar, 20 Ballygunge Park Road, Calcutta - 700019, India.

Received 25 July 1996



Geagte Redaktrise

RUILHOEKIE

Ek maak graag gebruik van die aanbod van die president in *Encephalartos* 46: 3 (Junie 1996), om te kom met idees om die tydskrif meer interessant te maak vir die gewone, nie so wetenskaplike, leser.

Wanneer die gogga 'n mens eers gebyt het, en jy graag jou versameling wil uitbrei, kan 'n gemiddelde persoon die skaarser soorte gewoonlik nie by kwekerie aankoop nie, terwyl daar dalk naby hom 'n versamelaar woon wat graag van sy oortollige plante sou wou ruil of verkoop.

'n Ruilhoekie in die tydskrif sou in dié behoefte kon voorsien, en ook nuttige skakeling tussen broodboomentoesiaste in 'n spesifieke omgewing moontlik maak.

P.J.C. Kuun, Posbus 39718, 0044 Moreletapark, Pretoria.

Ontvang 19 Augustus 1996

Geagte Redaktrise

BROOdBOME IN POTTE

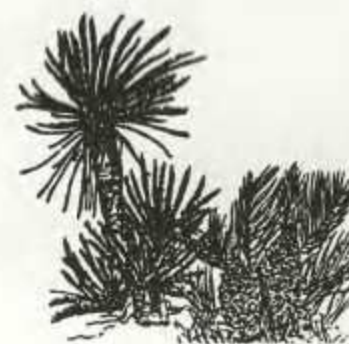
Na aanleiding van die president se oproep in *Encephalartos* 46: 3 (Junie 1996):

Om verskeie redes hou ek al my broodbome in houers en ek is seker daar is baie lede met houerplante.

Wat van 'n artikel oor of 'n rubriek vir: **Broodbome in Potte?**

Izak J. van den Berg, Williamsstraat 59, Wilkoppies, 2571 Klerksdorp.

Ontvang 28 Augustus 1996



NEW SCIENTIFIC REPORTS

Jäger, A.K. & van Staden, J.* 1996. Somatic embryogenesis in the cycad *Encephalartos ferox*. *J. S. Afr. Hort. Sci.* 6: 8-10.

[Callus cultures of *Encephalartos ferox* were established from zygotic embryo explants on a modified B5 medium containing 1 mg per litre 2,4-D and 1 mg per litre kinetin. Embryogenic callus was transferred to medium with ABA or without growth regulators and somatic embryogenesis occurred. Suspensors developed from proembryos and a dicotyledonary somatic embryo developed at the distal end of the suspensor. The somatic embryos turned green in the light and the suspensors desiccated. To date none of the embryos have germinated with shoot and radicle development.]

*Author's address: NU Research Unit for Plant Growth and Development, Department of Botany, University of Natal, Private Bag X01, 3201 Scottsville, South Africa.

Jäger, A.K. & van Staden, J.* 1996. Regeneration of *Encephalartos cycadifolius* via somatic embryogenesis. *J. S. Afr. Hort. Sci.* 6: 11-12.

[Somatic embryogenesis was induced in callus cultures derived from zygotic embryo material of *Encephalartos cycadifolius*. The somatic embryos were matured on a modified Gamborg B5 medium. Shoot formation occurred between the cotyledons, regenerating into a plantlet that could be transferred to soil.]

*Author's address: NU Research Unit for Plant Growth and Development, Department of Botany, University of Natal, Private Bag X01, 3201 Scottsville, South Africa.

Jeyasingh, D.E.P.* & Kumarasamy, D. 1995. *Aphanocapsa nageli* in symbiosis with *Cycas beddomei* Dyer. *Phytomorphology* 45: 247-251.

[A colonial blue-green alga, *Aphanocapsa nageli* of the Chroococcales, is shown to occur as an endosymbiont in *Cycas beddomei* Dyer which is an endemic species of cycad growing wild in the Eastern Ghats of India. The symbiont is placed in a new species, *Aphanocapsa cycadae* sp. nov..]

