ENCEPHALARTOS

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COVER / VOORBLAD : *Cycas segmentifida*

Female cone, about 200 mm across. In the Guangzhou Botanical Garden in May 1996. This species is characterised by the repeatedly segmented sporophylls.

Photo: Piet Vorster

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FROM THE PRESIDENT

It can be readily accepted that most collectors of cycads are not only collectors, but also conservationist lovers of nature. This is confirmed by group excursions to cycad colonies in their natural habitat, individual safaris to remote and inhospitable places and the provision of photographic material which are collected on such expeditions. At each possible opportunity there is enthusiastic talk about various aspects of cycads: where they occur, their growth habits and means of procreation. In cycad circles there is continuous speculation about rapid proliferation and wider distribution of plants through human intervention.

Cycad collectors does not only talk about cycads. Much effort goes into the removal of suckers and getting them to grow. Cycad people go out of their way to determine where the male and female plants of a specific species in their vicinity are. Male cone are regularly visited to determine exactly when pollen is released and female cones are closely watched so that the period of reception is not perchance overlooked. Pollen is carefully harvested, carefully marked and stored in small bottles until somebody somewhere needs it. Often pollen is send by express mail to the outskirts of the country to ensure that a female cone is not lost. And in the whole process a pleasant camaraderie, a friendly mutual assistance is to be observed. The same disposition one finds in the exchange of knowledge about methods of pollination, treatment of seed and soil mixtures.

Against this background I want to suggest that private individuals in the cycad environment consciously and unconsciously have taken the responsibility for the conservation, increase and distribution of plants on their shoulders.

In view of what has just been said about responsibility of the private individual for the conservation, increase and distribution of cycads, it is interesting to know that the State in particular, has committed itself constitutionally and in the interest of future generations to the protection of the environment. In article 24 of the Constitution the State undertakes to prevent ecological decline and to promote conservation through legislation and other methods. And each individual has a corresponding right to claim that the State fulfils its constitutional duties.

It may surely be accepted that the State, through its various legislators and executive officers, does not want to shirk its responsibilities. On its vast territory, in its botanical gardens and national parks valuable plants are,

VAN DIE PRESIDENT

Daar kan geredelik aanvaar word dat die meeste broodboomversamelaars nie net versamelaars is nie maar ook bewaringsgesinde natuurliefhebbers. Dit word bevestig deur groepuitstappies na broodboomkolonies in hulle natuurlike habitat, deur individuele safari's na afgeleë en onherbergsame plekke en deur die beskikbaarstelling van fotomateriaal wat op sulke ekspedisies versamel word. By elke moontlike geleentheid word daar geesdriftig oor verskeie aspekte van broodbome gepraat; waar hulle voorkom, hulle groeigewoontes en voortplantingswyses. In broodboomkringe word deurlopend gespekuleer oor hoe plante deur menslike ingryping vinniger vermeerder en wyer versprei kan word.

Broodboomversamelaars praat nie net oor broodbome nie. Daar word moeite gedoen om suiers af te haal en aan die groei te kry. Broodboommense gaan uit hulle pad om vas te stel waar die manlike en vroulike plante van 'n bepaalde spesie in hulle omgewing staan. Manlike keëls word kort-kort besoek om vas te stel presies wanneer stuifmeel vrygestel word. En vroulike keëls word fyn dopgehou sodat die periode van ontvanklikheid nie dalk misgekyk word nie. Stuifmeel word versigtig geoes, noukeurig gemerk en in botteltjies bewaar totdat iemand dit êrens nodig kry. Dikwels word stuifmeel per spoedpos na die uithoeke van die land gestuur om te verseker dat 'n vroulike keël nie verlore gaan nie. En in die hele proses is daar 'n aangename kameraadskap, 'n vriendelike wedersydse hulpvaardigheid te bespeur. Dieselfde gesindheid vind mens by die uitruil van kennis oor bestuiwingsmetodes, saadbehandeling en grondmengsels.

Teen hierdie agtergrond wil ek aan die hand doen dat privaat individue in die broodboomomgewing bewustelik en onbewustelik die verantwoordelikheid vir bewaring, vermeerdering en verspreiding van plante op hulle skouers geneem het.

In die lig van wat so pas oor die verantwoordelikheid van die privaat individu vir die bewaring, vermeerdering en verspreiding van broodbome gesê is, is dit interessant om te weet dat juis die Staat hom grondwetlik en in belang van toekomstige geslagte tot die beskerming van die omgewing verbind het. In artikel 24 van die Grondwet onderneem die Staat om deur wetgewing en ander metodes ekologiese agteruitgang te verhoed en bewaring te bevorder. En elke individu het 'n ooreenstemmende reg om daarop aanspraak te maak dat die Staat sy konstitusionele verpligtinge nakom.

Daar mag seker aanvaar word dat die Staat deur sy verskillende wetgewers en uitvoerende amptenare ook nie van sy verpligtinge wil wegskram nie. Op sy uitgestrekte grondgebied, in sy botaniese tuine en

after all, growing. In its offices, expert researchers and officials are working, surely trying to protect that which is entrusted to its care. But plants, other than cycads, are also growing. There is, as a matter of fact, a wide variety of flora and fauna to which attention must be given. The manpower and means to give specialized attention to each little orchid, aloe, wart-hog or elephant is definitely lacking.

It is probably not presumptuous to offer the specialized expertise of the organised cycad community to the State in the interest of the generations that will follow. If there is something like a misplaced possessiveness or an exaggerated desire to apprehend and prosecute on the side of the State (and I hope this is not the case), I want to plead that it must make room for an attitude of cooperation. Allow us to cooperate with you, to enrich in a wise manner the value of the treasures for which we are co-responsible.

Frederick de Jager

nasionale parke groei daar immers waardevolle plante. In sy kantore werk daar kundige navorsers en amptenare wat sekerlik probeer om dit wat aan hule sorg toevertrou is te beskerm. Maar daar groei ook ander plante as broodbome. Daar is trouens 'n wye verskeidenheid van flora en fauna waaraan aandag gegee moet word. Die mannekrag en die middele om aan elke klein orgidee, aalwyn, vlakvark of olifant gespesialiseerd aandag te gee ontbreek gewis.

Dit is seker nie voorbarig nie om in belang van geslagte wat kom aan die Staat die gespesialiseerde kundigheid van die georganiseerde broodboomgemeenskap aan te bied. As daar iets is soos 'n misplaasde besitlikheid of 'n oordrewe begeerte om te vang en te vervolg aan die Staat se kant is (en ek hoop dit is nie die geval nie), wil ek pleit dat dit plek moet maak vir 'n gesindheid van samewerking. Laat ons toe om die skatte waarvoor ons medeverantwoordelik is saam met u op 'n verstandige wyse nog waardevoller te maak.

Frederick de Jager

FOCUS ON ... FOKUS OP ...

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

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

CYCAS HAINANENSIS C.J. Chen ex W.C. Cheng, L.K. Fu & C.Y. Cheng

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

DISCOVERY

Southern China is a mostly mountainous area spanning moist tropical and subtropical zones. This combination of topography and climate forms a favourable habitat for cycads. Until recently the presence and diversity of cycads in this part of the world were poorly known. Explorations in the last two decades, however, have revealed and are still revealing many new species of *Cycas* in China. One of these occurs on the island of Hainan, off the coast of southern China. Described in 1975, it was named *Cycas hainanensis* C.J. Chen ex W.C. Cheng, L.K. Fu & C.Y. Cheng (Cheng *et al.* 1975). The type specimen was collected from a plant cultivated in a park in the provincial capital of Haikou. Recent expeditions to Hainan have revealed that this species is widespread in moist forests in the wet southeastern half of the island (Figures 1, 2).

The name of this species is in contention. One recent botanical work (Wang *et al.* 1996) places *Cycas hainanensis* in synonymy with the name *Cycas taiwaniana*

Figure 1 Map of Hainan Island with the shaded area indicating the approximate known distribution of *Cycas hainanensis*. The inset map in the upper left shows the location of Hainan Island relative to the rest of China.

Figure 2 View of the mountainous forest habitat of *C. hainanensis* near Sanya.

Carruthers. The type specimen of *C. taiwaniana* originated in mainland China in 1867, apparently from a cultivated plant in the vicinity of Xiamen, and has been the source of much taxonomic confusion (Shen *et al.* 1994). Xiamen is an old Chinese city known for its cultural development and horticulture. *Cycas taiwaniana* appears to have been native to subtropical hills and mountains from near Xiamen southward to the vicinity of Shantou (Shen *et al.* 1994, Lindstrom pers. comm.), and wild populations of this species are likely to be severely depleted or extinct after centuries of collecting for the horticultural trade. Hainan, a tropical island, located some 600 mniles southwest of Xiamen, on the other hand, has been a wild and remote area far removed from commerce of the old Chinese empire. Until the 1970's most of its expanse was inhabited by nonethnic Chinese peoples and malaria was rampant. It was only inhabited by ethnic Chinese exiled from the mainland. Because of the differences in climate, the geographic distance, and generic evidence (discussed below), in this paper I will treat *C. hainanensis* as a species distinct from *C. taiwaniana*.

Figure 3 Leaf of a young plant on a mountain roadside, near Sanya.

Figure 4 Old plant of *C. hainanensis* by road cut, near Sanya.

DESCRIPTION

Throughout its distribution on Hainan Island, *Cycas hainanensis* is fairly uniform in leaf, stem, and reproductive characters. Preliminary genetic analysis on

two populations indicates that *C. hainanensis* is genetically distinct from the *Cycas* populations studied so far from mainland China and S.E. Asia (Yang pers. comm.). The two populations studied are also distinct from one another. The mountainous terrain of the island appears to have reproductively isolated many populations of *C. hainanensis* for long periods, and based on genetic characters, some of these populations may deserve subspecies status (Walters and Young 1994, Yang pers. comm.). The following morphological description is based mainly on Wang *et al.* (1996).

Figure 5 Female plant with sporophylls, in habitat near Sanya.

1. STEM

The stem of *Cycas hainanensis* is aerial, reaching 3.5 m high (Figure 5). It is columnar and cylindrical to 400 mm diameter. Its surface is covered with persistent leaf bases. With age the lower part of the stem will become smooth (Figure 6). The stem exhibits strong apical dominance - suckers are usually not produced at the base and branching is rare.

2. LEAVES

Leaves are numerous in a crown, reaching 1–3 m long (Figures 3–5). The petiole is relatively long compared to most *Cycas*, reaching 250–1500 mm in length, with 26–45 pairs of spines. There are 76–144 pairs of undivided leaflets. Leaflet shape is linear, straight to slightly curved, flat with flat margins with an attenuate apex ending in a point. The texture is thin leathery, with the midvein prominent on both surfaces, and the upper surface is shiny. The middle leaflets are 170–400 mm long, 60–160 mm wide, with asymmetrical, decurrent bases, inserted at a ± 60 degree angle to the rachis.

Figure 6 Close-up of trunk of *C. hainanensis*, near Sanya. Note that the leaf scars on the upper trunk give way to a smooth texture at the trunk base.

3. CONES AND REPRODUCTION

In its original description, this species was distinguished by the shape of the female sporophylls (see Figures 7, 8). Subsequent studies have shown the female sporophyll shape to be highly variable (Wang *et al.* 1996) and it appears to be of relatively little use in distinguishing this species. Female sporophylls are 170–250 mm in total length, with a 100–150 mm stalk. Four to six ovules are attached to the stalk and the terminal end is expanded to form a flat, rhomboid to ovate shape with edges divided to form a comb pattern (see Figures 7, 8). They are covered with dense light-

Figure 7 Close-up of a wild female "cone" of *C. hainanensis* about one month after pollination, near Sanya.

Figure 8 Close-up of a female "cone" of *C. hainanensis*, in cultivation near Xinglong.

Figure 9 Male cone near end of pollenshedding, on a wild-collected plant at Xing Long Tropical Garden.

brown felt when young, but become a glabrous light green as they age after pollination. Mature seeds are globose, 30–45 mm long x 25–35 mm wide, with a yellow fleshy outer coat that turns red-brown with age. The inner hard coat has a distinctive irregular rough texture. Male cones are cylindrical to narrow ellipsoid, 490–700 mm long x 90–130 mm in diameter (Figure 9). The cone scales are yellowish green and the tip has a covering of brownish felt and a short spine.

In habitat cone maturation and pollination occurs from March to the beginning of June. A male cone I examined late in the pollen shedding stage, exhibited heat-producing activity in the evening period. This cone also emitted a sweet odour. Two species of beetles of the genus *Xenocryptus* (family Languriidae) were found on this cone (see Tang *et al.* 1997 for an illustration). Beetles of this family are found on cycad cones in Australia, Africa, and the New World as well as Asia (Tang *et al.*, in press). Experimental studies indicate that these type of beetles act as pollinators in many cycad species (Tang 1987, Norstog & Fawcett 1989, Donaldson *et al.* 1995). This evidence together suggest that these beetles play a role in the pollination of *Cycas hainanensis* as well. Seeds mature from October to December.

Orange-coloured larvae of a chrysomelid beetle, *Lilioceris* sp. feed on the young leaves of this cycad. The bright orange red adults can be seen mating on the foliage and presumably deposit their eggs on emerging leaves. They are not believed to play a role in the pollination of the plant.

Figure 10 Cultivated plants of *C. hainanensis* in a Miao minority village near Xinglong.

Figure 11 A robust specimen cultivated in a Miao minority village, with Prof. Fan of South China Botanical Garden.

AFFINITIES AND DIAGNOSTIC FEATURES

Hill (1995) divides the genus *Cycas* into four distinct sections. *Cycas hainanensis* is placed in the section *Stangerioides*, which comprises a group of forest *Cycas* found in the tropics and subtropics of southern China, Vietnam, Laos, northern Thailand, and northern Burma. Its closest relatives includes *C. taiwaniana* (discussed above), *C. szechuanensis*, *C. miquelii*, and perhaps *C. diananensis*. Also belonging to this section, but not as closely related, are *C. micholitzii*, *C. balansae* and *C. simplicipinna*. These are all species with primitive morphological characters and appear to belong near the base of the *Cycas* lineage.

At first glance, plants of various *Cycas* species appear very similar. There are a combination of characters, however, which can help to distinguish *C. hainanensis*. The hard inner seed coat of *C. hainanensis* and its relatives has an irregular rough texture, while those of most other *Cycas* are smooth. The leaves are fairly straight and do not arch as in many other species. The male cone scales have only a short spine and the odour it releases at pollen-shedding is relatively pleasant and sweet in contrast to the pungent, unpleasant odours released by male cones of *C. rumphii* and *C. pectinata*, which appear vegetatively similar.

DISTRIBUTION AND HABITAT

Today Hainan Island, from the air, appears heavily forested. This cycad has a patchy distribution along the wet southeastern section from an elevation of 50 m to mountain habitats up to 1700 m. The west and northwest areas of the island are dry and there appears to be another, as yet undescribed, dwarf species which inhabits this area. It is unclear whether these two species form intermediate populations. The wet southeastern coast consists mainly of second growth forest with a dense understorey that is difficult to traverse. During the Cultural Revolution in the 1970's most of the island's forest was cut and has since regrown. Old specimens of *C. hainanensis* in this forest often show stem damage attesting to this period of logging. In areas where it is locally abundant seedlings and young plants can be found, suggesting that it is successfully reproducing. In its natural habitat this is an understorey species of moist tropical forest (see Figures 3, 5) and shares its habitat with palms such as *Calamus*, *Licuala*, *Chuniophoenix* and *Caryota*. I observed them on brownish-orange clay soils and they are reported to occur on both limestone and volcanic soils (Walters *et al.* 1995). Localities cited by Wang *et al.* (1996) include: Qiongshan, Linshui, Qiongzhong, Baoting, Wanning, Cangjiang, Baisah, Ledong, Dongfang, Sanya, Tunchang, Wenchang, Tongshi, Danzhou, and Chenghai. Summers are hot and humid and the island is frost free. Average temperature in January is 23.8°C

Figure 12 Planting of *C. hainanensis* at Xing Long Tropical Garden.

and in July is 28.4°C. Rainfall averages 2000 mm annually on Hainan with most falling in the summer. The island is struck by typhoons virtually every year.

CULTIVATION AND HUMAN USES

On Hainan Island this cycad can be occasionally found as an ornamental plant, especially in villages near its native habitats (see Figures 10, 11). In cultivation, seedlings and young plants prefer constantly moist soils rich in organic matter. They respond to constant warmth, abundant moisture, and fertilizer with rapid continuous growth. Under such conditions this is among the fastest growing of all cycads. A garden worthy plant with leaves more than 1 m long can be produced from seed in two years under good conditions and probably faster under optimal conditions. In cultivation plants may grow larger and more robust than in the wild. Although in its natural state it is an inhabitant of the shady forest understorey, under cultivation it will thrive in full sun (see Figures 8, 11). In habitat plants were observed on edges of swampy areas which undoubtedly become flooded during heavy rains. I observed an established transplanted specimen, in a clearing adjacent to its habitat, standing in water, but showing a healthy crown of leaves. These observations suggest that in warm tropical conditions, at least, this species is tolerant of flooded conditions. Chen *et al.* (1995) reports that this plant is used medicinally to relieve coughing.

Large cultivated plants can be viewed in China at Xing Long Tropical Garden in Hainan Island (Figure 12), Fairy Lake Botanical Garden in Shenzhen, and the Cycad Garden in Panzhihua. Smaller seed-grown plants are cultivated in Nong Nooch Tropical Garden, Thailand and the Montgomery Foundation in Miami, Florida.

CONSERVATION STATUS

This species appears fairly widespread over a large part of Hainan Island with a scattered distribution. Several known populations are threatened or have been destroyed by agricultural development and road construction. Its forest habitat, however, while heavily logged in recent decades, is still very extensive and the plants in these forests seem to have recovered well from this earlier period of disturbance. It is protected in some forest reserves and is not considered under imminent threat of extinction. Recent cases of over-collecting of cycads in China, however, suggest that wild populations can be rapidly depleted if a market develops

for these plants (Walters & Young 1994, Yang & Pu 1994). In the 1980's the province of Hainan was declared a special economic zone by the Chinese government and development of the island as a tourist destination has proceeded at a rapid pace. Development and demand for landscape material will likely pose a serious threat to this species in the future. Propagation of these plants by seed is encouraged to bolster propagation stocks in cultivation.

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ARTICLE / ARTIKEL

SOME INSECTS AND OTHER INVERTEBRATES ASSOCIATED WITH THE AUSTRALIAN CYCAD *MACROZAMIA COMMUNIS* L. JOHNSON (ZAMIACEAE)

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ABSTRACT

Macrozamia communis, popularly known as the burrawang, grows between the coast and the Great Dividing Range from NW of Kempsey in the north to ESE of Bega in the south in the State of New South Wales (Text fig. 1).

All invertebrates collected, with the exception of three genera of molluscs, were arthropods. Thirteen orders of insects are listed, of which Coleoptera (15 families, 33 species), Hymenoptera (7, 21) and Diptera (12, 16) were the most numerous in numbers of species. Psocoptera (6, 11) and Hemiptera (7, 8) were next in order. Lepidoptera, a major, predominantly polyphagous, order

Text fig. 1. Distribution of *Macrozamia communis*.
⊡ Known northern, western and southern limits.

is represented only by four species belonging to four families. Spiders, Araneida, accounted for 13 genera and 26 species. Millipedes, centipedes and pseudoscorpions, were also recorded. About seven mollusc species were encountered.

Some species seem to be totally dependent on the cycad as a food plant, but others appear to have only a most casual relationship. Several gradations occur between the two extremes.

The great majority of the invertebrates recorded are native species, only four introduced species being encountered. There are two pest species, one introduced, one native.

INTRODUCTION

Invertebrates were mainly collected from:

1. the bases of leaves which terminate at the growing point deep in the caudex. Invertebrates often occur between the pinnules and the rachis.
2. the male cones between or inside the microsporophylls or breeding in the rachis and peduncles. Female cones are much less productive.
3. the caudex, in frass produced by the feeding of larvae of *Melanotranes internatus*.
4. the sweeping of leaves above ground, mainly at Seven Mile Beach. Some species were known to have a definite association with the plant, others were probably present purely by chance.
5. Monthly samples. From August 1979 to July 1980 (inclusive) at Seven Mile Beach 100 leaves were collected, their pinnules stripped and all fauna collected for examination.

Most of the material was collected in 1979 and 1980.

INVERTEBRATES ASSOCIATED WITH *M. COMMUNIS*

Locality abbreviations: K = Kurnell, N = Noraville, SMB = Seven Mile Beach, SF = State Forest.

PHYLLUM ARTHROPODA
CLASS INSECTA

COLLEMBOLA

Three species (Podaridae, Entomobryidae).
In male cone, SMB, 5/7/79. In leaves, SMB, 27/9/79. 25/6/80.

BLATTODEA

Blaberidae

Laxta granicollis (Sauss.). Among leaves, Fingal Bay, 24/9/75. Mt. Sugarloaf (near Wallsend), 3/1/79. SMB, 5/9/79. Among pinnae, Bodalla, 3/10/71. In leaf bases, near Bermagui, 13/6/71.

ISOPTERA

?Peduncles heavily infested, N, 27/3/88.
?Workers only, attacking caudex at Noraville.
Soldiers. In old stump, K, 23/9/67.

Rhinotemitidae

Coptotermes sp. In caudex, North Nowra, 30/3/80.

EMBIOPTERA

Oligotomidae

?Genus. Among leaves, Mogareka Inlet, 25/10/78.

DERMAPTERA

Spongiophoridae

?Genus. In caudex, North Nowra, 30/8/80.

ORTHOPTERA

Tettigoniidae

Clephanyodita sp. By sweeping, SMB, 26/2/80.