*Author's address: Lab. Palaeophytol., Dept. Botany, Madras Christian Coll., Tambaram, Madras 600 059, India.

Li, C.-J.*, Brownson, D.M., Mabry, T.J., Perera, C. & Bell, E.A. 1996. Nonprotein amino acids from seeds of *Cycas circinalis* and *Phaseolus vulgaris*. *Phytochemistry* (Oxford) 42: 443-445.

[Chemical studies on *Cycas circinalis* seeds from Guam provided two new nonprotein amino acids, N-(3'-

one-5'-methyl)-hexylalanine and leucine betaine. N-methylisoleucine, previously reported as a component of naturally occurring peptides, has been isolated as a free amino acid from the seeds of *Phaseolus vulgaris* (pinto bean), together with S-methylcysteine, pipercolic acid and a dipeptide, gamma-glutamyl-leucine.]

*Author's address: Dept. of Botany, Univ. of Texas at Austin, Austin, TX 78713-7640, U.S.A.

Mills, J.N.*, Lawley, M.J. & Thomas J. 1996. *Macrozamia toxicosis* in a dog. *Australian Veterinary Journal* 73: 69-72.

[A case of *Macrozamia riedlei* seed poisoning is described in a young Dachshund. Vomiting and depression commenced within 6h of ingestion; other signs that developed included severe hepatopathy, jaundice, abdominal pain that was unresponsive to analgesics, severe gastrointestinal haemorrhage and thrombocytopenia as well as crystalluria and narrow dyserythropoiesis. The dog was euthanased 6 days after ingestion of the seeds.]

*Author's address: Sch. Veterinary Studies, Murdoch Univ., Western Australia 6150, Australia.

Osborne, R.* & Stevens, J.R. 1996. Epicuticular waxes and glaucousness of *Encephalartos* leaves. *Phytochemistry* (Oxford) 42: 1335-1339.

[The epicuticular leaf waxes from four glaucous and four non-glaucous species of *Encephalartos* were examined by GC-mass spectrometry and SEM technique. The four glaucous-leaved species, *E. horridus*, *E. lehmannii*, *E. princeps* and *E. trispinosus*, were conspicuous in having leaf waxes containing a series of secondary alcohols. In addition to 10-nonacosanol as the principal wax component, minor amounts of C25 - C31 10-alkanols, 4,10-, 5,10- and 7,10-nonacosanediol and the ketone, 10-nonacosanone, were detected in these species. By contrast, secondary alcohols and ketones were absent in waxes from the non-glaucous species. Varying quantities of alkanes, fatty acids, primary alcohols, aldehydes and alkyl esters were present in all the samples. Amongst the non-glaucous species, *E. altensteinii*, *E. natalensis* and *E. woodii* were similar in their wax composition, but differed from *E. villosus*. Alkanes were dominant in the latter species, which had high proportions of hentriacontane and tritriacontane in parallel with the most prominent oxygenated wax compounds, C32 C34 fatty acids and aldehydes.]

*Author's address: 281 Buckley Road, Burpengary, QLD 4505, Australia.

Reveal, J.L. 1995. Newly required suprageneric names in vascular plants. *Phytologia* 79: 68-76.

[Several supra-ordinal names in current use in textbooks and the more technical literature are not validly published. The following, which pertains to cycads are now established: Cycadidae, Cycadophytina.]

Author's address: Dept. Plant Biol., Univ. Maryland, College Park, MD 20742-5815, U.S.A.

Siniscalco, C.G., Cozzolino, S., Aceto, S. & Gaudio, L.* 1996. Effects of *Encephalartos altensteinii* Lehm. extracts and methylazoxymethanol (MAM) on erythroid commitment in mouse erythroleukemia (MEL) cells. *South African Journal of Science* 92: 185-188.

[The effect of a crude extract of *Encephalartos altensteinii* Lehm. seeds on *in vitro* erythroid differentiation of MEL cells induced by DMSO is described. The experiments showed that the extract and one of its constituents, methylazoxymethanol (MAM), can interfere with erythroid differentiation, presumably modifying the level of DNA methylation. These results are discussed also as a possible cause of a case of strong anaemia observed in a botanist working with cycad seeds and derivatives.]