Coptaspis brevipennis Redt. Rests horizontally along pinnules. Brachypterous. Fingal Bay, 24/9/75. N, 28/5/79, 25/10/79, 11/11/79, 14/11/79, 19/11/80. Bouddi, 30/7/78. Woy Woy, 16/7/78. West Head, 27/4/80. Balgowlah, 6/4/80. SMB 27/2/79, 30/12/79, 29/1/80, 26/2/80, 23/3/80, 18/11/83.

Paragryllacris sp. In male cone, K, 1/3/70, 23/8/70. Between leaves, K, 11/11/67.

Gryllidae.

Ornebius coomealla Otte & Alexander. Between sporophylls, N, 15/12/79. Between sporophylls, Avalon, 13/12/92.

PSOCOPTERA
C.N. Smithers

Trogidae

Nymph, from male cone, *M. communis*, Bungwahl, 17/9/79, C.E.C.

Liposcelidae

Liposcelis sp. A.

1 female, *M. communis*, Cromer, 13/11/79, 17/10/80, C.E.C.

1 female, *M. communis* Cromer, 20/5/80, C.E.C.

1 female, ex caudex, *M. communis* Cromer, 13/5/80, C.E.C.

Liposcelis sp. B.

1 female, 2 nymphs, *M. communis*, Cromer, 2/7/80, C.E.C.

1 female, ex caudex, *M. communis*, Cromer, 13/1/80, 25/5/80, C.E.C.

1 female, *M. communis*, SMB, 25/4/79, 16/12/79, C.E.C.

1 female, ex caudex, *M. communis*, Cromer, 13/11/79, 3/10/80, C.E.C.

1 female, ex caudex, *M. communis*, Cromer, 13/11/79, 9/7/80, C.E.C.

3 females, ex caudex, *M. communis*, Cromer, 13/11/79, 24/8/80, C.E.C.

1 female, *M. communis*, Wingham, 13/11/80, C.E.C.

Liposcelis sp. C.

1 female, ex canopy, *M. communis*, Cromer, 13/11/79, 29/9/80, C.E.C.

several females, female cone, *M. communis*, 6 km E. Bungwahl, 17–18/9/79, C.E.C.

1 female, *M. communis*, Cromer, 13/11/79, 1/5/80, C.E.C.

2 females, ex male cone, *M. communis*, Balgowlah, 20/12/79, C.E.C.

1 female, caudex, *M. communis*, Cromer, 18/11/79, 23/9/80, C.E.C.

1 female, *M. communis*, Cromer, 13/11/79, C.E.C.

Pachytroctidae

Pachytroctes rugosus Smithers

2 females, ex male cone, *M. communis*, SMB, 25/4/78, C.E.C.

Sphaeropsocopsidae

Sphaeropsocopsis recens (Hickman)

1 female, *M. communis*, SMB, 25/4/79, C.E.C.

Caecilidae

Caecilius sp.

1 specimen, ex dried male cone, *M. communis*, SMB, 25/4/79, C.E.C.

Caecilius quercus Edwards

1 male, sweeping leaves, *M. communis*, SMB, 5/7/79, M.I.Nikitin.

Paracaecilius lemuris Smithers

1 male, sweeping leaves, *M. communis*, SMB, 5/7/79, M.I. Nikitin.

1 male, 1 female, night sweeping, *M. communis*, SMB, 27/9/79, M.I. Nikitin.

Ectopsocidae

Ectopsocus sp.

1 specimen, from female cone, *M. communis*, Mt. Sugarloaf, 3/1/79, C.E.C.

Ectopsocus australis Schmidt and Thornton

1 female, from *M. communis*, Balgowlah, 3/12/79, C.E.C.

(All determinations by C.N. Smithers. Specimens donated to Australian Museum Collection.)

(Smithers [1995] recorded *Caecilius quercus*, Caecilidae, being beaten from leaves of *Lepidozamia peroffskyana* near Taree. This is the only species and family known to be collected from both cycads. However, species recorded by Smithers were mainly from leaves; species collected by the author were mostly from male cones and caudices of *M. communis*.)

HEMIPTERA

Pseudococcidae

Dysmicoccus macrozamiae (Fuller). Mealy bug: in large numbers, at bases of leaves. Wide distribution, e.g., among leaves, Styx River, 17/3/72, 28/3/79. Among leaves, Ulan, 28/3/73. At bases, younger leaves, Wollar, 30/3/73. Among leaves, Pee Dee, 17/3/72, Carrai SF (near Kempsey), 29/3/79. Among leaves, Myall Lakes, 6/3/73. Fingal Bay, 18/9/75, 24/9/75. Mulbring, 21/6/81. N, 19/11/78, 13/1/80, 16/4/80, 27/3/88, 31/7/88, 27/5/90. Among leaves, Woy Woy, 16/7/78. On leaf, Cromer, 10/9/78. Balgowlah, 5/11/79, 3/12/79. SMB, 5/7/79, 28/11/79. Between bases of leaves, Shoalhaven Heads, 14/6/71. North Nowra, 27/1/80. 10.5 km N. of Batemans Bay, 13/10/78. Bermagui, 27/10/78. Nelson Beach, 26/10/78. Among leaves, Moon Beach, 26/10/78. Among leaves, Mogareka Inlet, 25/10/78.

Diaspididae

Aspidiotus nerii Bouche. Introduced, polyphagous pest; sometimes disfigures petioles by heavy infestations, accompanied by yellowing of pinnae. On sporophylls, Carrai SF (near Kempsey), 29/3/79. Bungwahl. 17–18/9/79. Infested petioles, Myall Lakes, 6/8/73. N, 15/12/79, 3/3/81, 16/4/81, 11/11/82, 27/3/88, 6/2/89, 10/9/89, 20/1/90, 26/4/92. On petioles and leaves, Cromer, 10/9/78. K, 23/5/70, 23/7/78. Balgowlah, 21/8/79, 5/11/79, 3/12/79, 6/4/80. Artarmon, 20/12/92. Neutral Bay, 14/12/80. Picnic Point, 13/8/78.

Flatidae

Siphanta acuta (Walker). Sweeping, S.M.B., 26/2/80.

Anthocoridae

Xylocoris flavipes (Reuter). Ex male cone, Mt. Sugarloaf, 3/1/79.

Lygaeidae

Nysius vinitor Berg. Sweeping, N, 16/4/80. SMB, 29/4/79.

Coreidae

Amorbus rhombifer West. Sweeping, SMB, 5/7/79, 25/3/80.

Agriopocoris sp. Sweeping, SMB, 27/9/79, 26/2/80.

Pentatomidae

Poecilometis gravis (F.). E. of Bungwahl, 18/9/79. N, 16/4/80.

THYSANOPTERA

Aeolothripidae

Cycadothrips chadwickii Mound. New species, new genus, new subfamily, described by L.A. Mound (1991). Type locality Noraville, 30/9/90, in male cone. Mt. Sugarloaf, 31/1/79. Munmorah, 24/11/80. In male cones, N, 19/11/78, 18/2/79, 25/10/79, 14/11/79, 19/11/80, 1/10/89, 1/10/90, 30/10/90. Cromer, 2/7/80, 1/10/80, 17/10/80. Avalon, 25/11/90, 13/12/92. Balgowlah, 5/11/79. Chatswood, 27/11/90. SMB, 28/12/79, 13/11/88, 1/10/89. 10.5 km N. of Batemans Bay, 13/10/78. Bermagui, 27/10/78. Nelson Beach, 26/10/78. Forster *et al.* (1994) state that this species is associated with *Macrozamia lucida, M. miquelli* and *M. mountperriensis* at various localities in Queensland.

Phlaeothripidae

Idolothrips spectrum Hal. Sweeping, SMB, 27/9/79.

COLEOPTERA

Histeridae

Hololepta lissopyga Mars. Under sporophylls, K, 23/9/67.

Staphylinidae

Aleochorinae. Ex male peduncle, Mt. Sugarloaf, 31/1/79.

Anotylus sp. Ex peduncle, N, 19/11/78.

Austrolophrum sp. In male cone, Avalon, 13/12/92.

Eulissus sp. Ex caudex, K, 14/2/64.

Quediina sp. Ex male peduncle, N, 19/1/79.

Quediina sp. B. Ex male cone, N, 15/12/79.

Thyreocephalus haemorrhous (Fauv.). Ex caudex, K, 12/2/64.

Xantholinus lonquini Fauv. In caudex, K, 28/2/64.

(Identifications by V.W.H. Lorimer.)

Buprestidae

Xyroscelis bumanna Williams & Watkins (1986), as new species. Flying, N, 17/11/83. Bred from leaf rachis (Mulder 1984). Adult at base of peduncle, N, 17/11/83. Williams & Watkins (1986) record the species from Woy Woy (holotype), Coonabarabran and Kurnell.

Elateridae

Conoderus nitidulis Cand. In axil of pinnule, SMB, 1/11/70.

Cantharidae

Chauliognathus lugubris (F.). On leaf, West Head, 27/4/80.

Nitidulidae

Brachypeplus n.sp. to be described by A.G. Kirejtshuk, of St. Petersburg, Russia. Among leaves. Widespread, e.g., Big Hill (Styx River), 17/3/72, 3/4/72, 27/3/79. Pee Dee, 17/3/72. Willi Willi, 18/3/72. Carrai SF, 29/3/79. Myall Lakes, 6/8/73. Fingal Bay, 18/9/75, 24/9/75. Mulbring, 21/6/81. Mt. Sugarloaf, 3/1/79. N, all months. K, 11/11/67, 23/5/70, 23/8/70, 19/12/75. SMB, 1/11/70, 5/7/79. At base of leaves, Shoalhaven Heads, 14/6/71. North Nowra, 27/1/80. Wogomia, 20/9/70. In bases of leaves, Yalwal, 3/10/70. Shallow Crossing, 13/10/78. Among leaves, 10.5 km N. of Batemans Bay, 13/10/78. 11 km S. of Bermagui, 13/6/7 (sic). Moon Beach, 26/10/78. Mogareka Inlet, 25/10/78.

Erotylidae

Episcaphula australis Boisd. Mt. Sugarloaf, 3/1/79.

Coccinellidae

Coelophora inaequalis F.). On young leaves, Shoalhaven Heads, 14/6/71.

Corylophidae

Sericoderus basipennis Lea. Carrai SF, 29/3/79. About 1 m long. Larvae, pupae and adults among microsporangia, Mt. Sugarloaf, 3/1/79. Ex male cone, N, 4/1/79, 28/5/79, 16/11/79, 12/10/80, 18/11/80. In base of leaves, SMB, 1/11/70, 27/2/79, 28/11/79. In male cones, SMB, 25/4/79. On young leaf, Shoalhaven Heads, 14/6/71. Bermagui, 27/10/78. Among leaves, Mogareka Inlet, 25/10/78.

Tenebrionidae

Homotrysis rufipes F. K, 23/9/67. By sweeping, SMB, 29/4/80, 30/7/80.

Cerambycidae

Ichthyodes centurio (Pasc.). Among pinnae, NE of Bodalla, 3/10/71.

Phaepate sp. Among petioles, SMB, 29/10/79.

Phalota tenella Pasc. Sweeping, SMB, 27/9/79.

Temnosternus planuisculus White. Ex bagged material, mainly dried leaves, Wingham, 31/10/79, 7/1/80, 19/9/80, 10/10/80, 3/8/81. 6 km E. of Bungwahl, 5/10/79, 18/10/79. Ex dried out petioles, SMB, 14/9/79, 5/11/79, 26/2/83. By sweeping, SMB, 27/9/79, 26/2/80, 25/3/80, 29/4/80, 26/2/83.

Sybra acuta Pasc. Bred by R.H. Mulder, ex rachis, K, 29/11/63.

Chrysomelidae

Rhyparida sp. Among leaves, Pee Dee, 17/3/72.

Belidae

?Genus. On leaf, N, 14/11/79.

Attelabidae

Euops sp. Sweeping, SMB, 27/9/79, 26/2/80.

Curculionidae

Amnemus quadrituberculatus (Boh.). Sweeping, SMB, 27/9/79.

Cherrus infaustus Ol. Sweeping, SMB, 29/4/80.

Leptopius duponti Boisd. On leaf, Mulbring, 21/6/81.

Melanotranes internatus (Pasc.). Breeds in caudex, accompanied by rise in temperature. Big Hill, 3/4/72. Pee Dee, 17/3/72. Willi Willi, 18/3/72. 20 km ex Merriwa, 30/3/73. 10 km ex Mulbring, 21/6/81. McMasters Beach, 6/7/78. Patonga, 23/3/80. Bred from caudex, Cromer, 13/11/79. Bred from caudex, K, 23/1/63–2/3/64 (more than 288 specimens). Bred from caudex, Engadine, 8/3/91. In base of leaves, Wogomia (near Nowra), 20/9/70. In bases of leaves, Yalwal, 3/10/70. Among leaves, Blackfellows Point (near Bodalla), 3/10/71. In leaf bases, 11 km S. of Bermagui, 13/6/71. Among leaves, 10.5 km N. of Batemans Bay, 13/10/78. Nelson Beach, 26/10/78. Among leaves, Mogareka Inlet, 25/10/78.

(Heat Production: A caudex found at Cromer on 13/11/79 was infested with larvae of *M. internatus*. On 11/1/80 after it had been observed that the internal temperature of the caudex was higher than that outside, two thermometers, widely separated, were inserted about 7 cm into the caudex. At 4 pm one thermometer registered 30°C, the other 32°C, while the outside air read 28°C, a difference of 2°C and 4°C respectively. Temparatures were recorded until 28/10/80 when the caudex had become too fragile to handle.

On 14/1/80 one thermometer read 25°C in the air at 11.15 am, and 33°C in the caudex at 12.05 pm, a difference of 8°C.

On 19/6/80 the thermometers, both in the ambient air and in the infested caudex, read 18°C.

Apparently the temperature was not uniform throughout the interior of the caudex, probably being influenced by the presence and/or activity of the larvae. As a general rule the temperature of the interior of the caudex fell over the period under observation until internal and external temperatures were equal. The interior of a healthy uninfested caudex may be cooler than the ambient air, e.g., a

thermometer inserted about 7 cm into a caudex at Noraville at 1.05 pm on 15/2/80 read 23°C, while the ambient air recorded 30.5°C.)

Perperus sp. Sweeping, SMB, 25/3/80, 29/4/80.

Sitophilus zeamais Mots. In caudex, K, 20/2/64. In base of leaf, Wogomia, 20/9/70.

Tranes lyterioides (Pasc.). Breeds in rachis and microsporophylls of male cones; also collected by sweeping leaves. Distribution: range of plant and beyond. Responsible for pollination in *M. communis* (Chadwick 1993). Big Hill, 3/4/72. Bungwahl, 17–18/9/79. Fingal Bay, 24/9/75. Mulbring, 21/6/81. N, all months. Intermediate localities. SMB, all months. In leaves, North Nowra, 27/1/80. Among pinnae, Pebbly Beach, 2/10/71. Among leaves, Mogareka Inlet, 25/10/78.

T. sparsus Boh. Adult found in large numbers in male cones, N, October, November, 1978, 1980, 1981, 1985. Avalon, 13/12/92 (Chadwick 1993). Engadine, December 1993.

DIPTERA

Tipulidae

Leptotarsus (*Macromastix*) sp. Sweeping, SMB, 16/4/80.

Anisopidae

Sylvicola dubius Macq. Bred from male peduncles, N, 17/11/79.

Scatopsidae

Undet. Ex damaged female cone, N, 15/12/79.

Sciaridae

Bradysia tritici (Coquill.). Ex frass in caudex, Cromer, 6/8/80.

Bradysia sp. Sweeping, SMB, 29/4/80.

Undet. Ex frass in caudex attacked by *Melanotranes internatus*, Cromer, 13/11/79, 4/6/80.

Stratiomyiidae

Exaireta spinigera Weid. Soldier fly, N, 10/2/79. Long series bred from frass in caudex damaged by *Melanotranes internatus*, Cromer, 24/12/79 to 24/3/80, 21/4/80. K, 30/10/67, 2/11/67, 6/11/67.

Ophiodesma flavipalpis Macq. Bred from caudex, K, 6/1/64.

Dolichopodidae

Achilus n.sp. Ex male peduncle, N, 23/1/79.

Syrphidae

Microdon variegatus (Walk.). Ex female cone, Bungwahl, 8/10/79.

Lauxaniidae

Homoneura sp. Sweeping, SMB, 25/3/80.

Lonchaeidae

Lamprolonchaea rugosifrons Bezzi. Bred from male cone, K, 30/12/65.

Platystomatidae

Lenophila dentipes (Macq.). N, 27/8/81, 25/10/81. Among leaves, West Head, 27/4/80. Bred from decaying frass of caudex, after feeding of *Melanotranes internatus*, Cromer, long series emerging from 7/1/80 to 24/3/80. Holloway and McAlpine associated it with *Eucalyptus* sp., The Entrance (McAlpine [1972]; McAlpine & Kim [1977]).

Heleomyzidae

Tapeigaster annulata (Hendel). Sweeping, SMB, 27/9/79.

Fanniidae

Fannia canicularis (L.) and *F. australis* Malloch: bred from damaged female cone, N, 14/11/79.

LEPIDOPTERA

Psychidae

Hyalarcta huebneri (Westw.). Case attached to rachis, N, 15/2/80.

Oecophoridae

Eulechria n.sp.. Bred from rachis of male cone; pupates under contersunk covering. Widespread, e.g., Ulan, 20/4/73. Carrai SF, 29/3/79. Bungwahl, 17–18/9/79. Fingal Bay, 12/2/76. Mt. Sugarloaf, 16/1/78. N, 20/11/78, 4/8/79, 19–20/11/79, 16/11/84, 1/10/90, 11/11/90. Patonga, 6/2/76, 30/12/65, 10/1/66. Avalon, 22/12/85, 25/11/90, 13/12/92. Balgowlah, 22/8/79. In cones, K, 6/12/69. In male cones, SMB, 1/11/70, 27/2/79, 25/4/79, 29/6/79, 17/8/79, 29/10/79, 30/7/80. Bermagui, 27/10/78.

Cosmopteridgidae

Pyroderces ?dendrophaga Meyr. Ex male cone, K, 4/1/66.

Lycaenidae

Theclinesthes onycha onycha (Hewitson). Larva attacking pinnules, N, 11/11/82. Adult flying, N. 25/9/83.

HYMENOPTERA

Ichneumonidae

Coccygomimus sp. Sweeping, SMB , 5/7/79.

Braconidae

Apanteles sp. Carrai SF. Emerged 6/10/79–10/11/79. E. of Bungwahl, 28/9/79. Mt. Sugarloaf, emerged 8, 19, 23/1/79. N, 7, 29/9/79. Balgowlah 2, 5, 12, 19/10/79, 2/11/79, 21/12/79, 4/1/80. K, 31/12/65. SMB, 15/1/79.

Chelonus sp. Ex male cone, Carrai SF, 29/3/79. Bred ex male cone, Mt. Sugarloaf, 10–27/1/79, 31/1/79. Ex male cone, N, 11, 19/11/78, 7/9/79, 14/11/79, 15/11/84, 22/10/89, 11/11/90. Ex male cone, Balgowlah, 12, 19/10/79. Ex male cone, K, 10, 13/1/64, 31/12/65, 16/11/84, 23/10/89. SMB, 14/9/79, 6/10/79.

Iphialax sp. 6 km E. of Bungwahl, 17/9/79. Ex male cone, Mt. Sugarloaf, 31/1/79. Ex damaged female cone, N, 22/12/79. Ex male cone, N, 15/11/84. Ex male cone, K, 24, 31/12/65. Ex aggregate of *T. lyterioides* cocoon material, SMB, 11, 14, 15/1/79. Ex male cone, Bermagui, 27/10/78.

?Doryctini. ?Genus. Ex male cones, K, 31/12/65.

Perilampidae

?Genus. Among male cones, Mt. Sugarloaf, 24/1/79.

Elasmidae

Elasmus lividus Gir. Ex male cone, Carrai SF (near Kempsey), 29/3/79. Balgowlah, 21/8/79.

E. ?longifasciativentris Gir. Ex male cone, K, 31/12/75.

E. near *homonae* P. ?. Ex male cone, K, 31/12/65.

Tiphiidae

Tachynomyia ?volatilis Smith. Ex leaves. SMB, 30/7/80.

Vespidae

Rhopalidia plebiana Richards. Small nests on pinnules. Weak sting. SMB, 25/3/80, 18/3/84, 16/3/86, 11/7/86, 19/11/87.

Formicidae

Aphaenogaster longiceps (Smith). N, 3/9/78, 27/5/90. Nest around base of caudex, SMB, 26/2/83.

Iridomymex glaber (Mayr). In peduncle, male cones, K, 1/3/70.

I. sp. (*itinerans* group). On young leaf, 11 km E. of Bermagui, 13/6/71.

I. punctatissima Emery. On young leaf, 11 km S. of Bermagui, 13/6/71.

Monomorium sp. (*rubripes* Mayr group). At bases of leaves, Myall Lakes, 6/8/73.

Myrmecia sp. Sweeping, SMB, 26/2/80

Paratrechina sp. N, 28/5/79.

Pheiodole sp. N, 28/5/79.

Polyrachis sp. Often on petioles, N, 11/11/82.

Rhytidoponera metallica (Smith). On leaf, Pee Dee, 17/3/72. Fingal Bay, 24/9/75. On leaf, Daleys Point, 18/7/71.

Additional undetermined Formicidae.

CLASS DIPLOPODA

Undetermined species. Among leaves, N, SMB, 15/2/80.

Strongylosomatidae

Clarethosoma clarum Cham. At bases of leaves, K, 23/9/67.

CLASS CHILOPODA

Ethmostigmus rubripes (Brandt). Amongst leaves, Bungwahl, 17/9/79.

Undet., 2 specimens. In old dry cone, Willi Willi, 18/3/72. Among leaves, Mogareka Inlet, 25/10/78.