**Author's address:* Dip. Genetica Biologia Generale Molecolare, Universita Federico II, Via Mezzocannone 8, 80134 Naples, Italy.

Spicer, R.A.* & Herman, A.B. 1996. *Nilssoniocladus* in the Cretaceous arctic: New species and biological insights. *Review of Palaeobotany and Palynology* 92: 229-243.

[*Nilssoniocladus* (Yimura and Sekido, 1975) is an important Mesozoic plant because it is widely regarded as representing a deciduous (leaf shedding), frost-resistant cycad. In this paper two new species of *Nilssoniocladus* are described.]

**Author's address:* Dep. Earth Sci., Open Univ., Milton Keynes, MK7 6AA, U.K.

Steyn, E.M.A.*, Strydom, D.J.F. & Botha, A. 1996. Fertilization and rejection of spermatozooids by egg cells in artificially pollinated ovules of *Encephalartos* (Zamiaceae). *Sexual Plant Reproduction* 9: 175-185.

[The structure and behaviour of free female, male and proembryonal nuclei of *Encephalartos villosus* Lem. were studied during a light-microscopical investigation of serially sectioned archegonia in successfully pollinated ovules. Before spermatozooids were released from the pollen tubes into the archegonial chamber, the ventral canal nucleus had disintegrated in the neck region of the egg cell among minute,

amoeboid bodies with PAS-positive granules. In archegonia containing multiple spermatozooids, the egg nucleus was unobtrusive and syngamy followed by proembryo formation regularly resulted. The egg cell usually reacted violently in archegonia penetrated by a single spermatozoid. These reactions were regarded as rejection phenomena and considered as indicators that the egg cell can differentiate between compatible and incompatible male gametes.]

**Author's address:* National Botanical Inst., Private Bag X101, 0001 Pretoria, South Africa.

Yagi, F.* & Tadera, K. 1996. Substrate specificity and transglucosylation catalyzed by cycad beta-glucosidase. *Biochimica et Biophysica Acta* 1289: 315-321.

[Initial rates of transglucosylation with diglucosides and diglucose-azoxyglycosides as acceptor by cycad beta-glucosidase were tentatively obtained. The formation of beta-1,3 glucosidic linkage was predominant, except for neocycasin A (beta-laminaribioside of methylazoxymethanol, MAM) as acceptor. With neocycasin A as acceptor, beta-1,4 and beta-1,6 glucosidic linkages were formed but beta-1,3 linkage was not.]

**Author's address:* Biochemistry Biotechnol., Fac. Agric., Kagoshima Univ., 1-21-24 Korimoto, Kagoshima 890, Japan.

Yang, S-L.* & Meerow, A.W. 1996. The *Cycas pectinata* (Cycadaceae) complex: Generic structure and gene flow. *Int. J. Plant Sci.* 157: 468-483.

[The *Cycas pectinata* complex is a group poorly understood Asian cycads threatened by habitat destruction and overcollecting. The genetic variation was estimated in 17 isozyme loci across 39 populations representing 10 taxa in this complex from China, India, Thailand and Vietnam. Three species from Thailand and an Indian endemic were also examined for comparison. Lower levels of intrapopulation variation than those reported for other gymnosperms were found in the *C. pectinata* complex. The results support the hypothesis that low intrapopulation variation with relatively high spatial differentiation is a biological and evolutionary characteristic typical of cycads, unlike other gymnosperms.]

**Author's address:* Univ. of Florida Research and Education Center, 3205 College Ave., Fort Lauderdale, Florida 33314, U.S.A.

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

CYCADS IN CONTAINERS / BROODBOME IN HOUERS

We would like to present this topic as a new column, and we invite readers experienced in growing cycads in containers to share their knowledge with us.

As an experiment we ask readers to comment on the following:

- best type of container (clay, asbestos, other?)
- container size in relation to size of cycad trunk
- best soil mix or other growing-medium

- fertilization
 - type of fertilizer
 - when to apply and in what doses
 - your experience with specific fertilizers such as nitrogen, potassium and phosphate
- watering - how often and how much
- exposure to full sun versus protection from hot sun (partial shade)

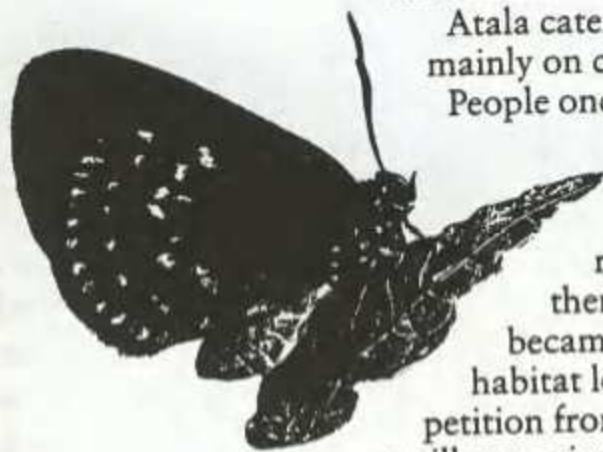
We also invite readers to supply photos for this column.

NEWSPAPER CLIPPINGS / KOERANTUITKNIPSELS

Butterfly Flutters Back

ONCE FEARED EXTINCT in Florida, the atala butterfly has been rescued by a native plant—the coontie.

Atala caterpillars feed mainly on coontie leaves. People once used the plants—settlers made arrow-root from them. The plants became scarce; that, habitat loss, and competition from another caterpillar species led to the atala's decline. Then in 1979



naturalist Roger Hammer found a few atalas on Key Biscayne. He placed coontie plants near the butterflies, which laid eggs on them. When the eggs hatched, the larvae were moved to a botanical garden. From them other atalas were reared. "Now people are planting coonties in their yards to attract atalas," he says.

—JOHN L. ELIOT

NATIONAL GEOGRAPHIC
JULY 1996

[A coontie is a specimen of the cycad species *Zamia integrifolia*. - Editor.]

MASSOSPONDYLUS : CYCAD PEST

[This beast was illustrated in *Archimedes* 38(3): 49 (Winter 1996). See how it tramples the seedlings with its 3-toed feet. This cycad has not been seen in recent years, and we suspect that it was devoured to extinction by *Massospondylus* dinosaurs. Readers are asked to keep a look-out for this beast in their gardens, as we

have reason to think that it can be even more destructive than the Leopard Moth.

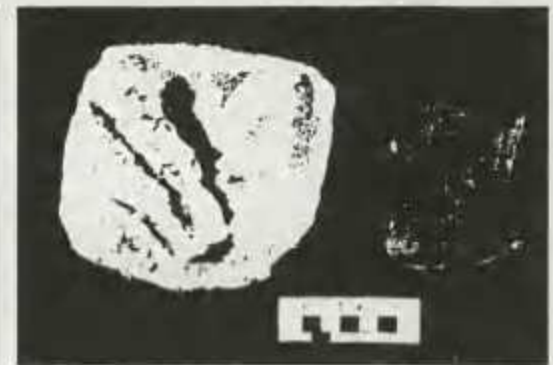
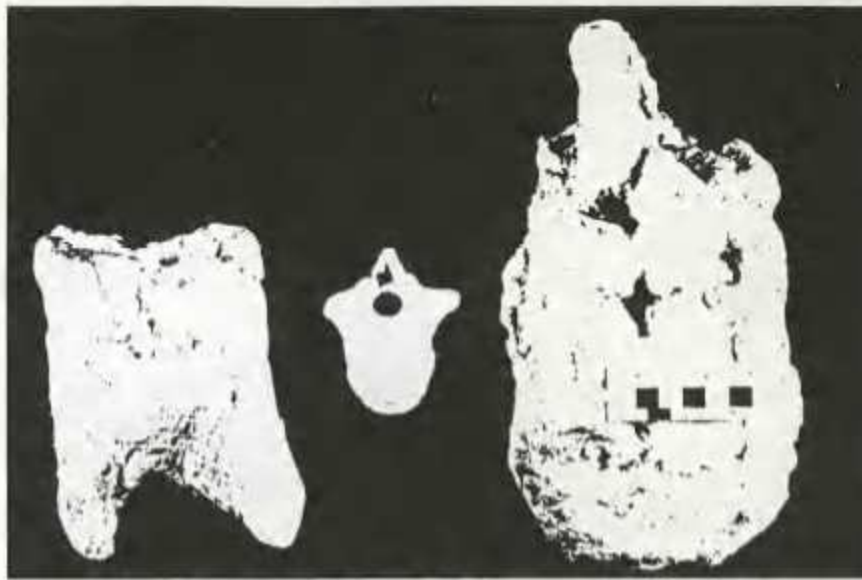
The seedbank hasn't got seed of the cycad at the moment, but our colleagues at *Jurassic Park* are working on it. - Piet Vorster.]