CLASS ARACHNIDA
ORDER ARANEIDA

Araneidae

Arcys sp. SMB, 26/2/80. PHOTOS P. 165.

Argiope keyserlingii Karsch. Spinning webs among leaves. N, 17/11/68. Balgowlah, 16/2/81.

Eriophora ?crassipes. Sweeping, SMB, 26/2/80.

Eriophora ?similaris. Sweeping, SMB, 26/2/80.

E. transmarinus Keyserling. N, 18/2/82.

Gasteracantha minax Thorell. On leaves, N, 18/1/83.

Phonognatha graeffei (Keyserling). Sweeping, SMB, 26/2/80.

Clubionidae

Clubiona ?robusta L.Koch. Among leaves. Woy Woy, 16/7/78.

Clubiona sp. Juvenile. N, 28/5/79.

Desidae

Lampona sp. In peduncle. In male cone, K. 1/3/70. N, 31/7/79. (P. 401).

Badumna sp. Ex female cone, SMB, 25/4/79.

Toxopsioides sp. Ex female cone, SMB, 25/4/79.

Gnaphosidae

Molycria ?n.sp. Ex disintegrating female cone, SMB, 25/4/79.

?Genus. Juvenile. Balgowlah, 21/8/79.

Heteropodidae

Isopoda vasta L.Koch. N, 25/10/79. Sweeping, SMB, 26/2/80.

Isopoda sp. On leaves, N, 28/5/79.

Olios diana Koch. Sweeping, among leaves. SMB, 25/4/79, 5/7/79.

Lamponidae

Lampona sp. N, 31/7/79.

Lycosidae

Pirata sp. Juvenile. Male. In male cone, SMB, 25/4/79.

Mysmenidae

Mysmena sp. Juvenile. Ex female cone, E. of Bungwahl, 17/9/79.

Oonopidae

Gamasomorpha sp. Ex female cone. Bungwahl, 17/9/79.

Salticidae

2 species, juveniles. By sweeping, SMB, 26/2/80.

Segestriidae

Ariadna sp. Ex female cone, SMB, 25/4/79.

Thomisidae

1 species, juvenile. By sweeping, SMB, 26/2/80.

Theridiidae

Latrodectus hasselti Koch. Mulbring, 21/6/81.

(Additional undetermined species.)

(All determinations by M.R. Gray. Specimens donated to the Australian Museum collection.)

ORDER PSEUDOSCORPIONES

Paraliochthomias queenslandicus (Beier). Among leaves, N, 3/9/78, 19/11/78.

Paraustrochernes victorianus Beier. Among leaves, North Nowra, 27/1/80. Among pinnae, Blackfellows Point, NE of Bodalla, 3/10/71. In leaf base, 10.5 km N. of Batemans Bay, 13/10/78. In base of leaves, 4 km from Shallow Crossing, 13/10/78.

Protogarypinus giganteus Beier. In leaf base, N, 19/11/78.

P. dissimilis Beier. In leaf base, N, 19/11/78.

Determinations by M. Beier, June 1979.

ORDER ACARI

Urodinychidae

Oodinychus n.sp. Wollar, 30/3/73. Toronto, 21/6/81. Among leaves, N, 16/11/79, 1/10/80. Among leaves, Woy Woy, 16/7/78. On leaves, Cromer, 10/9/78. On *T. lyterioides*, Balgowlah, 22/12/79. By sweeping, SMB, 5/7/79. In leaves, SMB, 5/7/79, 28/11/79. Ex leaves, Bermagui, 27/10/78. Ex leaves, Nelson Beach, 26/10/78.

?Family

New genus, new species. On *Melanotranes internatus* adults, sometimes in large numbers, clinging to and immobilising weevils, Cromer, 13/11/79–29/10/80.

Ixodidae

Ixodes sp. Among leaves, Mogareka Inlet, 25/10/78.

PHYLUM MOLLUSCA

Athoracophoridae

Triboniophorus graeffei Humbert. Among leaves, Bungwahl, 17/9/79. Low in leaf, Fingal Bay, 24/9/75. In leaf, N, 18/2/79, 14/11/79.

Arionidae (introduced)

Arion sp. Immature. Among leaves, Carrai SF (near Kempsey), 29/3/79.

Camaenidae

Meridolon duralensis (Cox). Among leaves, N, 16/3/80. Among leaves, SMB, 29/1/80.

M. gilberti (Pfeiffer). Among leaves, Bungwahl, 17/9/79. Among leaves, N, 28/2/79.

M. jervisensis (Quoy & Gaimard). Among leaves, SMB, 25/4/79.

M. middenense McLachlan. In leaves, N, 15/2/80. In male cone, K, 23/8/70.

M. sp. aff. *middenense* McLachlan. Among leaves, Mungo Brush, 6/8/73.

(Mollusca determined by P. Colman and W. Ponder. Specimens donated to the Australian Museum collection.)

One vertebrate, a gecko, *Amphibolurus* sp. (*muricatus* or *nobbi*) was found sheltering in the top of a male cone at Seven Mile Beach on 5/7/79.

DISCUSSION

Forster *et al.* (1994: 218) claimed to have published the first observations on insects (about 12 species) associated with *Macrozamia* spp. However, publications by Westwood (1886), Baird (1939), Ornduff (1990), Mound (1991) and Chadwick (1993) did not entirely overlook insects on this genus of cycad.. The present list contains about 100 species of insects, plus about 40 other invertebrates, and is by no means exhaustive. It is hoped that, on a quantitive basis, it shows the most numerous groups of invertebrates associated with *M. communis*.

It is noteworthy that only two invertebrate phyla, viz. Arthropoda and Mollusca have been collected on this cycad. The Class Insecta is most abundantly involved, the Coleoptera being the most common insect order.

The great majority of the species listed in this publication are native to Australia, but a number are regarded as introduced species, e.g., the scale insect *Aspidiotus nerii*, the bug *Xylocoris flavipes*, the grain weevil *Sitophilus zeamais*, the fly *Fannia canicularis* and the mollusc, *Arion* sp.

Some species have been found associated with *M. communis* in all months, e.g., *Melanotranes internatus, Tranes lyterioides, Brachypeplus* sp. This is probably true of several others, e.g., *Dysmicoccus macrozamiae*. Others probably have a more fleeting association, e.g., insects collected by sweeping, such as *Siphanta acuta*. The presence of species belonging to families normally parasitic would indicate a probable host-parasite relationship between some species associated with the cycad.

As female cones are open only for a very brief period to enable pollination to occur relatively few invertebrates are found inside the cones. Male cones open permanently when pollen matures, resulting in many more species penetrating the male cone.

The roles of the various invertebrates encountered in this study are not always obvious. Some may be fully dependent on the plant for their existence (?monophagous in some cases), such as *Sybra acuta, Temnosternus planuisculus, Xyroscelus humanna, Melanotranes internatus, Tranes lyterioides* and *Theclinesthes onycha onycha*. At the other extreme many are no more than casual visitors. A large number of species fall between the two extremes, with inadequate data available to categorise them. It is obvious that the plant provides a suitable environment for many species. At the base of the leaves a high humidity, constant temperature environment exists and provides suitable overwintering for some species which have been found throughout the year, e.g., *Tranes lyterioides, Brachypeplus* n.sp.

Some species are obviously widely distributed, e.g., *Dysmicoccus macrozamiae, Brachypeplus* n. sp., *Melanotranes internatus*, and *Tranes lyterioides* were located at Styx River in March 1972, at Mogareka Inlet in October 1978, and at numbers of intermediate localities, indicating a wide distribution, equal to (?or exceeding) that of the cycad. The author believes that more prolonged collecting would extend the distribution of additional species.

Although the Order Lepidoptera is a major order only one species, *Conobrosis haplochroma*, is the sole common representative and has been reared from *M.*

moorei, M. crassifolia, M. machinii in Queensland and *M. macdonnellii* in the Northern Territory. (Common 1997).

New species. The thrips *Cycadothrips chadwickii* is the first thrips to be described from any cycad (by L.A. Mound [1991]), and is commoner than was originally believed. A new nitidulid (*Brachypeplus* sp.) is to be described by A.G. Kirejtshuk, of St. Petersburg. The dolichopodid *Achalus* sp. is undescribed. The widespread moth *Conobrosis haplochroma* was described by I.F.B. Common in 1997. Some species of Hymenoptera, identified to genus only, may quite well be undescribed. Two species of mite, *Oodinychus* n.sp. in considerable numbers, and an undetermined phoretic species, are also in need of study by appropriate specialists.

Pests. Growers of cycads regard *Aspidiotus nerii* (introduced) and *Melanotranes internatus* (native) as pests because of the damage they inflict on living plants.

The vespid wasp *Rhopalidia plebia* attaches its nest to the pinnules of the cycad at Seven Mile Beach.

Immature, undetermined, species occur such as: cockroaches, beetles, caterpillars and spiders.

Phoresy. An unidentified mite, found only at Cromer, attaches itself to the appendages and ventral surface of the weevil *Melanotranes internatus* which becomes completely immobilised as a result.

Parasitism. Ichneumon, braconid, perilampid and elasmid species would be expected to have relationships with other species of insect associated with *M. communis*.

Monthly sampling: Over a period of twelve months *Dysmicoccus macrozamiae, Cycadothrips chadwickii, Brachypeplus* n.sp., *Melanotranes internatus, Tranes lyterioides, Conobrosis haplochroma* and *Oodinychus* n.sp. were consistently located in leaves and are considered typical invertebrate fauna of *M. communis*. Other species are less abundant, some undetermined species being represented by as few as one specimen.

The author has no doubt that the list of invertebrates frequenting *M. communis* could be augmented by additional collecting, e.g., in some cases only one specimen of a species has been found: this is frequently the case when sweeping. This survey would be better regarded as preliminary rather than definitive.

ACKNOWLEDGEMENTS

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CYCADS AT NONG NOOCH TROPICAL GARDEN

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Figure 1 Poonsak Vatcharakorn stands next to a specimen of *Cycas pectinata* at Nong Nooch Tropical Garden.

When the country of Thailand is mentioned, visions of exotic Asian culture, sights and food come to mind. When I first visited Thailand in 1995 as a guest of Nong Nooch Tropical Garden all these expectations and many more were soon to be fulfilled. I traveled in Thailand in January and February of that year in the company of Michael Perry of Florida and Si-Lin Yang of China with hopes of seeing the cycads of that country, which were at that time still poorly known. At Nong Nooch Tropical Garden we spoke extensively with its director, Mr. Kampon Tansacha. Mr. Tansacha, educated in the U.S. pursued a successful career as a movie producer in Thailand before embarking on a remarkable vision: to create a botanic garden to showcase the palms and cycads of Southeast Asia. Prior to the creation of Nong Nooch Tropical Garden, no botanic garden existed in Thailand to grow, study, and display the palms and cycads native to that country.

Figure 2 Other plants besides palms and cycads are featured at Nong Nooch, such as succulent plants, grown here under a transparent roof, so that irrigation can be controlled.

In the early years of Nong Nooch Garden in the late 1980's and early 1990's Kampon's field collector, Poonsak Vatcharakorn (see Figure 1), explored Thailand from its wet tropical forests in its southern peninsula to its cool mountains in the north along the Burma and Laos borders in search of palms, cycads, orchids and other unusual flowering plants. In every place he looked he found new and undescribed species of plants, that were vanishing under fire and rampant deforestation. The scientific explorations and studies sponsored by Nong Nooch Garden are now producing the best and most extensive studies of the palms and cycads of Thailand and the surrounding region.

Nong Nooch Tropical Garden is located about a two-hours drive south of the capital city of Bangkok near the seaside resort of Pattaya. The climate is tropical with a

Figure 3 Main cycad plantings at Nong Nooch Garden are sited on raised beds surrounded by granite boulders. Palms are mixed to provide shade from the tropical sun.

Figure 4 Anders Lindstrom, Cycad Curator at Nong Nooch Garden, tends cycad seedlings.

Figure 5 Large numbers of cycads, such as these *Encephalartos ferox*, are raised from seed at Nong Nooch.

wet season extending from May to October and a dry season extending from November to April. Nong Nooch Tropical Garden consists of 600 acres on gently sloping ground, of which 400 have been developed. There are manicured formal gardens in the classic European and Thai styles (Figure 2), cottages for overnight visitors, as well as a small zoo, elephant shows, and theatrical shows describing the cultural history of Thailand. Lakes and slopes terraced with boulders provide the frame and backdrop for manificent plantings of cycads and palms. Under the tropical sun and rain and with the coaxing of fertile soils the cycad specimens here have attained a large size in a short time. Both the palm and cycad collections at Nong Nooch now rank among the most extensive and well developed in the world. The bulk of the cycad collection is planted on raised beds, lined with large granite boulders (Figures 4, 5). Extensive colonies of *Cycas* native to Thailand are arranged in propagation colonies, with palms interspersed to provide shade.

Under the care of the cycad curator, Anders Lindstrom (Figure 4), a native of Sweden, Nong Nooch Garden's cycads are now producing seed, many of which are distributed to gardens and seed banks around the world (Figure 5).

REPORT BACK ON MEETING OF THE NATAL BRANCH OF THE CYCAD SOCIETY OF SOUTH AFRICA HELD ON SATURDAY 21 FEBRUARY 1998

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Received 30 March 1998

Forty millimetres of rain on Friday evening, which appeared to be widespread over the central coastal area of Natal, brought much needed relief to Pietermaritzburg and Districts after more than a week of record high temperatures of about 50°C in my shadehouses, which were not appreciated by man or plant. Saturday turned out to be a warm pleasant day.

Danie Nel was invited to talk to us about cycads, his long time interest, hobby and now business enterprise. He pointed out that cycads, like succulents, do not appreciate excessive moisture, and are more often than not killed by "kindness", while they would have quite happily survived drought. As with many other indigenous plants, cycads have become highly prized and sought after feature plants by gardeners. Many cheque-book collectors believe that purchasing cycads is a better financial investment than leaving money in the bank. This might have been so forty plus years ago and probably still applies to large plants today but there are now many nurseries producing hundreds of cycad seedlings which will have the effect of decreasing the value of plants in years to come and will also have the effect of lessening the loss of plants in habitat which at the moment are being removed by unscrupulous collectors and vendors.

The existing laws protecting cycads, unfortunately, differ from one province to the other but hopefully in the near future one set of laws will be applicable to all provinces. Growing a cycad from seed is not, at the moment, breaking any laws, and should you then give this home grown cycad to a friend, all that is required to make it legal is that you put in writing the fact that you have given or donated the plant to your friend. Moving a cycad from one province to another or moving a large cycad from one site to another may require Parks Board approval. When in doubt check with the Parks Board and hope that you are requesting information from an official who knows what a cycad is. Generally speaking the Board officials are quite helpful. To move a large cycad it may be necessary to have an identifying micro-chip inserted into the plant but this would only be to your advantage should the plant be stolen. The cost at the moment to install a micro-chip is only about thirty-five Rand.

Of the four existing families of cycads, species of three of them can be found in continental Africa. The only African representative of the family Cycadaceae is *Cycas thouarsii* which can be found in Madagascar and the coastal areas from Kenya to Mocambique. The family Stangeriaceae has only the one member *Stangeria eriopus* and it can be found in the coastal regions of Natal and the eastern Cape provinces. The family Zamiaceae is represented by one of its genera, *Encephalartos*, which contains probably the largest number of species of all the families.

The leaves of *Stangeria eriopus* are typically plant leaf shaped, are relatively soft and have no teeth. *Cycas thouarsii* leaves are also thornless except for a few thorns at the base of the leaf, and like *Stangeria eriopus* they

have a midrib along the length of the leaflets. Most *Encephalartos* plants have thorns or sharp lobes on the edges of the leaflets and have no midrib, which is the feature used by many amateurs to identify an *Encephalartos* from a *Cycas* or *Stangeria*.

Encephalartos and *Stangeria* species do not flower but produce male and female cones on separate plants, and it is not possible to determine the sex of a plant which is not "in cone". *Cycas* individuals produce a loose and leafy cone on the female plant with the male plant producing a typical compact cone. To produce fertile cycad seed it is therefore necessary for a male and female cone to be produced at the same time. As plants are not always co-operative in this respect, nurserymen, and collectors, tend to collect pollen when it is available and keep it in the refrigerator, sealed to prevent the entry of moisture, until a female plant is receptive to pollen. The removal of the male cone from the plant, before the pollen is dispersed by the wind will also, hopefully, avoid the possibility of hybridisation taking place. It is of vital importance that the pollen container is immediately labelled with the name of the plant, with other information possibly added such as the date of collecting and the source of the pollen. With unmarked containers mistakes can easily be made. It is usual to remove the flesh from the seeds before testing to establish if they are fertile. The method most commonly used, although not one hundred percent foolproof, is to drop them into a container filled with water. If the seeds sink they are likely to be fertile and if they float they are probably infertile. With a large quantity of seed, a further test can be applied to a small percentage of them. This involves the sectioning of the seeds to establish if a developing embryo is present. The dissected seed are, of course, of no further use and should be discarded.

Seed which is hopefully fertile should then be laid on a suitable mix or planted in an inclined or upright position. Danie prefers to lay seed flat on the mix as it is then possible to see the seed germinate and produce, initially, a root which grows quite quickly. Once the root has grown to a length of approximately one hundred millimetres the first leaf should appear. Danie prefers to replant about ten seedlings in the same large bag, to conserve floor or table space, using a plant mix consisting of bark and chicken or cattle manure. When the seedlings have developed into a reasonable size he carefully removes them from their bag and re-bags them into individual bags, remembering to label each plant. He prefers to write the name on one side of the label with a waterproof felt-tipped pen, duplicating the information on the other side of the label using a pencil, in an attempt to guarantee that the name will still be readable a few years later when it is necessary to replant the cycad into a larger bag.

He continually emphasised that cycads, and most indigenous plants, have only two main enemies, man and water. Cycads also have two main insect pests. At the seed stage the weevil *Antliarhinus zamiae* drills a hole in the seed shell and lays eggs inside the seed and when larvae hatch out, they completely consume the food-containing tissue of the seed. The only effective control to avoid the spread of the pest is to destroy the affected seed. Cones can be sprayed at regular intervals with a suitable contact insecticide as a preventative measure.

The leaves of mature plants can be attacked by a black-spotted moth, *Zeronopsis leopardina* which lays its eggs on the leaves, and when the larvae hatch out they feed on the leaves. In extreme instances the larvae will travel down the leaves and attack the stem. Again, when the caterpillars hatch out they should be sprayed with a contact insecticide. Danie prefers to spray with "Ripcord" as he has found that some of the other insecticides on the market may burn-damage the leaves. Other less damaging pests like mealy bugs, aphids and scale insects can be found on cycad leaves but they can be easily eradicated with a suitable insecticide.

Before planting out a cycad in your garden you should establish if your plant prefers full sun or shade, the colour of the leaves sometimes indicating if the plant prefers sun or shade. Bluish-green-leafed plants usually prefer a sunny position while green leafed plants would probably appreciate some shade.

Anyone intending to take a serious and practical interest in cycads should purchase or have access to two books written by South African authors: Cynthia Giddy's "Cycads of South Africa" and Douglas Goode's "Cycads of Africa".

Danie mentioned the one cycad which has remained elusive and which has defied all attempts at scientific reproduction, and that is a female specimen of *Encephalartos woodii*. The five hundred and fifty male specimens in cultivation around the world have all been derived from a single male specimen found in the Ngoye forest in 1895, found by and named after J. Medley Wood, the then Director of the Natal Government Herbarium. Maybe it was a natural hybrid?

At the end of his talk, Danie donated a small cycad to Ngaire to establish in the gardens of her new home at the Ethelbert Retirement Village. Val, who had always believed that growing cycads from seed was, to say the least, difficult, collected a few germinated seed and after Danie's talk felt quite confident that she could successfully bring them up to adult size. Incidently, "love palms" have always been popular as pot plants, but for something different I would recommend that seedlings of cycads would be more interesting and encourage talk around the "coffee table". From personal experience the cycad seedling will also remain small

if it is kept in a small pot.

Although the meeting was not as well attended as had been hoped for, Danie's talk was enjoyed and very much appreciated by the members who did attend. With last month's meeting it sets a high standard for the remaining meetings to attain this year. Anyone looking for further information or help on identifying, growing or caring for cycads should contact Danie on (H) 0332 510478 or (Cell) 082 9254540. Should your Club or Society be looking for an interesting venue, the Cycad Centre is always available. Danie will provide braai facilities, if required, and may even provide tea and/or coffee.

Tea and small talk followed as per usual and I often wonder if this part of the meeting is not one of the main reasons why people attend. Danie then led members crocodile fashion around the nursery section which, as well as the numerous varieties of cycads, cacti and succulents that were available, also has the largest colour variety of Epidendrums for sale that I have seen in any local nursery.

LEOPARD MAGPIE MOTH (*ZERENOPSIS LEOPARDINA*) INFESTATION SUMMER 1996/97

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Since retirement in 1992 special care has been taken in eliminating Leopard Magpie moths and larvae and squashing eggs in new growth and cones. This seemed to bear fruit as the number of moths killed in subsequent summers decreased rapidly until there were very few around during the summer of 1995/96. Unfortunately no records were kept.

During the summer 1996/97, however, the moths struck back with a vengeance.

The moths usually appear towards the end of October, taper off from mid December to mid January and increase again from then to the end of February or March.

This summer the number of moths killed were as follows:

Oct '96	13
Nov '96	104
Dec '96	22
Jan '96	61
Febr '97	5
Total	205

The most moths killed in one day were 21 on the 4th Nov '96 and 17 on the 19th Jan '97. Most moths usually appeared on very hot and humid days following a good rainfall.

The summer of 1997/98 is now being awaited with trepidation.

MULTIPLE CONES ON *CERATOZAMIA* INDIVIDUALS, AND A POSSIBLE EXPLANATION

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Received 3 April 1998

After a lot of correspondence with people about the coning of *Ceratozamia* species, it appears a number of people are under the impression that *Ceratozamia* individuals will only produce one cone per apex at a time. There was a picture of a *Ceratozamia mexicana* with two male cones on the cover of *Encephalartos* No. **42**. There was a description on the inside page, mentioning that this was an interesting occurrence, and

that our former president, Hannes Robbertse would want to study it.

Figure 1 Six male cones on a plant of *Ceratozamia norstogii*.

This is not such a rare occurrence with *Ceratozamia* species. I have specimens of five *Ceratozamia* species that produce multiple cones every year, but almost always they are male plants. Only once every other year will a female plant produce two cones. Figure 1 shows a *Ceratozamia norstogii* with six male cones. The leaves have been cut away so that you can see the cones in more detail. Figure 2 shows two female cones on a *Ceratozamia hildae*. One is larger than the other, because one has set seed and the other has not. If any sceptics think these cones are from different years, after a close look, you can see the next year's cone emerging in the middle. The large cone emerged in the spring, and the second in fall.

This may be getting off the subject, but people have mentioned the two seasons for coning of Ceratozamia. I was told that I could not produce good seeds on females in the fall season. I tried on nine different occasions (including the plant in Figure 2) and did not produce viable seed. Two years later, I had a *Ceratozamia kuesteriana* that produced a late cone. It became receptive in the normal fashion but instead I cut the cone open. The droplets on the micropyle area were absent. I have cut six cones since then, and all have been dry.

Figure 2 Two female cones on a *Ceratozamia hildae* with the new year's cone in the centre.

People are just starting to understand that cycads are very energy oriented. When I mentioned my "cone forcing" technique (see *Encephalartos* **44**: 25), I met with some resistance. Since then I have received phone calls and letters from people all over the world that tried my method. And got great results. One person in Illinois told me his female *Dioon edule* coned every three years. Since he tried my method, it has coned two years in a row, and is healthy. Male cones drop pollen and dry up in a short period of time, thus not causing too much strain on the parent plant. Female cones remain on the plant all year round and drain more energy out of the plant. This would explain why males produce multiple cones more frequently. I suspect there may be a correlation between the increase of energy before the cones are produced, and the frequency of multiple cones on my plants. There have been a few short articles on the subject of unusual cone counts on cultivated plants. No one mentions if these plants were taken care of better in cultivation than if they were in the wild. I would guess these plants were probably fertilized regularly. John Donaldson mentioned to me, he had noticed cultivated *Encephalartos villosus* plants would

produce many stems, where most wild plants only produce one. He attributed this to higher energy levels.

I have noticed a young plant with a larger mass, and a higher energy level, will produce seeds before an older, *slow growing* plant. There are ways to grow seedlings so that their stems become thicker. There are also ways to increase the mass of younger plants faster. When people come to realize that cycads are very energy oriented, the manner in which they cultivate their cycads will change considerably. There is no doubt that the end result will be an increase in cone production and hopefully an increase in seed production. The overall goal is that these plants can become more common.

PRESS RELEASE

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Received 24 April 1998

The Montgomery Foundation, Inc. in Coral Gables, Florida has officially changed its name to the **Montgomery Botanical Center**. Nell Montgomery Jennings honoured the name of Robert H. Montgomery, her then late husband, by founding the organization in 1959. Robert Montgomery had developed extensive palm and cycad collections at his Coral Gables estate. Nell wanted to promote scientific and educational use of these collections, and in so doing, promote recognition of the "Montgomery" name in the field of plant science.

The Montgomery Archive files, however, reflect more than thirty years of dissatisfaction with the old name. Nell wrote in 1969, "We have talked at times of re-naming it to the Montgomery Research Center for Plant Science or some such name." In 1988, Executive Director Nixon Smiley asked if we could adopt the name "Montgomery Research Center". In 1993, a strong consensus of the directors favoured the name "Montgomery Tropical Plant Science Center". Over the years no action was taken because of inertia and nostalgia for the old name.

One of the reasons for the dissatisfaction with the old name was that it did not link "Montgomery" directly with the field of plant science. The word "Foundation" did not convey that the organization is an operating entity actively conducting its own operations. Finally, there are at least five other charitable organizations whose names are exactly the same as the old name and even more organizations with similar names.

THE RAPID DECLINE OF A CYCAD POPULATION

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Received 14 April 1998

Recent studies show that cycads have declined substantially across southern Africa during the 20th century. Such changes could influence cycad distributions, especially for species that are characterised by outlying populations separated by considerable distances from the main distribution area. In the case of *Encephalartos friderici-guilielmi*, the distribution is given as mountains and rocky hill-slopes in the districts of Queenstown and Cathcart, extending eastwards at intervals to the vicinity of Kokstad (*Encephalartos* **18**: 4–9). One of these isolated populations occurs ESE of Tsolo in the Eastern Cape where the plants occupy a dolerite koppie dominated by grass and succulents including *Euphorbia pulvinata*. According to collecting records the other populations are in the districts of Tabankulu and Mount Ayliff.

Dr. R. Allen Dyer accompanied by Mr. D. Collett and others undertook a field trip to Mpumalanga, KwaZulu-Natal and the Eastern Cape during January 1946, before

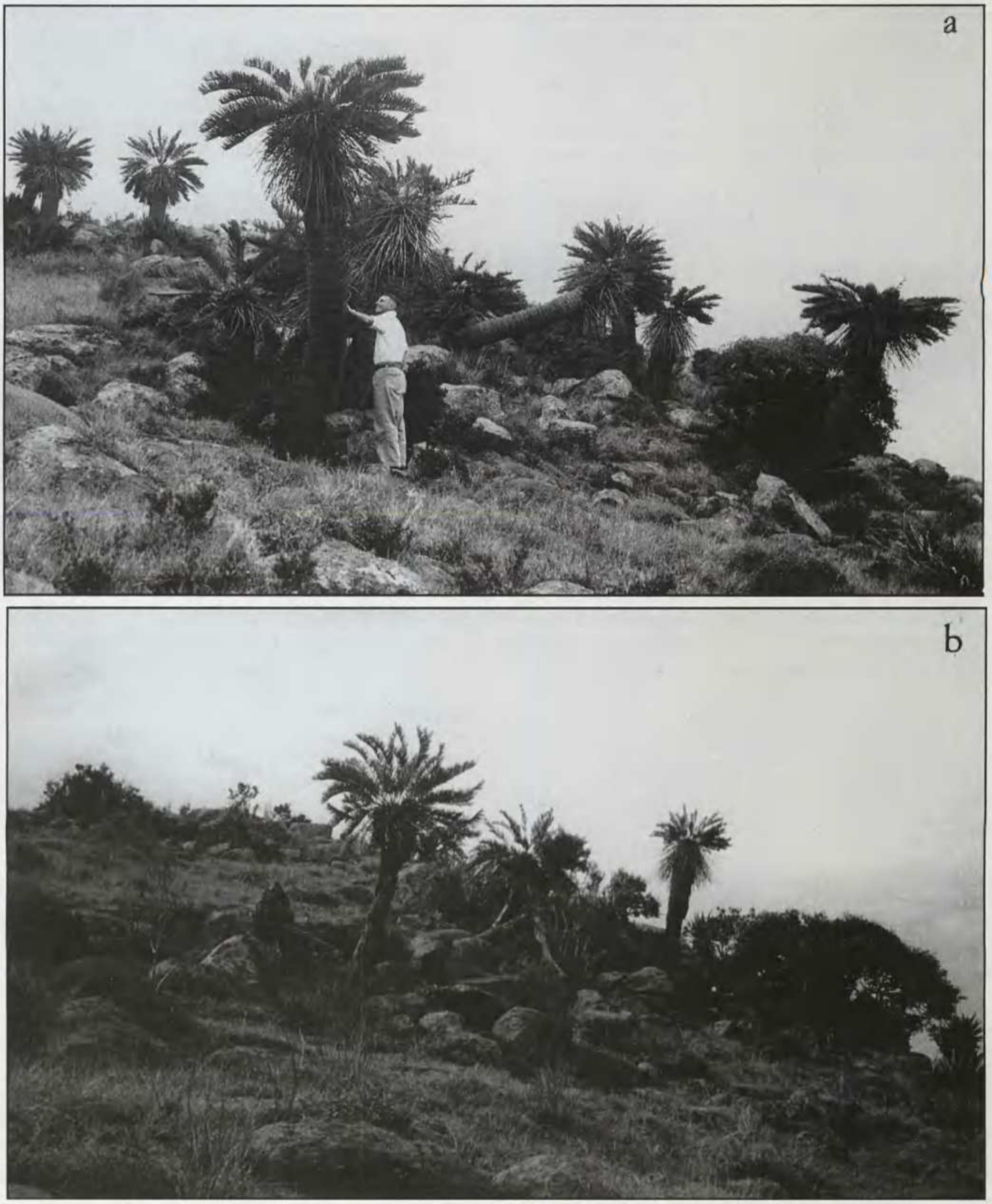

Figure 1 Matched pair of photographs showing decline in population of *Encephalartos friderici-guilielmi* (a: 19 January 1946, b: 21 February 1996).

returning to Pretoria via the Free State. On the 19th January 1946, they visited the population of *E. friderici-guilielmi* near Tsolo and collected material of the cycads as well as material of *Agapanthus praecox* subsp. *orientalis, Stapelia verrucosa* and *Euphorbia pulvinata*. Photographs taken at the time show an impressive and

healthy looking population of cycads and one of these (Figure 1a) was used in Dyer's monograph of the cycads *in Southern* Africa. The caption read: *"Encephalartos friderici-guilielmi*: a group near Tsolo, Transkei, with D. Collett lost in admiration." Some of the stems in this photograph are up to 12 ft. (3.7 m) in length and if studied carefully a total of ca. 22 stems or suckers can be seen. Cones visible in the photograph indicate the presence of both male and female plants.

As part of a study of matched photographs sponsored by WWF-South Africa and Mazda Wildlife Fund, I visited the site 50 years later, on the 21st February 1996. I re-photographed what was left of the cycads (Figure 1b with Mr. Jim Feely) and the deterioration in the state of this population is quite clearly shown (Figure 1a & b). What was once a thriving population has now been reduced to a few badly damaged individuals. Of the original ca. 22 stems or suckers present only 5–6 remain. Almost all the stems present have had the sheath of old leaf bases removed over practically the whole length of the stem. These persistent leaf bases form a protective layer around the central pith and corky cambium layers and this resists attack from outside by insects. The extent of the damage is clearly shown in Figure 2 where only the top quarter of the stem is still protected by the persistent leaf bases. It is evident from the hack marks on the stem that the removal of leaf bases has been done by some mechanical means as opposed to damage caused by either animals or insects. This damage is consistent with bark collection for the muti trade in which outer sections are cut out with a panga or similar instrument. Similar damage can be seen in Figure 3 that

Figure 2 Damage to trunk of *E. friderici-guilielmi*. Note hack marks on trunk.

Figure 3 Damaged *E. friderici-guilielmi* trunk with two dead stumps on the right.

Figure 4 Stumps of *E. friderici-guilielmi* with living suckers at the base.

also shows two dead stumps where the top sections have been cut off. Figure 4 shows a plant in which all the tall stems have been stripped of their leaf bases and the tops of the stems cut off. The depression on the cut surface of the stem on the left is due to the desiccation of the central pith area exposing the ring of corky cambium.

These are dramatic changes that have taken place in the relatively short period of 50 years, especially when one considers the ages that these plants are capable of attaining. While it seems that most of the surviving mature stems are still producing flushes of leaves, it must only be a question of time before they succumb to infection or insect attack. The decline in numbers of plants and the possible change in the ratio of male to female individuals would also have a detrimental effect on seed production of this population. Recruitment through seedling established is further impaired due to heavy trampling and grazing prevalent in the area.

Fortunately suckers have emerged at the bases of some of these trunks (Figure 4) and hopefully this could mean the survival of at least a few individuals from this once thriving population.

In general, bark stripping from cycads appears to be a localised practise that affects relatively few populations. However, as this study shows, the impact on small cycad populations can be devastating.

ACKNOWLEDGEMENTS

I would like to thank Cherise Dorfling for assistance in the field and Dr. John Donaldson for comments on an earlier draft of this article. Thanks also to Mr. & Mrs. Feely for their hospitality and assistance in locating the site. Sponsorship for the project was provided by Mazda Wildlife Fund and WWF-South Africa.

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0039 Lynn-oos

Ontvang 24 April 1998

PROGRAM VIR 1998

SATERDAG 1 AUGUSTUS OM 14H00 IN DIE HOOFGEBOU VAN DIE NASIONALE BOTANIESE INSTITUUT, PRETORIA: Dr John Donaldson, hoof van die Navorsingsprogram vir Bewaringsbiologie te Kirstenbosch Botaniese Tuin, sal ons toespreek oor "**Life in the slow lane: The Biology of cycad populations**".

SATERDAG 5 SEPTEMBER OM 14H00 IN DIE HOOFGEBOU VAN DIE NASIONALE BOTANIESE INSTITUUT, PRETORIA: Mnr Maans Kemp, van Port Elizabeth en eertydse redakteur van "*Encephalartos*" en skrywer van verskeie "Fokus op ... " artikels vir die tydskrif, sal ons toespreek. Die titel van sy praatjie sal wees: "**Een en ander oor die Oos-Kaapse broodbome**".

SATERDAG 7 NOVEMBER: Afsluitingsfunksie. Besonderhede sal later bekend gemaak word.

Op Saterdag 6 Februarie het 'n entoesiastiese groepie van ons taklede die voorreg gehad om met Shaun McCarthy 'n besoek te bring aan Mondi se *Encephalartos humilis* reservaat wat tussen hul plantasies naby Sabie geleë is. Die reservaat is op uitvalgrond

Figuur 1 Meerkoppige eksemplaar van *Encephalartos humilis* in Mondi se broodboomreservaat naby Sabie. / Figure 1 Multi-headed specimen of *Encephalartos humilis* at Mondi's cycad reserve near Sabie in Mpumalanga.

tussen die plantasies geleë en dit bevat naas die goeie stand ou meerkoppige plante wat oorspronklik daar voorgekom het, ook heelwat ander eksemplare wat vanaf die plantasies daarheen oorgeplant is (Figuur 1). Shaun is baie entoesiasties oor die projek en hy het die geleentheid benut om ons lede te pols oor die beste wyse waarop die reservaat bestuur behoort te word. Ons wil

Shaun weer eens bedank dat hy, buite sy normale werkstyd, ons op so 'n vriendelike wyse na die reservaat vergesel het en ons breedvoerig daaroor ingelig het. Nadat ons gesellig saam geëet het, is ons na 'n heerlike eendag-uitstappie uitmekaar.

'n TERUGBLIK DEUR 'n VERSAMELAAR

Wes J. Jacobs
Ashleighweg 19, 4180 Scottburg, R.S.A.

Ontvang 8 April 1998

Dit is met nostalgie dat daar teruggedink word aan die vroeë vyftiger jare toe die broodboom nog 'n relatiewe onbekende plant was. Daar was op dié stadium, na my wete, slegs enkele persone wat werklik in hierdie plante belanggestel het - dit was inderdaad 'n fees as jy gelukkig was om so 'n persoon raak te loop.

Ons as huisgesin het destyds die vakansieoord Xai-Xai in die voormalige Mosambiek gereeld besoek. Vanweë die gereelde besoeke het ons ook hegte vriendskappe met party van die permanente inwoners (Portugese) gesluit en met ons terugkeer na die R.S.A. het hulle gewoonlik 'n paar *Encephalartos ferox* plante aan ons geskenk. Die "ondekking" van die plante, met ons eerste besoek aan Mosambiek, het heel toevallig plaasgevind. Ons het die oggend 'n paar kilometer langs die strand gaan stap en het besluit om die terugtog agter die sandduine aan te pak. Die betrokke kusgebied is bosryk, ongerep en op plekke bykans ondeurdringbaar. Na heelwat gesukkel het ons na ongeveer 1½ uur bo-op 'n groot sandduin deur die struikgewas gebreek. Wat 'n fantastiese gesig het ons begroet! Onder ons het 'n vallei van ongeveer 200 m x 350 m gestrek wat oortrek was met *E. ferox* individue wat byna almal oor volwasse manlike of vroulike keëls beskik het. Slegs enkele laaggroeiende struike was tussenin te bespeur. 'n Ongelooflike mooi kontras is gevorm deur die donkergroen broodbome met oranjerooi keëls teen die agtergrond van spierwit sand. Die eerste gewaarwording wat 'n mens tref is dat die Groot Meester hierdie "skildery" self moes beplan en uitgevoer het. Hierdie skepping gesien in sy konteks van natuurlike vorm en lyn en die ongereptheid van die natuur sal uiters moeilik in enige mensgeskepte uitleg geëwenaar kan word. Nietemin, die gogga het my hierna gebyt en met die loop van die jare het ek die *E. ferox* plante uitgeruil en so 'n volle versameling opgebou.

Dat die broodboom 'n besondere bekoring het is nie te bewtyfel nie, veral gedagtig aan sy uniekheid en die mistiek wat dit inhou. Vir my is die grootste wonder en verrassing wanneer een van hulle wat jy geplant het se eerste stel blare verskyn en in al hulle glorie ontvou. Dink maar aan die *E. lanatus* met sy skitterwit-silwer blare, of die *E. horridus* met sy uitstaande persblou blare, of wanneer daardie sagte brose blare deur klipharde grond bars om te ontvou. Vir my as versamelaar het die genot nie gelê net om plante te versamel nie maar ook in die vriendskappe wat gesluit is met die mense wat my "broodboom-pad" oor die jare gekruis het - mense wat dieselfde liefde as jy deel. Wat 'n aangename voorreg en verrykende ondervinding is dit om gedagtes met sulke mense te deel. Dit is ook so dat elke broodboom in my besit 'n unieke storie het of gekoppel is aan 'n episode wat met die koop of die ruil van die plant plaasgevind het. Om elkeen aan te haal sal vir doeleindes van hierdie artikel egter te lank wees. Gevolglik sal dit moet oorstaan vir 'n latere artikel. Voordat afgesluit word wil ek graag 'n paar gedagtes uitlig met betrekking tot die impak van die destydse promulgering van die ordonnansie rakende die registrasie van broodbome teen 31 Oktober 1977. Dit wil skyn dat die rede wat aanleiding tot hierdie maatreël gegee het een of twee persone was wat broodbome uit hulle natuurlike habitat verwyder het en dit dan teen uiters hoë pryse van die hand gesit het en selfs uitgevoer het! Die uitwerking van die maatreël is egter heeltemal deur die owerhede onderskat aangesien 'n ieder en 'n elk toe broodbome op groot skaal uit die veld verwyder het en dit in hulle tuine aangeplant het voor die keerdatum wat neergelê is. Daar is weliswaar vanaf die datum van publikasie van die ordonnansie tot die keerdatum meer broodbome uit hulle natuurlike omgewing verwyder as wat dit in al die jare voor dit gebeur het. Na promulgering het mense ook soveel skuiwergate in die ordonnansie gevind dat die reeds uitgedunde natuurlike habitat verder verkrag is deur mense wat geen liefde vir die plante het nie maar dit bloot as 'n middel gesien het om geld te maak. Ek wil my verstout om die blaam vir die uitwissing van die broodboom in sy natuurlike staat aan die deur van ons owerhede te lê. Na my beskeie mening sou dit effektiewer gewees het om die oorspronklike sondaars vas te getrek het.

Summary

A RETROSPECTIVE VIEW BY A COLLECTOR

The author looks back to the early fifties when cycads were relatively unknown. At that stage, to his knowledge, only a few persons were really interested in these plants and it was a real pleasure to meet such a person.

At that time he and his family visited the holiday resort at Xai-Xai in Moçambique regularly and formed staunch friendships with some of the Portuguese residents, who usually gave them some *Encephalartos ferox* specimens as a present.

He and his family "discovered" *E. ferox* in habitat by chance during their first visit to Moçambique. One morning they went for a walk on the beach and after several kilometres decided to go round the sand dunes on their way back. As the relative coastal area was pristine woodland, and in some places nearly impenetrable, it took them nearly an hour and a half to reach the summit of a large sand dune. What a fantastic sight greeted them! A small valley below the dune was thickly populated with *Encephalartos ferox*. Nearly all being mature male and female specimens in cone. The dark green cycads with their bright orange-red cones contrasted strongly with the snow-white sand in the background, and it was incredibly beautiful to behold. The author's first thought was that God must have planned and created this "painting". It will be extremely difficult for any landscape designer to equal this creation as seen in its context of natural form and line and untouched environment.

After this experience the author was bitten by the cycad-collecting bug, and as the years went by he exchanged some of his *E. ferox* for specimens of other species and thus built up a complete collection. It is true that cycads are fascinating, especially because of their uniqueness and mysticism. For the author it is a miracle and a surprise when a cycad that he planted pushes leaves for the first time and the leaves unfold in all their glory, e.g., *Encephalartos lanatus* with its silver-white leaves, and *E. horridus* with its exceptional purple-blue leaves, or when those soft fragile leaves burst through hard soil to unfold. The author not only enjoyed collecting cycads, but also found it delightful to make friends with people who crossed his "cycad road" over the years - people who shared their love of cycads with him. He regards it as a pleasant privilege and an enriching experience to share opinions with such people. Every cycad in his possession has a unique story or is connected with an episode that occurred when the plant was bought or exchanged, but these will have to be recorded in a later article.