Massospondylus
(‘Massiewe werwel’)

Massospondylus was die volopste Suid-Afrikaanse dinosouriër en een van die volopste primitiewe dinosouriërs ter wêreld. Buiten vir een skedel van Arizona, Noord-Amerika, wat as 'n moontlike *Massospondylus* geklassifiseer is, word die res, en dit is letterlik honderde, *Massospondylus*-fossiele in Suid-Afrika aangetref. Die vondse wissel vanaf beenfragmente, geïsoleerde bene en voetspore tot volledig geartikuleerde skelette.

Die 3-6 meter lange *Massospondylus* kom in die geologiese lae bo dié waarin *Euskelosaurus* gevind word, voor. Daar is duidelike ooreenkomste tussen die twee tipes dinosouriërs en die huidige mening is dat *Euskelosaurus* of *Massospondylus* se direkte voorsaat was of dat beide vanuit dieselfde, maar tot dusver onbekende, voorouer gestam het. *Massospondylus* het soos 'n miniatuur en slanker weergawe van *Euskelosaurus* gelyk. 'n Gemiddelde *Massospondylus*-werwel is ongeveer 6 cm in deursnit, terwyl sy *Euskelosaurus* eweknie s'n meer as dubbel die deursnit kon hê.

Massospondylus het 'n lang dun nek en stert gehad en selfs die lyf was lank en silindervormig. Die sterkgeboude agterbene was heelwat langer as die voorbene. Hierie kenmerk was onder andere gebruik om die teorie dat *Massospondylus* 'n tweebeenige dinosouriër was, te staaf. Die teenargument is dat die voorste gedeelte van die liggaam veel swaarder as die agterste gedeelte was en dat dit sou veroorsaak het dat hulle vooroor val.