The author wishes to express his opinion on the impact of the promulgation of the ordinance regarding registration of cycads on 31 October 1977. Apparently the reason for this precautionary measure was that one or two persons removed cycads from the wild and sold them at exorbitant prices and even exported the plants. The effect of the proposed measure was, however, completely underrated by the authorities because everybody then removed cycads on a large scale from the wild to transplant them in their gardens before the decreed date. Certainly, from the date of publication of the ordinance to the deadline more cycads were removed from the wild than in the preceding years. After promulgation so many loopholes were found in the ordinance that the already depleted natural habitats were further denuded by people who had no love for the plants but saw them as a way to make money. The author makes bold to blame the authorities for the annihilation of cycads in their natural habitats. In his opinion it would have been more effective to catch and prosecute the original sinners.

LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

Dear Editor

NEWS FROM THE CYCAD CENTRE

Herewith some photos of weird plants in my garden as a contribution to your magazine.

There are photos of the "Spoon" *Encephalartos natalensis* (Figures 1, 2), a most sought after plant - but almost unavailable - we have tried to find these plants in collections but without success.

Then there is the "Ramshorn" *Encephalartos natalensis* (Figures 3, 4), which is supposed to originate in the Krantzkloof area. It is quite a beautiful plant and of the few people who have them only males have turned up so far.

Then in the nursery I always sort out the strange plants and among them are a miniature *Macrozamia communis*

Figure 1 The "Spoon" *Encephalartos natalensis* specimen.

Figure 2 Close-up of some of the leaves of the "Spoon" *E. natalensis* specimen.

(Figure 5); an *Encephalartos horridus* with spikey leaves and a sucker with full sized leaves attached to its side (Figure 6); and a weird looking *Zamia furfuracea* with lobed leaflets (Figure 7). Maybe someone would like to comment on these plants. Any offers?

Figure 3 The "Ramshorn" *E. natalensis* specimen.

Figure 4 Close-up of some of the leaves of the "Ramshorn" *E. natalensis* specimen.

News from here is that we were once again quite prominent on the wildlife show. Disappointingly though, we could not sign up one new member this year.

Figure 5 The miniature *Macrozamia communis*.

Figure 6 This *E. horridus* specimen has weird leaflets, but its sucker (on the left) has normal leaves.

Willy Tang has written a new book on CYCADS IN THAILAND which will now cost R20.00 due to clearance and customs. It is a rather interesting book and was reviewed by Piet Vorster in "*Encephalartos*" **53**: 33–35.

There is an amazing number of cones pushing in our garden this year. We trust that everyone else will have as good a crop of cones. So far we were unable to determine male and female ratios. We try and keep a large pollen bank, so if members require pollen, give us a call. If you are prepared to pay for the overnight postage we will gladly assist where possible.

Avis Meresman, CYCAD CENTRE, Box 45, 3730 Umlaas Road, R.S.A.

Received 31 January 1998

Figure 7 The *Zamia furfuracea* specimen with lobed leaflets.

Dear Editor

CYCADS OF THE WORLD

I wish to thank Leon Pienaar and Pieter Janse van Rensburg for compiling the list of described cycad species which was published on page 10 of the March 1998 edition of "*Encephalartos*". I have been trying to keep an up to date list for my own interest and I found a number of species in the authors' list which I did not know of.

Could the authors (or any other knowledgeable readers) please, however, enlighten this layman with regard to the following questions which arose from my studying the list:

1. The undermentioned species do not appear in the list. Are they still recognised? I provide one source in brackets in which there is a reference to the species concerned. The three source publications referred to are the following: "*Encephalartos*" (abbreviated to "*Enc.*"), "Cycads of the World" by D.L. Jones (abbreviated to "Jones") and "Cycad Cultivation" by W. Tang (abbreviated to "Tang").

Ceratozamia spinosa (*Enc.* **46**: 34), *Cycas desolata* (*Enc.* **46**: 11), *Cycas diannanensis* (*Enc.* **47**: 31), *Cycas elonga* (*Enc.* **47**: 31), *Cycas elonga* (*Enc.* **47**: 30), *Cycas ferruginea* (*Enc.* **43**: 39), *Cycas guandongensis* (*Enc.* **48**: 22), *Cycas jenkinsiana* (Jones), *Cycas micholitzii* var. *stenosis* (Tang), *Cycas multiovata* (*Enc.* **48**: 22), *Cycas norstogii* (*Enc.* **52**: 8), *Cycas undulata* (Jones), *Macrozamia lucida* (Jones), *Zamia cupatiensis* (Jones), *Zamia jirijirimiensis* (Jones), *Zamia kickxii* (Jones), *Zamia lindenii* (Jones), *Zamia monticola* (Jones), *Zamia obidensis* (Jones), *Zamia ottonis* (Jones), *Zamia sylvatica* (Jones).

2. The list indicates *Ceratozamia fuscoviridis* and *Ceratozamia plumosa* as separate species. In some other sources they are referred to as subspecies. What is the correct situation?

3. Both *Cycas taiwaniana* and *Cycas taitungensis* appear in the list. Are they recognised as separate species or did the name *Cycas taitungensis* replace *Cycas taiwaniana*?

Thank you very much, in anticipation, for responding to my questions.

***Maans Kemp**, 51 Constance Road, Broadwood, 6070 Port Elizabeth.*

Received 24 April 1998

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Dear Editor

A NEWLY IDENTIFIED CYCAD PEST AND DATA ON THE COLD TOLERANCE OF CYCADS

Our readers might be interested to know that according to a note in the March 1998 issue of the *Palm and Cycad Society of Western Australia Inc.*, the larvae of the moth *Crytptoptila immersana* has been identified as the caterpillar which can be a pest in Australia where it devours newly emerging cycad leaves. The larvae of this leafroller species feed between the joined leaves of a range of plants in Australia. It attacks both native Australian and introduced species and it has been observed on *Bowenia* spp, *Cycas rumphii*, and *Ceratozamia* spp.

From information presented on the WEB (Internet) it also appears that the lowest temperatures that cycads can endure, often are considerably lower than one would have expected, especially for species emanating from tropical areas. The temperatures provided are said to be the lowest that the species are known to have been exposed to and survived without major damage:

Cycad species	Lowest temperature in degrees Celcius
Ceratozamia mexicana	– 3,9
Cycas circinalis	– 5
C. revoluta	– 16,7
C. rumphii	– 5
Dioon edule	– 7,8
D. mejiae	– 5
D. spinulosum	– 5
Encephalartos ferox	– 5
E. lehmannii	– 6,7
Lepidozamia hopei	– 5
L. peroffskiana	– 5
Macrozamia riedlei	– 7,8
M. moorei	– 6,7
Zamia floridana	– 5
Z. furfuracea	– 3,9

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

Received 24 April 1998

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Geagte Redaktrise

ONGEWONE GEDRAG VAN DIE VROULIKE KEËLS VAN *ENCEPHALARTOS MUNCHII*

Mnr P.M.S.J. Erasmus van Pretoria het in Desember 1996 die vier vroulike keëls op sy eenstammige *Encephalartos munchii* herhaaldelik droog bestuif. Tot almal se verbasing het die keëls teen Februarie 1998 nog geen tekens van uitdroging of spontane disintegrasie getoon nie. Hulle is gevolglik van die moederplant verwyder en in 'n motorhuis geberg waar hulle in Maart 1998 spontaan uitmekaar geval het. Die omnule ("sade") aan verskeie megasporofille (keëlskubbe) was onontwikkeld (kyk Figuur 1) en het in water gedryf en is weggegooi. Onder die oorblywende omnule wat normaal voorgekom het, was daar enkeles waarvan die embrio's alreeds 'n wortel gevorm het wat etlike millimeter uit die omnel ("saadpit") uitgegroei het. Van die oorblywende omnule was sowat 65% bevrug en het hulle binne enkele weke gekiem.

***Nat Grobbelaar**, Posbus 15357, 0039 Lynn-oos, Suid-Afrika*

Ontvang 24 April 1998

Figuur 1 Regs is 'n *E. munchii* megasporofil met 'n normale grootte sowel as 'n onontwikkelde omnuul. / Figure 1 On the right is an *E. munchii* megasporophyll with a normal as well as an undeveloped omnule.

Summary

UNUSUAL BEHAVIOUR OF THE FEMALE CONES OF *ENCEPHALARTOS MUNCHII*

Mr. P.M.S.J. Erasmus of Pretoria repeatedly pollinated the four female cones on his single-stemmed *Encephalartos munchii* in December 1996 with dry pollen. To everybody's amazement the cones have not started to dry out or fall apart by February 1998. The cones were therefore removed from the plant and stored in a garage where they spontaneously disintegrated in March of the same year. The omnules ("seeds") of several megasporophylls (cone scales) were quite small and undeveloped (see Figure 1) and about 30% of the omnules floated in water and was discarded. Amongst the remaining omnules, which all appeared normal, several had already produced a radicle of several millimetres which protruded from the omnel ("seed kernel"). About 65% of the remaining omnels were fertile and germinated within a few weeks.

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

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Dear Editor

LEGAL REGISTRATION OF CYCADS AND TRANSPORT OF BASAL SUCKERS

I have recently become aware of some of the problems that face a cycad collector in our country, and especially in certain provinces. I recently obtained an *Encephalartos eugene-maraisii* from a friend whose father grew the plant from seed many years ago. Sadly (and obviously), there is no documentation of any kind. It would now appear that I have two choices. Try to register the plant legally or just keep quiet. Most of my cycad friends strongly suggested the latter option because of the tremendous implications of trying to register the plant legally without anything more than a letter of donation from the previous owner. Now I, by trying to play by the rules, run the risk of losing my plant or even my entire collection. If I keep quiet, I run the same risk. Any suggestion from Nature Conservation or from other collectors?

Another issue is the removal of suckers from other collectors or private gardens and transport thereof. Apparently the procedure to be followed is the following: 1) Identify the plant to be transported. 2) Obtain a legal transport permit from both the provinces involved (which, I am told, could take up to a year to obtain). 3) Obtain a letter of donation from the owner of the mother plant. 4) Remove the sucker carefully. Now in the light of this I would like to sketch the following scene: My parents live in Knysna and, knowing about my interest in cycads, have identified a few friends who own cycads. I arrive there on my annual holiday and am offered a few suckers. Being young and enthusiastic I gladly accept and remove them, carefully sealing the mother plant and obtaining a letter of donation. I have just broken the law which states that I must have a permit to transport cycads. I have studied my literature and permits carefully and I find no clarity as to how suckers are meant to be handled if obtained from a registered mother plant in this way. I cannot imagine any collector going through the legal rigmarole described above in order to transport a sucker. Once again, one runs the risk of being caught and losing the entire collection. What is to be done in such a case?

I think that Nature Conservation should try to distinguish two groups of people from each other: Firstly rich guys who have thousands to pay for cycads and who simply want them as status symbols. I have been in such gardens and it has broken my heart to see massive plants with unfertilized female cones. And secondly, persons who are truly interested in these fascinating plants and who have a true love for them and their conservation. I think most of the members of this Society belong to this group. If people in the second category are not treated reasonably when trying to abide by the law, they are forced to act outside the law. I would gladly co-operate with the authorities, but when old-time collectors advise me to rather keep quiet about a legal cycad that has never even in the wild, I begin to wonder if we are being treated fairly. I look forward to correspondence from Nature Conservation and from fellow collectors.

Confused young enthusiast

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

Received 12 March 1998

NEW REGIONAL BRANCH / NUWE STREEKTAK

The **LOWVELD** Regional Branch of the Cycad Society of South Africa (CSSA) (comprising the magisterial districts of Nelspruit, Barberton, White River, Pilgrim's Rest, Lydenburg and Waterval Boven) was instituted in 1997.

According to the Constitution [Article 6.1 (a)] at least ten members of the CSSA residing in the relevant area, must jointly recommend the establishment of a Regional Branch for the area. The establishment of the Lowveld Regional Branch was recommended by twelve members.

Article 6.2 of the Constitution decrees that all the members of the Society which reside in the geographical area of a Regional Branch, shall automatically also be members of the particular Regional Branch.

Die **LAEVELDSE** Streektak van die Broodboom Vereniging van Suid-Afrika (BVSA) (wat die landdrosdistrikte Nelspruit, Barberton, Witrivier, Pelgrimsrus, Lydenburg en Waterval-Boven insluit) is in 1997 gestig.

Volgens die Grondwet [Artikel 6.1 (a)] moet minstens tien lede van die BVSA wat in die betrokke geografiese gebied woonagtig is, gesamentlik die stigting van 'n Streektak vir die gebied aanbeveel. Die stigting van die Laeveldse Streektak is deur twaalf lede aanbeveel.

Artikel 6.2 van die Grondwet bepaal dat alle lede van die Vereniging wat in die geografiese gebied van 'n Streektak woonagtig is, outomaties ook lede van die besondere Streektak is.

MANAGEMENT COMMITTEE / BESTUURSKOMITEE

Chairman (contact) / Voorsitter (kontakpersoon): Leon van Rooy, P.O. Box/Posbus 1019, 1240 White River/Witrivier, R.S.A. Tel.: (013) 751 2419.
Secretary-Treasurer / Sekretaresse-Tesourier: Mrs/Mev S.L. van Rooy.
Additional Member / Addisionele Lid: Mr/Mnr M.G. Pienaar.

[- Editor / Redaktrise]

NEW CYCAD PUBLICATIONS

BYRNE, M., WAYCOTT, M., HOBBS, A.A. & JAMES, S.H. 1997. **Variation in ribosomal DNA within and between populations of *Isotoma petraea* and *Macrozamia riedlei*.** *Heredity* 79(6): 578–583.

[Restriction fragment length polymorphisms in ribosomal DNA were observed within and between populations of *Isotoma petraea* and *Macrozamia riedlei*. *Isotoma petraea* is a diploid self-pollinating species which has evolved complex hybridity in response to inbreeding and exhibits high levels of genetic differentiation between its geographically isolated populations. *Macrozamia riedlei* is a diploid dioecious wind-pollinated cycad with high levels of gene flow throughout its population system. Variation in rDNA was observed within and between populations of both species. In *L. petraea* the level of variation was low with most individuals having one length variant, except in populations with fixed hybridity, whereas in *M. riedlei* high levels of variation were observed with an average of eight variants per individual. The pattern of variation in *L. petraea* showed homogenization of length variants within individuals and populations with divergence of length variants between populations. The pattern of variation in *M. riedlei* showed mixing of length variants and maintenance of various length variants within individuals and populations. The different patterns of variation are consistent with the different breeding systems of the two species.]

First author's address: Western Australian Herbarium, Dep. Conservation Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983, Australia.

DONALDSON, J.S. 1997. **Is there a floral parasite mutualism in cycad pollination? The pollination biology of *Encephalartos villosus* (Zamiaceae).** *American Journal of Botany* 84(10): 1398–1406.

[Observations and experiments were carried out over

5 years to distinguish between wind and insect pollination in the cycad *Encephalartos villosus* Lemaire (Zamiaceae). They were also designed to determine whether a pollination mutualism exists between *E. villosus* and *Antliarhinus zamiae* (Thunberg) (Coleoptera: Brentidae), an obligate ovule parasite that routinely parasitizes a large proportion of the ovules. The percentage of fertilized ovules dropped slightly when wind was excluded from the megastrobilus. However, when insects were excluded by either net bags or insecticide there was a substantial decrease in the proportion of fertilized ovules. Five beetle species belonging to four families were found on the strobili at the time of pollination. Using data on the effectiveness of pollen transfer to the receptive ovule, as well as data on abundance and pollen loads, a pollinator importance value (PIV) was determined for each beetle species and a pollinator importance index (PII) was determined for each population. PII values showed that an undescribed weevil (*Porthetes* sp., Curculionidae) was consistently the most important pollinator. *A. zamiae* and an undescribed beetle species within the Xenoscelinae (Languriidae) played a minor role in the pollination, and their contribution varied from year to year and between populations. Two additional beetle species, *Metacucujus goodei* Endrody-Younga (Boganiidae) and a second species of Xenoscelinae, had very low PII values and probably had little or no effect on pollination. Low PII scores for *A. zamiae* were a result of its low numbers on the microstrobilus and the tendency of the beetles to remain on the outside of the megastrobilus. In the interaction between *E. villosus* and *A. zamiae*, the cycad does not appear to benefit significantly from a pollination service and I interpret this to mean that the relationship is antagonistic rather than mutualistic. There is, however, a possible mutualism between *Porthetes* sp. and *E. villosus*.]

Author's address: Ecol. Conservation, National Botanical Inst., Private Bag X7, Claremont 7735, South Africa.

GOO, M.Y.C. & SIPES, B.S. 1997. **Host preference of *Radopholus citrophilus* from Hawaiian anthurium among selected tropical ornamentals.** *Hortscience* 32(7): 1237–1238.

[Fourteen tropical ornamental plants were evaluated for their host status to a population of *Radopholus citriphilus* isolated from anthurium. No nematodes were recovered from the roots of *Aglaonema commutatum, Caryota mitis, Cycas revoluta, Dracaena deremensis, Neodypsis decaryii, Ravenea* spp., or *Spathiphyllum wallisii* 5 months after inoculation, making these plants nonhosts.]

First author's address: Dep. Plant Pathol., Univ. Hawaii at Manoa, Honolulu, HI 96822-2279, U.S.A.

JÄGER, A.K. & VAN STADEN, J. 1997. **Cultured cycads: Tissue culture of South African cycads.** *Veld & Flora* 83(4): 113.

[Callus cultures were developed from embryo tissue that were obtained from seeds of *Encephalartos cycadifolius, E. dyerianus, E. ferox* and *E. natalensis*. Callus were also obtained from young leaf tissue of *E. woodii*. The calli derived from embryo material eventually all gave rise to whole plants with leaves and roots. The calli from leaf tissue continued to grow as callus cultures.]

First author's address: Dept. of Botany, University of Natal, Pietermaritzburg, South Africa.

KOKUBUGATA, G. & KONDO, K. 1994. **Quantitative variability in karyotype of *Cycas revoluta*.** *La Kromosomo* II-75-76: 2613–2618.

[The arm ratios of twelve terminal-centromeric chromosomes among the chromosomes of the complement at mitotic metaphase showed wider standard deviations than those of the other chromosomes, because the lengths of the short arms of the terminal-centromeric chromosomes were more stable than those of the long arms. The lengths of all the chromosomes at mitotic metaphase at the root-tips studied were always larger than those in the leaflets studied.]

First author's address: Lab. of Plant Chromosome and Gene Stock, Faculty of Science, Hiroshima Univ., 1-4-3 Kagamiyama, Higashi-Hiroshima City 739, Japan.

PAN, M., MABRY, T.J., CAO, P. & MOINI, M. 1997. **Identification of nonprotein amino acids from cycad seeds as N-ethoxycarbonyl ethyl ester derivatives by positive chemical-ionization gas chromatography-mass spectrometry.** *Journal of Chromatography* A 787(1–2): 288–294.

[Nonprotein amino acids from nine species of cycad seeds were analyzed as N-ethoxycarbonyl ethyl ester (ECEE) derivatives by positive chemical-ionization gas chromatography-mass spectrometry. Based on the retention times and mass spectrometry analyses, 12 nonprotein amino acids were identified in these seeds. In addition to the excitatory and putative neurotoxin beta-N-methylamino-L-alanine (BMAA), the known neurotoxin beta-N-oxalylamino-L-alanine (BOAA) was detected from the seeds of *Macrozamia moorei* and *M. communis*, and delta-N-oxalyl-ornithine was obtained from the *Cycas revoluta* seeds. A novel nonprotein amino acid named cycasindene, previously reported from *C. revoluta*, was also found in the seeds of members of the *C. angulata* and *C. rumphii* complex. Eight additional known nonprotein amino acids were also identified. This is the first report of the neurotoxin BOAA from cycad seeds.]

First author's address: Dep. Bot., Univ. Tex., Austin, TX 78713, U.S.A.

RANI, M.S., RAO, C.V., GUNASEKAR, D., BLOND, A. & BODO, B. 1998. **A bioflavonoid from *Cycas beddomei*.** *Phytochemistry* (Oxford) 47(2): 319–321.

[A new biflavanone, tetrahydrohinokiflavone, together with amentoflavone has been isolated from the leaves of *Cycas beddomei*. Their structures were established on the basis of spectral and chemical evidence.]

First author's address: Dep. Chem., Sri Venkateswara Univ., Tirupati 517 502, India.

SITAR, V. & JABLONSKY, J. 1997. ***Otozamites graphicus* (Leckenby) Schimper from the shales of the supra-posidonia beds (Pieniny Klippen Belt of the Western Carpathians, Slovakia).** *Acta Palaeobotanica* 37(1): 13–16.

[The second discovery of the genus *Otozamites* in the Klippen Belt demonstrates the important role of Cycadopsida in the plant cover of islands surrounded by the Middle Jurassic sea at the northern margin of the Western Tethys.]

First author's address: Dep. Geology Palaeontol., Fac. Natural Sciences, Comenius Univ., Mlynska dolina G, 842 15 Bratislava, Slovakia.

VOVIDES, A.P., OGATA, N. & SOSA, V. 1997. **Pollination of endangered Cuban cycad *Microcycas calocoma* (Miq.) A.DC.** *Botanical Journal of the Linnean Society* 125: 201–210.

[Observations indicate that natural regeneration in the field of the cycad *Microcycas calocoma* (Miq.) A.DC. is extremely low, and has been so since early this century. It appears that populations of its insect pollinator are practically extinct, but some pollinator activity appears to be present in the largest population of *Microcycas*. Recommendations for identification and captive breeding of the pollinator are suggested as a complementary conservation strategy to a *Microcycas* propagation programme already established at the Cuban National Botanical Garden.]

First author's address: Departamento de Sistematica Vegetal, Instituto de Ecologia, A.C. Apdo, Postal G3, 91000 Xalapa, Veracruz, Mexico.

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

NEWSPAPER AND MAGAZINE CLIPPINGS / KOERANT- EN TYDSKRIFUITKNIPSELS

Naweek-Beeld Saterdag 31 Mei 1997

Broodboom-sindikaat oopgevlek; 45 gevind

'n Sindikaat wat glo onwettig in broodbome handel dryf, is gister deur die polisie en die Mpumalanga-parkeraad oopgevlek toe 45 broodbome, wat in 'n reservaat naby Swaziland gesteel is, by twee huise in Rosebank en Norwood, Johannesburg, gevind is.

Sewe van die bome het ingeplante mikroskywe gehad wat ondersoekbeamptes van die Mananga-reservaat tot in Johannesburg gelei het.

Drie vermeende sindikaatlede het eergisterog-gend die laaste sewe van die bome in die reservaat ontwortel, waarna dit na die twee huise aangery is. Ondersoekbeamptes het saam met die polisie en lede van die eenheid vir die beskerming van bedreigde spesies op nog 38 broodbome by die twee huise beslag gelê.

'n Woordvoerder van die parkeraad het gesê Audrey Gabbin, eienaar van een van die huise, is tydens die klopjag in hegtenis geneem. Gabbin het gister vlugtig in die Johannesburgse landdroshof verskyn en is op borgtog van R4 000 vrygelaat. Die eienaar van die tweede huis jag glo in die Noordelike Provinsie en sal na verwagting ná sy terugkeer aangekla word.

Drie vermeende lede van die sindikaat is ook in hegtenis geneem. Twee van hulle is op waarskuwing vrygelaat terwyl die derde nog in aanhouding is.

Die broodbome waarop beslag gelê is, sal eers in 'n kwekery van die parkeraad versorg word voordat dit in die natuur hervestig word. – (Sapa).

ISLE OF WIGHT COUNTY PRESS — FRIDAY, JANUARY 16, 1998

STORMS REVEAL PREHISTORIC FOSSIL

Martin Simpson with the fossil cycad found at Blackgang beside a modern day variety. Picture by PETER BOAM

Rare palm tree from days of dinosaurs

RECENT storms are thought to have washed out a rare fossil which was found at Blackgang on Sunday.

The fossil — a rare prehistoric palm tree dating back 100 million years — was found by Blackgang Chine-based freelance fossil collector, Martin Simpson.

Mr Simpson, 39, found the fossilised cycad in the landslip area near Rocken End.

The part he found was the well-preserved trunk of the cycad, a small palm tree.

The plant would have lived alongside dinosaurs in the Cretaceous period, and may have been a source of food for them.

Mr Simpson said the cycad was quite rare and only three complete specimens had been found on the Island in the last 150 years.

"It was quite funny because I went down there to see what the cliffs looked like after the storms and I just found it," he said.

"It's quite big and it weighs about ten stone, so I didn't know how to get it up from the beach. Luckily there were some visitors along there and they helped me to carry it up."

Mr Simpson — who has been collecting fossils for about 20 years — found a much smaller cycad there in 1990 after the last big storm.

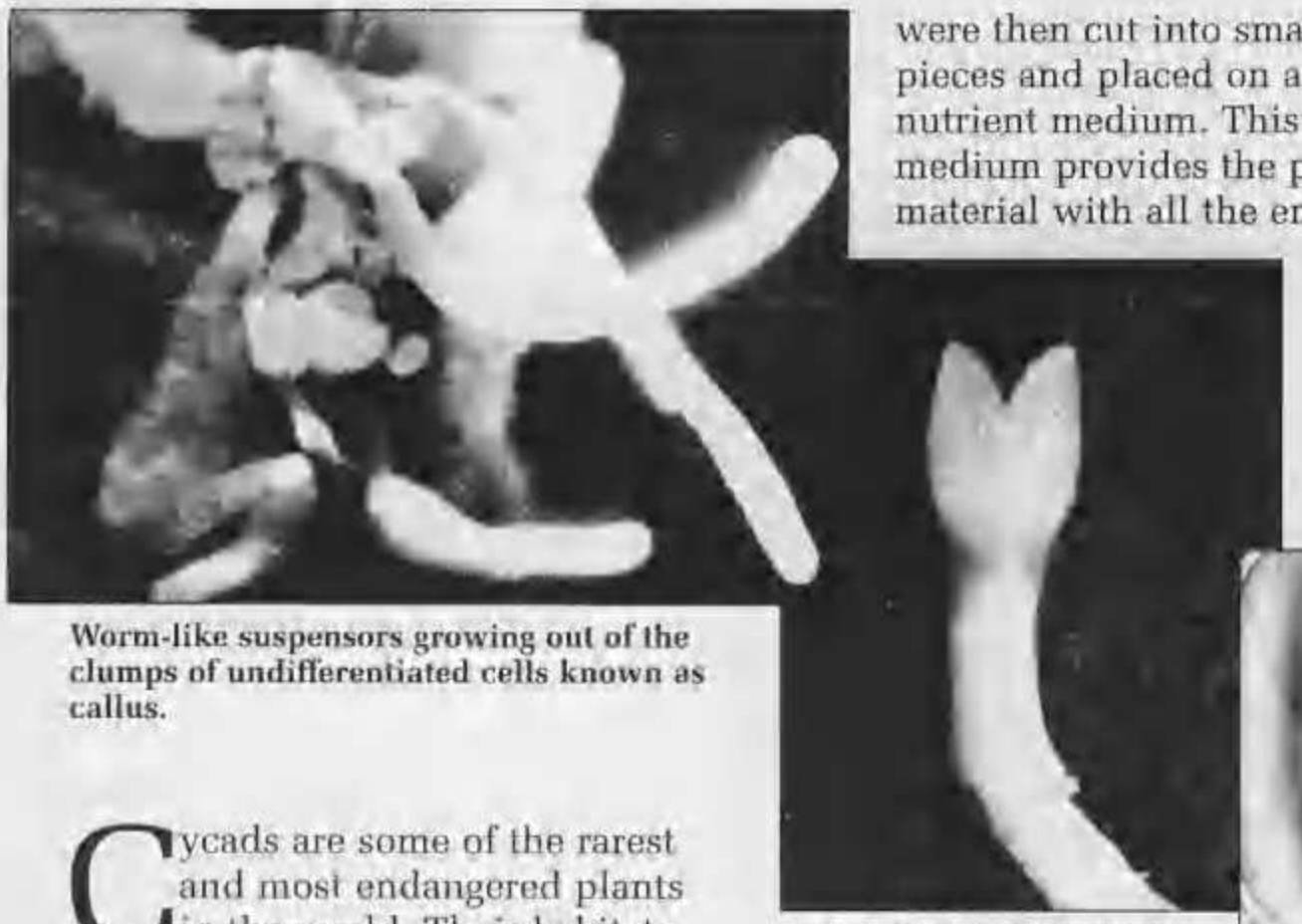
He will now clean up the fossilised cycad and intends to have it on display at his shop at Blackgang Chine in the summer.

Thanks to Mrs R. Williams from the Isle of Wight and Roy Osborne from Australia who sent in this clipping.

CULTURED CYCADS

Tissue culture of South African cycads.

by Anna K. Jäger and Johannes van Staden, Department of Botany, University of Natal, Pietermaritzburg



Worm-like suspensors growing out of the clumps of undifferentiated cells known as callus.

Cycads are some of the rarest and most endangered plants in the world. Their habitats are being destroyed and they have become collector's items which has led to an increase in the demand for rare species. The recent outcry at cases of unscrupulous plundering of cycad sites shows that South Africans are aware of the threat cycads are under.

A way to ease the threat to South African cycads could be to micro-propagate them, and we set out to investigate this option. Central American cycads have already been put into tissue culture, so we could draw on their experience.

In consultation with the widely-known cycad expert Roy Osborne we decided to work on five species: *Encephalartos cycadifolius*, *E. dyerianus*, *E. ferox*, *E. natalensis* and *E. woodii*. Of these, *E. woodii* is the most important species to tissue culture as it is possibly the rarest plant in the world. Only male plants of *E. woodii* are known - all offsprings of the single specimen found at the end of the last century and planted in the Durban Botanic Gardens.

To get the tissue culture started we sterilized seeds in household bleach. Thereafter we carefully opened the seeds and took the embryo out. This was all done under sterile conditions, as it is crucial that no fungus or bacteria get into the cultures. The embryos were then cut into small pieces and placed on a nutrient medium. This medium provides the plant material with all the energy, minerals and vitamins it needs to grow under artificial conditions. In the case of *E. woodii*, where no seeds are available, we used young leaf material from a new sprout. This was also sterilized in bleach and placed on the nutrient medium.

Left. **A little embryo forms at the end of the suspensors in *Encephalartos natalensis*.** Right. **Eventually the suspensor withers and a long tap root forms.**

A shoot emerges between the cotyledons of a somatic (artificial) embryo of *E. cycadifolius*.

Photos: A. Jäger and J. van Staden.

After two weeks on the nutrient medium, the embryo pieces had swollen and were growing prolifically, producing masses of undifferentiated cells, called callus. We grew up as much callus as we could by repeatedly transferring callus clumps to new medium. Then, after about six months, we observed that the callus was changing. Instead of just being masses of undifferentiated cells, now something more structured was emerging. Great was our surprise when we saw worm-like structures growing out of the callus clumps, some growing to a length of 4 cm. Soon we realized that these worm structures had to be suspensors, resembling the suspensor an embryo sits on inside a cycad seed. And rightly so - as after another few weeks we noticed that a little embryo was forming at the end of the suspensors, just as the embryo sits in a seed. These artificial or somatic embryos were all dicotyledonous. When the culture flasks were moved into the light, the embryos became green as they could now photosynthesize for themselves. They were still attached to the suspensor, which connected them to all the nutrients in the medium. Eventually the suspensor desiccated and a root formed where it had been.

Then a little shoot appeared between the cotyledons. This shoot grew into the first leaf of a little cycad plant. We left the plantlets in tissue culture for a few months to become strong enough to be planted out into soil. The plantlets established well enough in a sand-vermiculite mixture.

We only obtained somatic embryos of the four species where we had used the embryo as starting material. From the *E. woodii* culture that was started from leaf material we have only got as far as the callus stage. This tells us that the embryo is the best starting material for tissue culture of these cycads. This is not really surprising as one would expect embryo cells to have a better potential for growing than cells from a leaf.

We hope with time that we will be able to grow plantlets from our tissue culture of *E. woodii*, and that our research will be a stepping stone to mass propagation of cycads by tissue culture, so these endangered plants that lived when the dinosaurs roamed on Earth will survive into the future.

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2289	DOLLOWAY, Kevin	11 Padfield Gardens, Eleanor Crescent, PINETOWN, 3610
1464	DONALDSON, Dr J S	NBI, Private Bag X7, CLAREMONT, 7735
2227	DROTSKY, Mnr S J	Posbus 1202, CARLETONVILLE, 2500
2281	DU BOIS, B	P O Box 95205, WATERKLOOF, 0145, (Pretoria)
0806	DUNCAN, Mrs Lorraine	10 7th Street, Linden, JOHANNESBURG, 2195
1298	DU PLESSIS, Mnr André	Essenhoutweg 9, Wilkoppies, KLERKSDORP, 2570
2298	DU PLESSIS, Mnr C J	Posbus 31436, TOTIUSDAL, 0134
2107	DU PLESSIS, Mev I E	Voortrekkersweg 811, WONDERBOOM-SUID, 0084
2290	DU PLESSIS, Dr J	Wychwoodlaan 31, Linkside, PORT ELIZABETH, 6001
0955	DU PLOOY, Mnr J F	Posbus 177, MONDEOR, 2110
2218	DU PREEZ, Mnr H K	Dikbaslaan 59, WONDERBOOM, 0182
1577	DU PREEZ, Mnr J C	Posbus 5452, Onverwacht, ELLISRAS, 0557
1854	DU PREEZ, Mnr J G	Fismerstraat 8, ELSBURG, 1428
1428	DU RAND, Mr L	P O Box 1254, ROOSEVELT PARK, 2129
1810	DU TOIT, Mnr Biem	Posbus 3942, PIETERSBURG, 0700
1271	DU TOIT, Mnr H X N	Posbus 22, BREDASDORP, 7280
0971	DU TOIT, Mnr K P	Posbus 75, BURGERSFORT, 1150
2040	DU TOIT, Mnr P J & VAN DER WESTHUIZEN, Mnr J	Posbus 2328, KLERKSDORP, 2570
1713	DUVENHAGE, Mr H J	P O Box 4015, PRETORIA, 0001
1630	EKSTEEN, Mnr L J	Posbus 4496, EMPANGENI, 3880
2148	ELLIOT, Mr V	45 Grenville Avenue, SAVOY ESTATE, 2090
1219	ELLISON, Mr E	P O Box 92186, NORWOOD, 2043
2011	ELOFF, Mnr Frits	Posbus 12609, CLUBVIEW, 0014
1848	ELS, Annemarie	Posbus 117, ELLISRAS, 0555
1985	ENGELBRECHT, Mev Ina	Posbus 560, FERNDALE, 2160
0817	ERASMUS, Dr C S	77 Rustenburg Road, EMMARENTIA, Johannesburg, 2195
2132	ERASMUS, Mnr H J	Posbus 180, DUIWELSKLOOF, 0835
2052	ERASMUS, Mnr M J	Posbus 914-1178, WINGATEPARK, 0153
1863	ERASMUS, Mnr P M S J	Posbus 31231, TOTIUSDAL, 0134
2327	ESTERHUIZEN Jacque	Posbus 11909, ASTON MANOR, 1630
0802	ESTERHUYSE, Mr D	22 Headingly Avenue, WESTVILLE, 3630
2252	ESTERHUYSE, Mnr L W	Balmoral Ave 169, Lisdogan Park, ARCADIA, 0083
0793	EVERETT, Mr W A	P O Box 238, CONSTANTIA, 7848
2319	FERREIRA, Mev C	Posbus 733, LOUIS TRICHARDT, 0920
0577	FERREIRA, Mnr Stefan	Ravelstraat 33, RIEBEECKSTAD, 9469
9015	FLORA CONSERVATION COMMITTEE	Botanical Society of SA, Kirstenbosch, CLAREMONT, 7735
1961	FLETCHER, Mr C M	P O Box 200, PORT ALFRED, 6170
1963	FOKKENS, Mr J F	P O Box 14504, NELSPRUIT, 1200
1852	FOUCHÉ, Mnr G W	Oaklaan 43, PRIMROSE, 1401
1901	FOURIE, Mnr G B	Posbus 75113, LYNNWOODRIF, 0040
2044	FOURIE, Mnr J J A	Posbus 908541, MONTANA, 0151
0689	FOURIE, Mnr M J	Hobsonstraat 9, STILFONTEIN, 2551
0542	FRITZ, Mnr G	Posbus 139, HEIDELBERG, 2400
1632	FUGLISTER, Mr F J	P O Box 121, HALFWAY HOUSE, 1685
2084	FUHRI, Mr E P	137 Dunville Road, BLUFF, Durban, 4052
2238	GARRATT, Dr P J V	71 Myro Drive, Glenmore, DURBAN, 4001
0200	GERBER, Mr Harry	45 Anieno Road, Montclair, DURBAN, 4001
1988	GIBBON, Mr Craig	P O Box 20392, RICHARDS BAY, 3900
0018	GIDDY, Mrs Cynthia	P O Box 208, BATHURST, 6166
2113	GIELINK, Mr C C	P O Box 3786, DURBAN, 4000
2108	GIESE, Mr D G	P O Box 2, GONUBIE, 5256
1841	GITTLESON, Mr G	31 Sunnyside Road, ORCHARDS, 2192
1614	GNEITING, Mr C F H	P O Box 72188, LYNNWOOD RIDGE, 0040
1466	GOLDSCHMIDT, Dr R P	P O Box 68332, BRYANSTON, 2021
0525	GORE, Mnr P H	669 Killick Avenue, Les Marais, PRETORIA, 0084
2273	GOSSMANN, J F	Sultanastraat 5, Uitsig, WELLINGTON, 7655

1335	GOULD, MR & MRS T	P O Box 132, PENNINGTON, 4184
2138	GOUWS, Mnr A R	Arcadiastraat 869, ARCADIA, 0083
1170	GREENAWAY, Mr I H	12 Florida Lane, 1st Avenue, FLORIDA, 1709
1789	GREYLING, Mnr J J	21ste Laan 760, RIETFONTEIN, 0084
1720	GRIESEL, Mnr C L B	Queens Crescent 427, Lynnwood, PRETORIA, 0081
2030	GRIMBEEK, Mnr P J	Posbus 5238,BARBERTON, 1300
1400	GROBBELAAR, Mev Hanneke	Tarentaalkloof, Posbus 15357, LYNN-OOS, 0039
0097	GROBBELAAR, Prof N (Erelid)	Tarentaalkloof, Posbus 15357, LYNN-OOS, 0039
0143	GROBLER, Mev Maria	Posbus 914, PIETERSBURG, 0700
2285	GROBLER, Mnr P C	Posbus 236, PIETERSBURG, 0700
1840	GROBLER, Mnr P S	Posbus 20871, NEWCASTLE, 2940
2305	GROENEWALD, Kaptein L	Katjiepieringlaan 114, EDELWEISS, Springs, 1559
2234	HACKNEY, Mr F M	29 Danny Street, GLENVISTA, 2091
0420	HANACZECK, Mr H W	P O Box 44, DUIWELSKLOOF, 0835
1178	HARRIS, Mr M V	5 FitzPatrick Street, SASOLBURG, 9570
1600	HARRIS, Mnr R	Posbus 16514, VERWOERDBURG, 0140
0510	HARRISON, E R	P O Box 104, MTUBATUBA, 3935
0296	HARRY MOLTENO LIBRARY	The Librarian, Kirstenbosch, Private Bag X7, CLAREMONT, 7735
0601	HART Mr G B	P O Box 72727, LYNWOOD RIDGE, 0040
2271	HATTINGH, Mev Elza	Posbus 797, HONEYDEW, 2040
0077	HATTINGH, Mev E F	Posbus 181, GROBLERSDAL, 0470
2318	HATTINGH, Mnr J F	Riethaanstraat 897, MONTANA PARK X1, 0159
1586	HEIBERG, Mnr B	Posbus 3210, TZANEEN, 0850
1964	HEINE, Mnr E W P	Groeneweide 10, STELLENBOSCH, 7600
2326	HELM, Marius	Posbus 9260, RICHARDSBAAI, 3900
0115	HENMAN, Mr Enrico	12 Dhlinza Street, ESHOWE, 3815
2096	HENNING, Dr J C	Posbus 1168, ELLISRAS, 0555
0433	HENNING, Dr N G C	Cantonmentsweg 80, Lyttelton Manor, VERWOERDBURG, 0157
1610	HENRICO, Mev H	Posbus 30430, MÔRESKOF, 9462
1080	HEYNS, Mnr J O	Wenningstraat 115, Groenkloof, PRETORIA, 0181
2063	HLOMOHLOMO GAME RESERVE cc	P O Box 95192, GRANT PARK, 2051
2006	HOBBS, Mnr E T	Bosveldweg 157, WONDERBOOM, 0182
1711	HOLLANDER, Prof W J	R.A.U., Posbus 524, AUCKLANDPARK, 2006
9002	HOOFDIREKTORAAT NATUURBEWARING	Privaatsak X209, PRETORIA, 0001
1794	HOOG, Mr R J L	22 Douglas Road, KLOOF, 3610
0086	HOOLE, Mr James C	P O Box 7958, Newton Park, PORT ELIZABETH, 6055
1946	HÖRING, Mr H J	12 Leeuwenhof Street, Oak Glen, BELLVILLE, 7530
1983	HORSTHEMKE, Mr R E	P O Box 365, FERNDALE, 2160
2236	HOWES, Cobie & Julie	55 Homestead Avenue, HILLCREST, 3610
0498	HULSHOF, Mr A	P O Box 1526, KLERKSDORP, 2570
1766	HUNTER, Dr J J	Nietvoorbij, Privaatsak X5026, STELLENBOSCH, 7599
1155	ISACKS, Mr G A	8 Medway Road, WESTVILLE, 3630
1168	ISACKS, Mr G R	44 Windham Avenue, HILLARY, 4094
0528	JACOBS, Mnr W J	Ashleyweg 19, SCOTTBURGH, 4180
2178	JANSEN, Mnr Zandberg	Roosweg 8, DAWNVIEW, Germiston, 1401
1900	JANSE VAN RENSBURG, Mnr J A	Privaatsak X9059, PIETERMARITZBURG, 3200
1002	JANSE VAN RENSBURG, Mnr J M	Posbus 92, VRYHEID, 3100
1217	JANSE VAN RENSBURG, J P	Jopie Fouriestraat 374, PRETORIA-NOORD, 0182
2248	JANSE VAN RENSBURG, Mev M M	Posbus 304, SWELLENDAM, 6740
2269	JANSE VAN RENSBURG, Mnr W	Privaatsak X5912, UPINGTON, 8800
0458	JOHANNES, Mr G	P O Box 215, PIET RETIEF, 2380
0644	JOHANNES, Mr H C	P O Box 276, PAULPIETERSBURG, 3180
1797	JOHANNESBURG PUBLIC LIBRARY	Market Square, JOHANNESBURG, 2001
2214	JONKER, Mnr W	Posbus 1363, MIDDELBURG, 1050, Mpumalanga
1415	JORDAAN, Mnr A S	Ponsfordsingel 36, ESCOMBE, 4093
1527	JORDAAN, Past. Ben	P O Box 55884, PIETERSBURG, 0700
2076	JORDAAN, Dr J B	Posbus 19166, NELSPRUIT, 1200
0146	JORDAAN, Sakkie & Anna	Posbus 104, WARRENTON, 8530
2292	JOUBERT, J J	Posbus 21991, Helderkruin, ROODEPOORT, 1730
1355	JOUBERT, Mnr W	Posbus 376, WARMBAD, 0480
1462	KABLE, Mr A J	12 Orchid Road, Tygerdal, GOODWOOD, 7460
0223	KACHELHOFFER, Mr N J	P O Box 3107, PRETORIA, 0001
1791	KADWA, Dr M A	Park Lane Clinic, Junction Avenue, PARKTOWN, 2193
0714	KANTOR, Mr S R	P O Box 59542, KAREN PARK, 0118