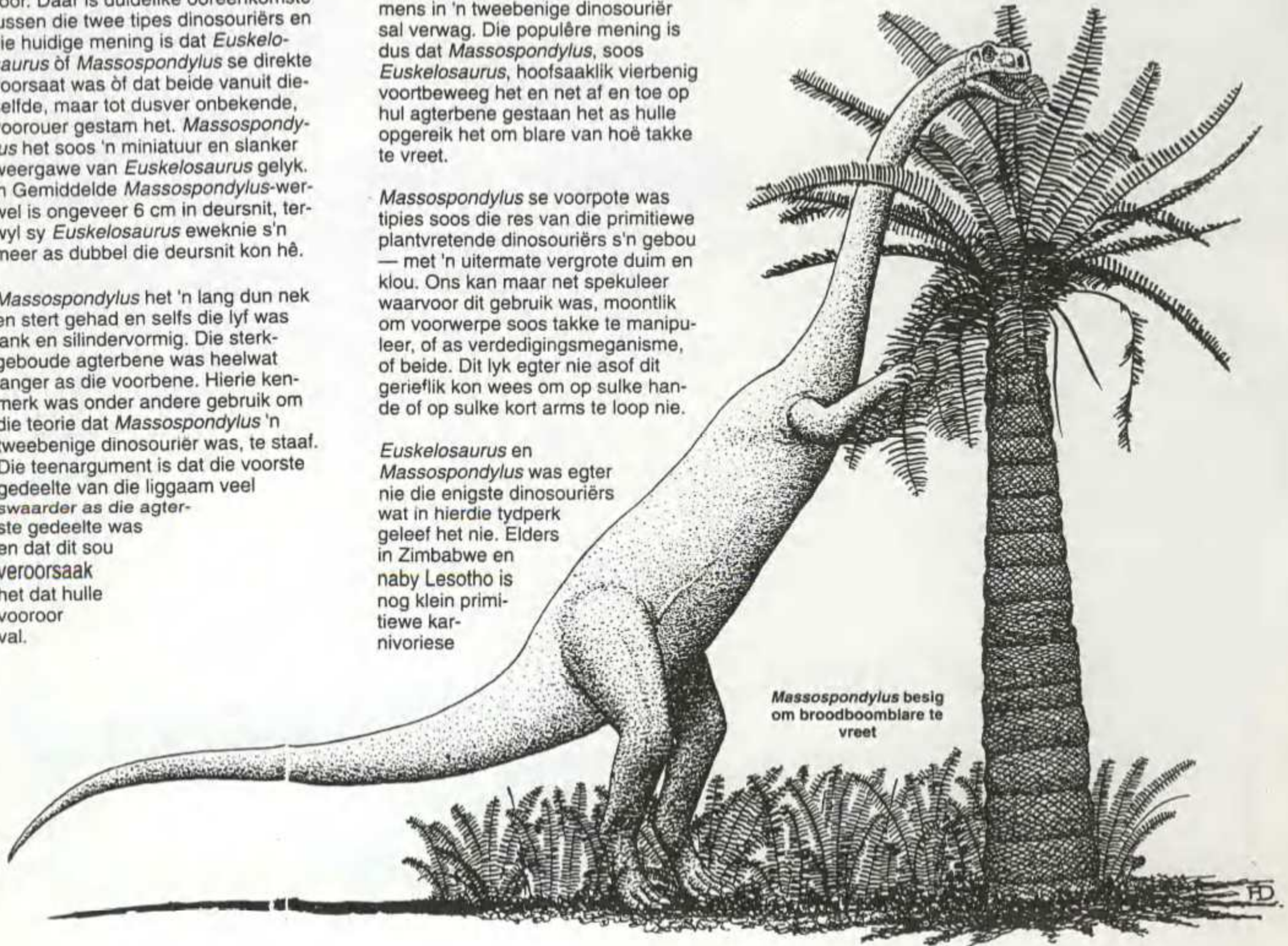
Voorpoot van *Massospondylus* (die oorspronklike fossiel word in die Transvaal Museum gehuisves)

Daarbenewens was *Massospondylus* se skouergordel en voorarms, alhoewel kort, sterker gebou as wat mens in 'n tweebeenige dinosouriër sal verwag. Die populêre mening is dus dat *Massospondylus*, soos *Euskelosaurus*, hoofsaaklik vierbenig voortbeweeg het en net af en toe op hul agterbene gestaan het as hulle opgereik het om blare van hoë takke te vreet.

Twee *Euskelosaurus*-werwels weerskante van 'n *Massospondylus*-werwel. Die *Euskelosaurus*-werwels is in teenstelling met die *Massospondylus*-werwel nog nie skoongemaak nie

Massospondylus se voorpote was tipies soos die res van die primitiewe plantvretende dinosouriërs s'n gebou — met 'n uitermate vergrote duim en klou. Ons kan maar net spekulêr waarvoor dit gebruik was, moontlik om voorwerpe soos takke te manipuleer, of as verdedigingsmeganisme, of beide. Dit lyk egter nie asof dit gerieflik kon wees om op sulke hande of op sulke kort arms te loop nie.

Euskelosaurus en *Massospondylus* was egter nie die enigste dinosouriërs wat in hierdie tydperk geleef het nie. Elders in Zimbabwe en naby Lesotho is nog klein primitiewe karnivoriese



Massospondylus besig om broodboomblare te vreet