2002	KELLERMAN, Mnr E O	Posbus 73618, LYNNWOODRIF, 0040
0010	KEMP, Mr H J	51 Constance Road, Broadwood, PORT ELIZABETH, 6070
1989	KEMPKES, Mr I	P O Box 1850, VEREENIGING, 1930
2151	KENDALL, L	P O Box 11324, HATFIELD, 0028
0081	KENNEDY, Mnr H C	Blok A–E 17, Huis Vergenoegd, Hoofstraat 188, PAARL, 7646
2222	KLEYNHANS,Mev A C	Posbus 3758, PRETORIA, 0001
0745	KLOPPERS, Mnr John S	Posbus 24, GROBLERSDAL, 0470
1867	KOCKOTT, Mrs C P	P O Box 1253, STILFONTEIN, 2550
2112	KOEN, Mr J J	P O Box 6838, HOMESTEAD, 1412
1358	KOFMAN Mnr J H	Floraunaweg 806, Florauna, PRETORIA-NOORD, 0182
1538	KOK, Mnr M B	Posbus 48187, HERCULES, 0030
1871	KONIG, Mr Andrew	P O Box 475, BUCCLEUCH, 2066
1939	KORKIE, Mnr & Mev E S	Vampirestraat 569, ELARDUSPARK, 0181
2291	KOTZÉ, Mnr H J	Hoërskool Monument Park, Privaatsak, Dan Kingweg, KRAAIFONTEIN,7570
2192	KRIEL, Mnr Henri-Jacques	Posbus 890130, LYNDHURST, 2106
1812	KRIEL, Mnr W J	Rupertlaan 34, SOMERSET-WES, 7130
2260	KRITZINGER, E D & I M	Wrightstraat 15, Parkrand, BOKSBURG, 1459
1302	KRUGER, Mrs F J	22 Approach Avenue, Selwyn, FLORIDA, 1709
2286	KRUGER, H C	P O Box 1061, HERMANUS, 7200
2311	KRUGER, Mnr Johan	Posbus 911343, ROSSLYN, 0200
1923	KRUGER, Mnr L	Posbus 13586, LERAATSFONTEIN, 1038
1373	KRUGER, Mnr N J S	Posbus 46, RANT-EN-DAL, 1751
0853	KRUGER, Dr P W B	Posbus 3173, PRETORIA, 0001
1140	KRUGER, Mnr S R	Reineckestraat 45, Panorama, BETHLEHEM, 9700
1672	KUSCHKE, Mnr A E	Posbus 54, HAZYVIEW, 1242
1832	KUUN, Mnr P J C	Posbus 39718, MORELETAPARK, 0044
1888	KUYPER, Mnr A	Posbus 2241, MONTANAPARK, 0159
2206	LANDMARK STUDIOS	c/o Mr Mark Young, P O Box 2489, HALFWAY HOUSE, 1685
1679	LEACH, Mev Marie	Kingfisherstraat 124, Horison Uitbreiding, ROODEPOORT, 1725
2114	LEEB, Mnr G A R	Posbus 1275, TZANEEN, 0850
2129	LEEB, Mnr G A R	Privaatsak X1, LYNN EAST, 0039
1532	LESSING, Mnr & Mev J	Oribistraat 30, JEFFREYSBAAI, 6330
1166	LIGHTLEY, Mr C G	c/o SA Wire, P O Box 756,, EMPANGENI, 3880
1948	LOMBAARD, Mnr J A	Posbus 50689, WIERDAPARK, 0149
1240	LOMBARD, Mnr J H	Posbus 908285, MONTANA, 0151
2228	LOOTS, Hein	Posbus 2057, VRYHEID, 3100
1494	LOTTER, Mnr D	Posbus 602, GRAAFF-REINET, 6280
2133	LÕTTER, Mnr L J	Posbus 8776, NEWCASTLE, 2940
0645	LOTTER, Mnr W J	Posbus 48520, Hercules, PRETORIA, 0030
0159	LOUBSER, Prof J D	Posbus 11315, QUEENSWOOD, 0121
2033	LOUBSER, Mr Neil	261 Canopus Street, WATERKLOOFRIF, 0181
2219	LOURENS, Mnr A J	Posbus 9455, ELSBURG, 1407
2177	LOURENS, Mnr Jaco	Posbus 4078, HALFWAY HOUSE, 1685
2310	LOUW, Mev E	Posbus 832, OTJIWARONGO, NAMIBIË
1676	LOUW, Mr J P	P O Box 21433, VALHALLA, 0137
1272	LOUW, Mnr W H	Posbus 2860, BRITS, 0250
1324	LOVATT, Mr M	P O Box 338, EMPANGENI, 3880
2209	LOVE, Mr C F M	P O Box 2690, DURBAN, 4000
2094	LUBBE, Mnr C E J	Posbus 1126, TZANEEN, 0850
1587	LUBBE, Mnr D P	Giraffeweg 47, Monumentpark, PRETORIA, 0181
2083	LUCAS, Mr S C	36 Feldspar Road, HELDERKRUIN, ROODEPOORT, 1724
2275	MACASKILL, Dr Leslie	Posbus 36046, MENLOPARK, 0102
1978	MACGREGOR, Mr C A	P O Box 101525, MORELETAPARK, 0044
1980	McARTHUR, Mr H B	P O Box 452, GILLITTS, 3603
1721	MALAN, Mnr C	Posbus 11258, QUEENSWOOD, 0121
2069	MANGA, Mr Vasan	P O Box 1536, BENONI, 1500
0561	MARAIS, Mnr A J	Posbus 28006, SUNRIDGEPARK, 6008
1973	MARAIS, Mr R E B	67 Glover Avenue, DORINGKLOOF, 0157
2203	MARITZ, Mnr H P	Posbus 39156, GARSFONTEIN-OOS, 0060, Pretoria
2274	MARTEN, Mr M	32 A G Visser Street, Brackenhurst, ALBERTON, 1450
1372	MARX, Mr M A M	P O Box 701, BERGVILLE, 3350
2255	MASSYN, Mnr C	George Anton Park 29, George Antonstraat, ANNLIN, 0182
1805	MAUD, Mr C S	1 Howard Place, DURBAN NORTH, 4051
2142	McBEAN, Mr W	8 Louw Avenue, MONUMENT, 1739

1660	McCLELLAN, Dr Tracy	Dept Genetics, University of the Witwatersrand, Private Bag 3, WITS, 2050
2324	McKINLAY, Mr D F	P O Box 31388, WONDERBOOMPOORT, Pretoria, 0033
2325	McLAREN, Mr S	9 Eleventh Ave, NORTHMEAD, Benoni, 1501
2280	MEIRING, Mnr R B	Amandelweg 83, Amanda Glen, DURBANVILLE, 7550
1667	MERESMAN, Ms Avis	P O Box 45, UMLAAS ROAD, 3730
0205	MEYER, Mnr C C	Ralstonweg 20, FERNGLEN, PORT ELIZABETH, 6045
1575	MEYER, Prof J J M	Dept Plantkunde, Universiteit van Pretoria, PRETORIA, 0002
1109	MEYER, Mr P K	P O Box 435, ST MICHAEL'S-ON-SEA, 4265
1107	MIDDELMANN, Mr W J	402 CPOA, 231 Main Road, RONDEBOSCH, 7700
1809	MIDDLEWICK, Dr G C	P O Box 1383, ROOSEVELT PARK, 2129
2048	MILLAR, Mrs R E	P O Box 49300, ROSETTENVILLE, 2130
2263	MILTON, Mr M V	P O Box 4627, GEORGE EAST, 6539
2150	MINNAAR, Mnr & Mev D	Posbus 95597, WATERKLOOF, 0145
2110	MINNAAR, Mnr J J	Posbus 1580, GARSFONTEIN, 0042
0006	MINNIE, Dr Ollie J	P O Box 137, MTUBATUBA, 3935
2199	MONTEIRO, A M	P O Box 85, KNIGHTS, 1413
1210	MOODIE, Mnr S T	Posbus 3125, PRETORIA, 0001
2014	MOOLA, Dr Y	P O Box 23521, ISIPINGO RAIL, 4110
1957	MOSTERT, Mev Cassandra	Posbus 687, KEMPTONPARK, 1620
2086	MOSTERT, Mnr P J	Main Road 353, ESCOMBE, QUEENSBURGH, 4093
0741	MULDER, Mr I B	Saffraanlaan 10, Weltevredenpark X9, ROODEPOORT, 1709
2183	MULDER, René & Elmarie	Lynnburnweg 66, LYNNWOOD MANOR, 0081
2230	MULDER, Mnr Theuns	Ashstraat 3, VANDERBIJLPARK, 1911
1798	MÜLLER, Mnr E	Posbus 17360, PRETORIA-NOORD, 0116
2016	MULLER, Mr George	P O Box 1358, RIVONIA, 2128
1965	MULLER, Mnr H F	Kahlerstraat 64, Idasvallei, STELLENBOSCH, 7600
1837	MÜLLER Mr T	P O Box 12437, ONDERSTEPOORT, 0110
1722	MULLER, Mnr T I	Posbus 11074, Universitas, BLOEMFONTEIN, 9321
0737	MULLER, Mr W F	1427 Moulton Avenue, WAVERLEY, 0186
1922	MYBURGH, Mnr & Mev F M	1ste Weg 20, KEW, 2090
2304	MYBURGH, Dr Jan G	Victorstraat 43, MURRAYFIELD. Pretoria, 0184
2170	MYBURGH, Mnr J L	Posbus 6455, ONVERWACHT, Ellisras, 0557
0397	MYBURGH, Mej J S	Departement Plantkunde, Universiteit van Pretoria, PRETORIA, 0002
0523	MYBURGH, Mnr P P	Associationweg 9, Dawnview, GERMISTON, 1401
1620	MYERS, Mev M M	Posbus 401, WITRIVIER, 1240
2221	NAGEL, Mr J J (Jnr)	418 16th Avenue, RIETFONTEIN, Pretoria, 0084
1470	NASSER, Mr M	P O Box 175, NORTH RIDING, 2162
1232	NATIONAL BOTANICAL INSTITUTE	The Librarian, Private Bag X101, PRETORIA, 0001
9011	NATAL HERBARIUM	The Curator, Botanic Gardens Road, DURBAN, 4001
9001	NATAL PARKS BOARD, The Director	(Att Mr R Scott-Shaw), P O Box 662, PIETERMARITZBURG, 3200
9016	NATALSE BIBLIOTEEK, Die Bibliotekaris	(Afd Pligeksemplare), Posbus 415, PIETERMARITZBURG, 3200
2191	NATIONAL BOTANIC GARDEN, NELSPRUIT	The Library, P O Box 1024, NELSPRUIT, 1200
0065	NATIONAL BOTANICAL INSTITUTE	The Librarian, Kirstenbosch, Private Bag X7, CLAREMONT, 7735
1865	NATIONAL BOTANICAL INSTITUTE	The Nursery, Private Bag X101, PRETORIA, 0001
0993	NAUDE, Mnr A S B	Posbus 6895, Kanonkop, MIDDELBURG, 1050
0536	NAUDE, Mnr J J	Posbus 13649, Sinoville, PRETORIA, 0129
1570	NAUDE, Mnr J J	Posbus 157, TZANEEN, 0850
2220	NAUDE, Mnr L J	Durbanweg 90, MOWBRAY, Kaapstad, 7700
2242	NEL, Mnr A J T	24ste Laan 828, RIETFONTEIN, 0084
0261	NEL, Mnr D P	P O Box 45, UMLAAS ROAD, 3730
2296	NEL, Dr E U	Posbus 11538, ERASMUSKLOOF, Pretoria, 0048
1423	NEL, Mnr J J G	Jan van Riebeeckweg 300, OUDTSHOORN, 6620
1784	NEL, Mnr P W	Posbus 122, NABOOMSPRUIT, 0560
0227	NEL, Mnr William	Posbus 87, MTUNZINI, 3867
2124	NELL, Dr Johan	Posbus 2787, RANDBURG, 2125
1943	NELL, Mnr J F	Hexrivierstraat 40, Eastvale, SPRINGS, 1560
0237	NELL, Mnr J M	Danielstraat 60, Lambtonm Gardens, GERMISTON, 1428
1346	NEWLAND-NELL, Mr T	9 Perth Street, Kabega Park, PORT ELIZABETH, 6025
1194	NIEMAND, Mr & Mrs H & D	50 Judges Avenue, Cresta Ext 1, RANDBURG, 2195
1192	NIEUWENHUIZEN, Mr R	P O Box 2086, DURBANVILLE, 7551
1503	NIEUWOUDT, J & L	P O Box 292, SKEERPOORT, N W Province, 0232
0829	NIEWOUDT, Prof C F	Posbus 17129, GROENKLOOF, 0027

2009	NIEWOUDT, Mev M C	Posbus 6457, BIRCHLEIGH, 1621
2294	NORMAN, Tyrone & Sue	P O Box 3315, Cluster No 1, SUNNINGDALE, 4051
1869	OBERHOLZER, Mr N S	61 17th Street, PARKHURST, 2193
1968	OBERHOLZER, Niel & Thea	Posbus 44622, LINDEN, 2104
1588	OCHSE, Mr A L	P O Box 310, HONEYDEW, 2040
2104	OLIVIER, Mnr A H J	Posbus 4761, BRITS, 0250
1732	OLIVIER, Mnr H G	Posbus 15057, LAMBTON, 1414
0094	OLIVIER, Mnr & Mev J & L	Posbus 288, KIRKWOOD, 6120
0872	OOSTHUYZEN, Mnr J C	Posbus 59911, KARENPARK, 0118
0400	OSBORNE, Mrs P J	Green Pastures, P O Box 45, DURBANVILLE, 7550
2257	PAGE, Mnr & Mev C & A	Posbus 32167, GLENSTANTIA, 0010
2215	PARKER, Mr K	Sydneys Hope, Po SIDBURY, 6131
0357	PARSONS, Mr J S	P O Box 41652, CRAIGHALL, 2024
2300	PAUTZ, Mr M J	Cycads for Africa, P O Box 209, KNYSNA, 6570
2244	PAUW, Dr J C	Posbus 461, PAARL, 7464
2266	PESSOA, Mr José P M C	P O Box 59064, KENGRAY, Johannesburg, 2100
0059	PHIPSON, Mrs Y H	3 Dickens Place, PINETOWN, 3610
2282	PIENAAR, Jacques	Posbus 14152, BREDELL, 1623
0024	PIENAAR, Mr Leon	626 Jan Visse Avenue, ROSEVILLE, 0084
2207	PIENAAR, Mnr M G	Posbus 1300, NELSPRUIT, 1200
2287	PIENAAR, Mnr W J	Posbus 2169, MONTANAPARK, 0159
2193	PIETERS, Mr A H	P O Box 14181, WEST ACRES, 1211
1323	PIETERSE, Mnr F	Emus Erasmuslaan 278, Erasmusrand, PRETORIA, 0181
1354	PILLAI, Mr L	55 Maple Crescent, Circle Park, KLOOF, 3610
0078	PINKER, Mr Colin	P O Box 2115, NELSPRUIT, 1200
1941	POTGIETER, Dr Chris	Posbus 12, HUMANSDORP, 6300
1152	POULTON LIBRARY	Durban Parks Department, P O Box 3740, DURBAN, 4000
2185	POWELL, J B	Dowlingweg 2, Warner Beach, KINGSBURGH, 4126
0864	PRANGLEY, Mr	P O Box 35245, NORTHWAY, 4065
2043	PRETORIUS, Mnr De V	Posbus 128, LETSITELE, 0885
1843	PRETORIUS, Mnr & Mev J	Posbus 327, LEVUBU, 0929
2307	PRETORIUS, Peet	Posbus 2425, DURBAN, 4000
2149	PRINSLOO, Mnr C J	Posbus 50176, WIERDAPARK, 0149
0166	PRINSLOO, Dr G C	Posbus 523, KROONDAL, 0350
1581	PRINSLOO, Mnr J J	Posbus 25219, MONUMENTPARK, 0105
0631	PROZESKY, Mr J G	P O Box 6172, BIRCHLEIGH, 1621
1917	QUINN, Peter & Linda	P O Box 77, DURBAN, 4000
0832	RADEMEYER, Mev C	Windsorstraat 5, GEORGE, 6530
2337	RADEMEYER, Mnr Gideon J	Posbus 1527, FONTAINEBLEAU, 2032
1759	RAUTENBACH, Mnr J W	Kameeldoringstraat 10, Vredekloof, BRACKENFELL, 7560
1112	RAUTENBACH, Mnr M J	Irving Steynstraat 19, SOUTH CREST, ALBERTON, 1449
0732	REICH, Mr R G	1015 Martha Street, ELDORAIGNE, 0157
1197	REINACH, Dr Norman	Posbus 1834, GEORGE, 6530
2270	RETIEF, Mnr & Mev D	Posbus 2634, DURBANVILLE, 7551
1370	RICHTER, Mr M P	P O Box 209, KNYSNA, 6570
0759	RIDGE, Mr Bruce	22 Estuary View, Beacon Bay, EAST LONDON, 5241
1222	RIORDAN, Mr S	CRM City Branch 4 South, P O Box 61689, MARSHALLTOWN, 2107
1654	ROBBERTSE, Prof P J	Astridstraat 167, Meyerspark, PRETORIA, 0184
1253	ROBINSON, Mr Ken	P O Box 41168, CRAIGHALL, 2024
1201	ROOS, Dr A	Marine Rylaan 303, Brighton Strand, DURBAN, 4052
1699	ROOS, Mr C A	P O Box 7186, ALBEMARLE, 1410
2005	ROOS, Mnr P B	Posbus 1543, POTGIETERSRUS, 0600
2175	ROOSENDAL, Mr S	29 Bamboes Street, KILNER PARK, 0186
0187	ROSS, Mr W D	20 Wanless Road, Glenmore, DURBAN, 4001
0973	ROSSOUW, Mr N B	38 Middleton Road, ESCOMBE, 4093
2197	ROSSOUW, Mnr W D G	De La Fontainelaan 14, MONTE VISTA, 7460
2171	ROUSSEAU, Mnr Robert	Posbus 32416, GLENSTANTIA, 0010
1853	ROUWENHORST, Erik	Posbus 620, NEWCASTLE, 2940
1442	ROUX Mnr J J	Graphitestraat 64, WILROPARK, 1724
1633	ROUX, Mnr T	Posbus 16464, PRETORIA-NOORD, 0116
1893	RUDMAN, Mr E R	35 Brand Van Zyl Avenue, Vanes Estate, UITENHAGE, 6230
0415	RUDMAN, Mr R R	3 Dunn Road, Jansendal Township, UITENHAGE, 6229
2276	RUTOWITZ, Mrs Allison	Private Bag X571, SILVERTON, 0127
1402	RYAN, Dr M J	Mahemlaan 3, RUSTENBURG, 0299
2225	SAMPSON, Mr J D	38 Pitts Ave, DISCOVERY, 1710, Gautang

1829	SCHAAP, Mnr S	Posbus 149, GRAVELOTTE, 0895
1685	SCHEHLE, Mr Anton	P O Box 72917, LYNNWOOD RIDGE, 0040
2301	SCHELHASE, Fred	Posbus 61596, PIERRE VAN RYNEVELD, 0045
0311	SCHIMMER, Mr C M	P O Box 274, ALLANRIDGE, 9490
1984	SCHMIDT, Mr E V	4 Lauriston Lanes, 55 Viking Road, GLEN LAURISTON, 0185
0424	SCHMIDT, Mnr F E	Posbus 53126, WIERDA PARK, 0149
1881	SCHOEMAN, Mnr J	Posbus 38448, GARSFONTEIN, 0042
2204	SCHOEMAN, Mnr M D	Posbus 409, MONTANA, 0151
0082	SCHOEMAN, Mnr S J	Posbus 16001, PRETORIA-NOORD, 0116
2128	SCHOLTZ, Mnr W C	Posbus 924, ELLISRAS, 0555
1729	SCHOLTZ-KOEN, Dr M	Posbus 16343, PRETORIA-NOORD, 0116
2198	SCHUCH, Mnr C H & Mev E	Posbus 74968, LYNNWOODRIF, 0040
2283	SCHUTTE, Mr H P	P O Box 12596, JACOBS, Durban, 4026
1880	SCHUTTE, Mev J E	Posbus 1745, RUSTENBURG, 3500
2202	SCHUTTE, Mnr M	Buhrmannstraat 30, Horison, ROODEPOORT, 1724
1077	SCHUTTE, Dr R L	P O Box 650580, BENMORE, 2010
0647	SCHWELLNUS, Mnr M R	Posbus 7045, Newton Park, PORT ELIZABETH, 6055
1612	SCOPEL, Dr G	32 12th Street, Orange Grove, JOHANNESBURG, 2192
2000	SCOTT, Mr J J	17 Slangkop Avenue, Rand Park Ext 4, RANDBURG, 2195
0477	SCRIBA, Mr J H	College for Foresters, Saasveld, Private Bag X6531, GEORGE, 6530
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2256	SIM, Mnr Henry	Posbus 239, KROONSTAD, 9500
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1959	SMALBERGER, Mnr H C	Posbus 17190, PRETORIA-NOORD, 0116
2223	SMALL, Mr P R	P O Box 4132, LOUIS TRICHARDT, 0920
0534	SMIT, Mnr D D	Posbus 11126, HATFIELD, 0028
1821	SMIT, Mnr J	Posbus 2110, POTCHEFSTROOM, 2520
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0903	Smith, Prof G F	NBI, Privaatsak X101, PRETORIA, 0001
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2116	SMITH, Mr M R	P O Box 164, BROEDERSTROOM, 0240
1830	SMITH, Mr T D	6 Uve Road, KLOOF, 3610
0698	SMUTS, Mnr M N	Posbus 13682, SINOVILLE, 0129
2120	SNYMAN, Mnr A D	Posbus 520, UTRECHT, 2980
1481	SNYMAN, Mr A J	P O Box 5450, Panorama Park, WINKELSPRUIT, 4145
1815	SNYMAN, Dr P H R	Posbus 565, MONTANAPARK, 0159
2249	SOLE, Terry	P O Box 634, EDENVALE, 1610
0992	SPICER, Mr B E J	23 Westriding Road, HILLCREST, 3610
9003	STAATSBIBLIOTEEK	Die Direkteur, (Afd Pligeksemplare), Posbus 397, PRETORIA, 0001
2331	STEENKAMP, Mnr J H	Posbus 34, BRITS, 0250
0911	STEENKAMP, Mnr & Mev K	Posbus 218, LOUWSBURG, 3150
2205	STEENKAMP, Mnre P & W	Posbus 17257, GROENKLOOF, 0027
1816	STEFFENS, Mnr A S	Posbus 1642, EMPANGENI, 3880
1576	STEP, Mnr E O	Van Riebeecklaan 133, LYTTELTON MANOR, Centurion, 0157
2279	STEVENS, Mr J S	P O Box 121, SKUKUZA, 1350
2050	STEYN, Dr G F	Voortrekkerstraat 173, GREYTOWN, 3250
1236	STEYN, Mr R C	P O Box 1218, HONEYDEW, 2040
2254	STOLZ, A H G	Moultonlaan 1176, WAVERLEY, Pretoria, 0186
1004	STRANEX, Mr Phillip	P O Box 53235, KENILWORTH, 7745
1117	STRANG, Mrs C	P O Box 69212, BRYANSTON, 2021
1401	STROBOS, Mnr J G	Posbus 518, KLOOF, 3640
0084	STROEBEL, Mnr Pieter	Posbus 189, PORT ELIZABETH, 6000
2210	STRUYF, Mnr Wim	Posbus 1954, NELSPRUIT, 1200
0213	STRYDOM, Dr Dawid	Anglo American Prospecting Services, Private Bag X2051, CARLETONVILLE, 2500
2056	STRYDOM, Mr G	21 Constantia Street, Culemborg Park, RANDFONTEIN, 1760
9006	SUID-AFRIKAANSE BIBLIOTEEK	Die Direkteur, (Afd Pligeksemplare), Posbus 496, KAAPSTAD, 8000
0139	SWANEPOEL, Mnr Johan	Posbus 911, BLOEMFONTEIN, 9300
1879	SWANEPOEL, Mnr Louis	Posbus 6093, BIRCHLEIGH, 1620
1890	SWART, Dr I J	Posbus 1006, WITRIVIER, 1240
1167	SWARTS, Dr S W	Posbus 21172, BLUFF, Durban, 4052
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1833	TAPPIN, Mr G S	P O Box 162, WELKOM, 9460
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0147	TATE, Mr D M	P O Box 8099, DIE HEUWEL, 1042
1689	TEN CATE, Mnr A S	Posbus 1, BROEDERSTROOM, 0240
1708	TERBLANCHE, Prof J	Mimosalaan 448, LYNNWOOD, 0081
()	THERON, Prof G K	Posbus 1790, GROENKLOOF, 0027
2078	THEUNISSEN, Mnr P	Posbus 244, HECTORSPRUIT, 1330
2277	THOMPSON, Mnr B P	Posbus 14195, SONOVILLE, 0129
2246	THORPE, Mr Robin P	P O Box 1797, MOUNT EDGECOMBE, 4300
1808	THURSTON, Mrs V A	c/o Private Bag X6, MAIDSTONE, 4380
0304	TOPHAM, Mr André	P O Box 44, HOEDSPRUIT, 1380
0178	TOPHAM, Mnr C W	Apiesdoringlaan 88, Wonderboom, PRETORIA, 0182
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2237	UDEMANS, Mr Willie L	P O Box 90711, BERTSHAM, Johannesburg, 2013
1599	ULRICH, Mnr B J	Posbus 1956, LADYSMITH, 3370
0678	UNGERER, Mr H	P O Box 279, MELVILLE, 2109
1760	UYS, Mev A G	Posbus 2399, PANORAMA LANDGOED, 1718
0322	VALLABH, Mr P D	373 Mink Street, Laudium, PRETORIA, 0037
2032	VAN ASWEGEN, Mnr A C	Posbus 96, LEVUBU, 0929
2299	VAN BUREN-SCHELE, Mnr F J	Posbus 1881, CRESTA, 2118
2134	VAN DAM, Mev H C	Posbus 8496, NEWCASTLE, 2940
1526	VAN DEN BERG, Mnr I J	Williamsstraat 59, Wilkoppies, KLERKSDORP, 2571
1836	VAN DEN BERG, Mnr T	Posbus 768, POTGIETERSRUS, 0600
1144	VAN DEN HEEDE, Mr A M P	P O Box 2031, PINETOWN, 3600
1882	VAN DER MERWE, Dr Antoinette	P O Box 44004, LINDEN, 2104
1283	VAN DER MERWE, Mnr C H	Posbus 993, Rant-en-Dal, KRUGERSDORP, 1751
1918	VAN DER MERWE, Mnr F A	Posbus 679, BARBERTON, 1300
0136	VAN DER MERWE, Mnr J F	Posbus 39, DUIWELSKLOOF, 0835
2126	VAN DER MERWE, Mr L	Private Bag X19, SOMERSET WEST, 7129
1745	VAN DER MERWE, Mr W S	P O Box 13655, SINOVILLE, 0129
2181	VAN DER WALT, Mnr A J (Snr)	Blackberry 85, ZWARTKOPS X4, Centurion, 0157
2140	VAN DER WALT, Mnr A J	Posbus 39, ELLISRAS, 0555
0203	VAN DER WALT, Mnr A S J	Posbus 77720, Fontainebleau, RANDBURG, 2032
0038	VAN DER WALT, Mev Ita	Cycad Kwekery, Posbus 15251, LYNN-OOS, 0039
2091	VAN DER WALT, Mnr P J C	Cowens Crescent 32, Sunny Side, PIETERMARITZBURG, 3201
2284	VAN DER WALT, W H	P O Box 59112, KENGRAY, 2100
2077	VAN DER WESTHUIZEN, Mnr J	Posbus 335, AMANZIMTOTI, 4125
0746	VAN DER WESTHUIZEN, J F G	Posbus 1536, NORTHCLIFF, 2115
2127	VAN DER WESTHUIZEN, Mnr M G	Posbus 424, MAGALIESKRUIN, 0150
1728	VAN DEVENTER, J C	Posbus 6379, Welgemoed, BELLVILLE, 7530
2125	VAN DYK, Mr C P	18 Headingley Avenue, WESTVILLE, 3630
2328	VAN ELLEWEE, Mev Christa	Leliehof, PIKETBERG, 7320
1987	VAN ELST, Mr Deon	P O Box 89201, LYNDHURST, 2106
2297	VAN GEEMS, Mnr J J	Langeberg Ridge, Posbus 10521, DURBANVILLE, 7551
0752	VAN GREUNING, Mnr J	8ste Laan 940, WONDERBOOM-SUID, 0084
2010	VAN HEERDEN, Mnr F J	Posbus 90678, MAGALIESKRUIN, Pretoria, 0150
1185	VAN HEERDEN, Dr H G	P O Box 237, STRAND, 7140
0983	VAN HEERDEN, J L	Undine 2, Eversdal, DURBANVILLE, 7550
2105	VAN JAARSVELD, Mnr W	Posbus 28283, DANHOF, 9310
2070	VAN NIEKERK, Dr A R	Posbus 252, SOUTHBROOM, 4277
2272	VAN NIEKERK, Mev Cecilia	Posbus 262, IRENE, 1675
2329	VAN NOORD, A A	140 Senior Drive, NORTHCLIFF, 2195
2213	VAN ONSELEN, Mnr R L	Posbus 82680, DOORNPOORT, Pretoria, 0017
2232	VAN RENSBURG, Mnr H C J	Schreinestraat 16, Ivypark, PIETERSBURG, 0699
2293	VAN RENSBURG, Mnr Johannes	Posbus 3270, DAINFERN, 2055
2208	VAN RENSBURG, Mnr N A J	Posbus 1399, WITRIVIER, 1240
2240	VAN RENSBURG, Mr P F J	54 Kosmos Avenue, WILRO PARK, 1724
1258	VAN ROOY, Mnr Leon	Posbus 1019, WITRIVIER, 1240
1924	VAN ROOYEN, Mnr H C	Posbus 2690, WELKOM, 9460
1903	VAN ROOYEN, Prof H G	Dept Kurrikulumstudies, R.A.U., Posbus 524, AUCKLANDPARK, 2006
1925	VAN ROOYEN, Ds J C	Posbus 2752, MIDDELBURG, 1050
2136	VAN ROOYEN, Mnr L A	Posbus 69, GREYTOWN, 3250
2332	VAN VUUREN, Mnr Henco	Posbus 32395, GLENSTANTIA, 0010

1819	VAN VUUREN, Mr J A	P O Box 13474, CLUBVIEW, 0014
0229	VAN WYK, Mev G	Posbus 11306, HATFIELD, 0028
2145	VAN WYK, Mnr G B	Bloukeurstraat 32, Blommendal, BELLVILLE, 7530
1267	VAN WYK, Mnr P L	Posbus 12881, ONDERSTEPOORT, 0110
1891	VAN WYK, Mnr R J	Posbus 113, MOOINOOI, 0325
1756	VAN ZYL, Elkie	Posbus 115, MOOKETSI, 0825
0910	VAN ZYL, Mnr J H	Posbus 95332, WATERKLOOF, 0145
0681	VENTER, Mnr F F C	Ontdekkersweg 367, Florida Park, Uitbr 3, FLORIDA, 1709
2320	VENTER, Mev Marlene	Posbus 854, PHALABORWA, 1390
2057	VERMAAK, Mnr E de J	Perskeblomweg 9, Pelissier, BLOEMFONTEIN, 9301
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1825	VILOEN, Mnr G T R	Tugelaweg 1, DUNDEE, 3000
1607	VILJOEN, Mnr Jaap	Posbus 1735, MULBARTON, 2059
2123	VILJOEN, Mnr J H	Mineroastraat 8, Amanda Glen, DURBANVILLE, 7550
1609	VILJOEN, Mnr J J	Republiekstraat 88, VRYHEID, 3100
1949	VILJOEN, Mr Norman	28 Cheviot Road, THE HILL, Johannesburg, 2197
0071	VISSER, Mnr Ben	Posbus 3538, BRITS, 0250
2013	VISSER, Mr George	39 Rouxton Road, LANSDOWNE, 7780
2092	VISSER, Mnr J B	Posbus 913, HARTBEESPOORT, 0216
1770	VISSER, Mnr W P	Windhoekweg 2, Arauna, BRACKENFELL, 7560
0917	VORAJEE, Mr R	P O Box 222, LADYSMITH, 3370
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2172	WELKEN, Mnr Pieter A (Jnr)	Posbus 398, PONGOLA, 3170
0175	WELLS, Mr B K	P O Box 7068, Newton Park, PORT ELIZABETH, 6055
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1380	WENTZEL, Mnr P	Posbus 1016, KROONSTAD, 9500
0047	WENTZEL, Mr Stephanus	170 Blackwood Street, ARCADIA, 0083
2144	WESSELS, Mnr A P	Posbus 3110, KENMARE, 1745
0448	WESSELS, Dr F H	P O Box 7, PHALABORWA, 1390
1318	WESSELS, Mnr J W	Posbus 31, HEIDELBERG, 6665
2322	WESTLAND, Mnr Chris	Posbus 1140, HUMANSDORP, 6300
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0587	SHAHAK, Mr D	Tirat TSVI, DN EMEK BEIT SHEAN 10815

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1680	SANTAGATA, Mr Luigi	Via Sanfelice 25, AVERSA (CE) I-81031
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1691	SHIMIZU, Mr Hideo	Atagawa Tropical & Alligator Garden, Atagawa, Higashi Izu Machi, Kamo Gun, SHIZUOKA 413-03

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2027	MACKENZIE, Mr Paul C	Rosslyn River Garden Centre, P O Box 63499, NAIROBI

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0325	BOYER, Mr Keith	70 Opanuku Road, RDI Henderson Valley, AUCKLAND
2187	HUTT, Thane	35 Lancaster Road, Beachaven, AUCKLAND
1781	LONG, Mr M	Hiltop Enterprises, 38 Grammar Road, RDI KATIKATI, Bay of Plenty
0718	LAUGHLAND, Bryan	20 Vic Butler Street, Mt Roskill, AUCKLAND

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0884	ALLEN, Dale & Irma	P O Box 135, MBABANE

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1506	HARDY, Mr R M	18 Beechdene Grove, ERDINGTON, Birmingham BS3 6PN
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0731	KING, Mr A	34 Keats Avenue, ROMFORD Essex RM3 7AR
0929	NATURAL HISTORY MUSEUM	Acq Section, Cromwell Road, LONDON SW7 5BD
0734	PLATFORD, Mr R J	9 Waycross Road, CRANHAM, Upminster, Essex RM14 1LZ
2001	ROYAL BOTANIC GARDENS	Library, Kew, RICHMOND, Surrey TW9 3AE
9004	ROYAL BOTANIC GARDENS	Threatened Plant Unit, Kew, RICHMOND, Surrey TW9 3AE
1203	SHAW, Mr A	10 Park Hill, Darfield, BARNSLEY, South Yorkshire S73 9HD
1912	SPENCER-JONES, Mr A	12 The Brooklands, TARBOCK ROAD, Liverpool L36 5YD
1437	WASKIN, Mr S	65 Parc Brynmawr, Llanelli, CARMARTHENSHIRE,
2250	WATT, Mr Ian	25 Treves Road, DORCHESTER, Dorset DT1 2HE
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2154	BECK, Charles R	101 Wandering Trl, JUPITER, FL 33458
2155	BENZIE, Jim	5110 Shosone, ORANGE, CA 92667
1292	BERGMAN, Mr W P	3233 Brant Street, SAN DIEGO, California 92103
1052	BESSE, Dr & Mrs B	6729 Peacock Road, SARASOTA, Florida 34242
1747	BIAGI, Louis	2000 Hoover Avenue, OAKLAND, California 94602-1924
1734	BLAUER, John	418 Pirate Road, NEWPORT BEACH, California 92663
1895	BOBICKS PALM GROWERS	3744 Lake Drawdy Drive, ORLANDO, Florida 32820-1443
2334	BRESSLER, R M	1055 So. San Rafael, PASADENA, CA 9105
1457	BROOME, Mr T	9128 Golden Gate Boulevard, POLK CITY, Florida 33868
1394	BROWN, Mr E D	10712 Lippizan Drive, JACKSONVILLE, Florida 32257
2313	BUCKLEY, Robert	32005 Pleasant Glen Road, TRABUCO CANYON, CA 92679-3228
1288	BURNETT, Mr W L	P O Box 17908, NORTH LITTLE ROCK, Arkansas 72117-0908
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0598	CAUDRY, Mr J	264 Almyra Drive, LAKE MARY, Florida 32746
0709	CHEEK, Mr Bane W	2813 Country Club Rd North, WINTER HAVEN, Florida 33881
1595	CHEMNICK Mr J	114 Conejo Road, SANTA BARBARA, California 93103
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1568	DUDENHOEFFER, Mr J	P O Box 1391, BONSALL, CA 92003
0137	DWYER, Mr Patrick	35 Culver Avenue, ALBANY, New York 12205
1591	ECKEL, Mr D	2119 Victoria Drive, FULLERTON, California 92631
1772	ERICKSON,B	5408 Santa Teresa Avenue, SANTA ROSA, California 95409
9005	FAIRCHILD TROPICAL GARDEN	Library, 11935 Old Cutler Road, MIAMI, Florida 33156
2335	FOSTER, Phillip A	11521 Augusta Dr, BALCH SPRINGS, TX 75180
1736	FRITZ, William H	114 Willow Creek Rd, UNION, MO 63084
1748	FROEHLICH, Mr D	13219 Stern Avenue, LA MIRANDA, California 90638-2454
2157	GARDNER, Ted	1550 Mountain Drive, SANTA BARBARA, CA 93103

2217	GORDIN, Scott	c/o Loanstar America, Inc, 411 W Lambert #402, BREA, CA 92821
2315	GORDON, Dave	3054 Shadypark Dr, LONG BEACH, CA 90808-3923
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1594	GUILIANO, Merle	3115 Grove Road, PALM BEACH GARDENS, Florida 33410
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1860	HENNELL, Mr Ken	38555 Harris Trail, FALLBROOK, California 92028
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1773	HOLTON, D F	5221 Third Road, LAKE WORTH, Florida 33467
2098	HOWARD, Mr Bob	2514 North Lanchmont Ave, SANTA ANA, Ca 92706
2169	HUEPPI, Peter A	2918 Williams Grant, SUGAR LAND, Texas 77479
2159	HUNT, Alan	P O Box 310508, ATLANTA, Georgia 31131
1051	HUNTINGTON LIBRARY	Acquisitions Dept/Bot/, 1151 Oxford Road, SAN MARINO, CA 91108
1878	JAEGGI, Mr Fred	P O Box 5061, HAUPPAGE, New York 11788
1920	KATZ, Mr M	10534 Ilona Avenue, LOS ANGELES, CA 90064
1427	KOPFSTEIN, Mr R	6903 Kellyn Lane, VISTA, CA 92084
1444	KRAATZ, Mr J W	P O BOX 1867, VISTA, California 92085-1867
2160	KURTH, Dr Donald J	10569 Apple Lane, RANCHO CUCAMONGA, CA 91739
0918	LEWIS, Mr H W	1238 Olive Lane, LA CANADA, California 91011-2211
1897	LITTLE, Mr J R	2125 Bonita Ladora Way, EL CAJON, California 92019
2161	LOPES, Joe A	4104 Ahwahnee Ct, MODESTO, CA 95356
1737	LOWE, Mr Dan	44 Buena Vista Drive, DANVILLE, California 94526
1738	LUTHER, Harry	The Marie Selby Botanical Gardens, 811 S Palm Avenue, SARASOTA, Florida 34236
2316	LYMAN, Kevin D	9319 Goyette Pl, SANTEE, CA 92071
1635	McDANIEL, Mr I	4034 Crest Heights, FALLBROOK, California 92028
1750	MAEROWITZ, Mr Todd	472 Tiller Lane, REDWOOD CITY, CA 94065
1777	MEDLOCK, Mr E	420 15th Street, MANHATTEN BEACH, CA 90266
0570	MOLDOCH, Mr W	1544 Shipview Road, ANNAPOLIS, Maryland 21401
1739	NIPPER, Bobby	2322 NW 15 Pl, GAINESVILLE, Florida 32605
2317	NOBLES, Allen R	10837 Pine Tree Trl, TALLAHASSEE, FL 32311
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2163	REDLAND NURSERY Inc	18455 SW 264 St, HOMESTEAD, FL 33031
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2100	RETZLAFF, Mr David	1849 C St, LINCOLN, NE 68502
2164	RICE, David A	4851 Marguerita Ln, LA MESA, CA 91941
1814	SHAFFER, Richard	82-751 Boston Court,INDIO, California 92201
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1898	SMITH, Mark & Linda	P O Box 622, RANCHO SANTA FE, California 92067
1899	STERNBERG, Karen & Paul	2124 Camino Cantera, VISTA, California 92084
1884	STEVENSON, Dr Dennis W	New York Botanical Garden, BRONX, NY 10458
2080	TALLEY, Mr H Ray	133 Eagle Rock Avenue, SILVER STRAND BEACH, CA 93035
0188	TANG, Mr Willie	Fairchild Tropical Garden, 11935 Old Cutler Rd, MIAMI, Florida 33156-4299
2196	ROSS, Mary Jo & Terry	2579 Brust Court, EL CAJON, CA 92019
2167	TRACY, Michael S	1131 South Grand Avenue, DIAMOND BAR, CA 91765
2073	TUFENKIAN, Mr David	365 Vereda Del Ciervo, GOLETA, CA 93117-5305
0919	TURLO, Mr A	5521 Towers Street, TORRANCE, California 90503
1668	US CYCAD SOCIETY SEED BANK	1417 Hilgard Avenue, SIMI VALLEY, California 93065
1933	VAN TWUYVER, Mr S	14058 Davenport Ave, SAN DIEGO, California 92129
1439	WAGNILD, Mr Gary	405 Olive Street, INGLEWOOD, California 90301-2217
0657	WALSKA, GANNA LOTUSLAND FOUNDATION	695 Ashley Road, SANTA BARBARA, CA 93108
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1090	WORKS, Roy E	4610 Central Avenue, TAMPA, Florida 33603
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ZIMBABWE

1626	ALOE & CACTUS SOCIETY OF ZIMBABWE, (The Cycad Branch)	P O Box CY 300, Causeway, HARARE
1409	COETZEE, Mrs H M	Estelle Farm, P O Box 12, MHANGURA
1991	GILLESPIE, Mr M D	P O Box 3486, HARARE
1315	LAPHAM, Mrs E	P O Box H.G. 960, Highlands, HARARE
1670	LEACH, Mrs M P	P O Box 726, MUTARE
2295	McLAUGHLAN, Miss G M	1 Lloyd Close, Ballantyne Park, HARARE
1218	MÜLLER, Mr D	P O Box 246, RUSAPE
1942	MURIMBA, Mr E S	Vumba Botanical Garden, Private Bag V7472, MUTARE
1412	NIENABER, Mrs R J	Exotica Nursery, P O Box 89, MHANGURA
0096	TURNER, Mr I S	P O Box CH613, Chisipite, HARARE
2068	WATERS, Mr I R	29 Ridge Road, Avondale, HARARE