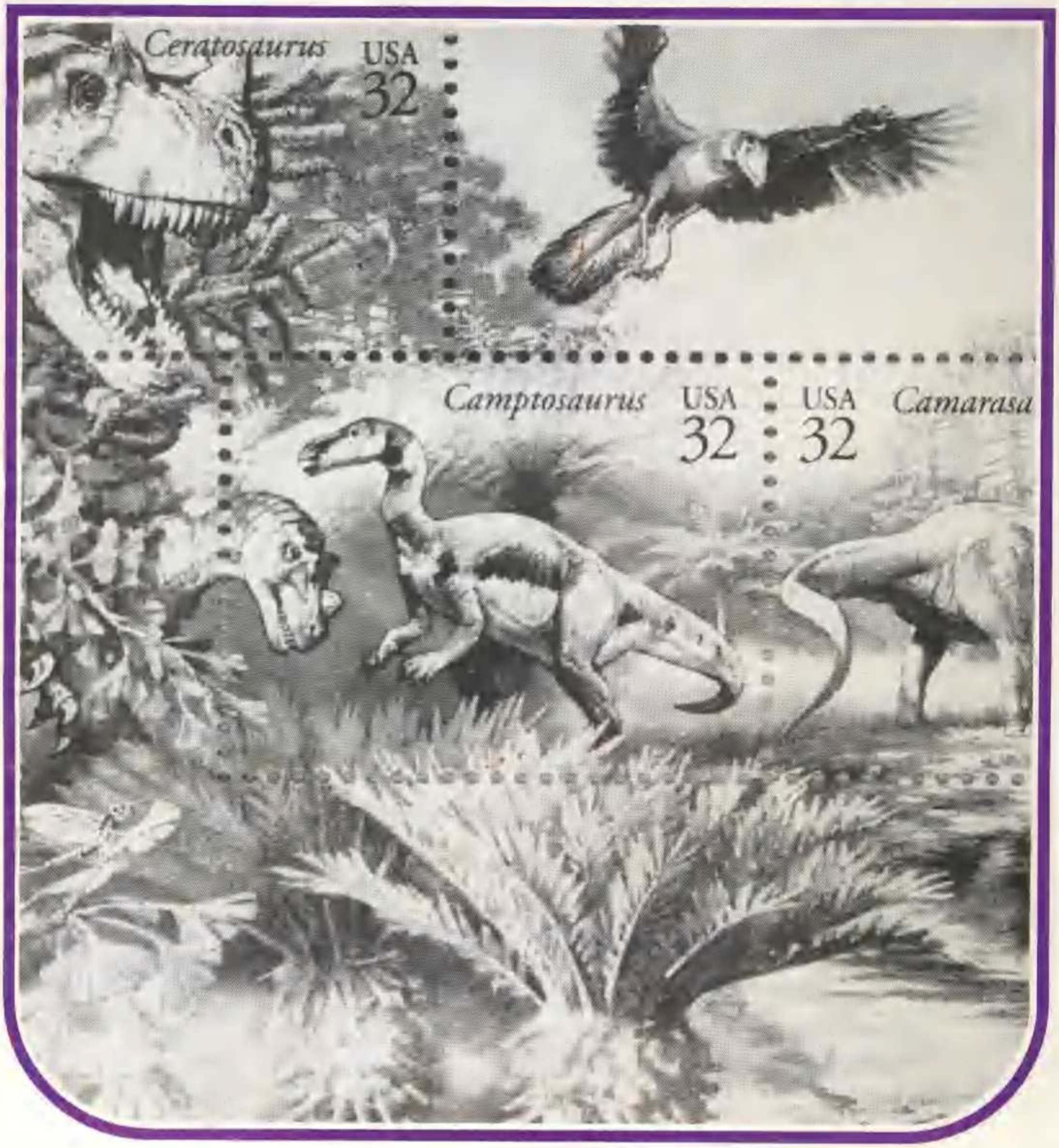
ENCEPHALARTOS

JOURNAL OF THE CYCAD SOCIETY OF SOUTH AFRICA

TYDSKRIF VAN DIE BROODBOOM VERENIGING VAN SUID-AFRIKA

NO. 53 MARCH / MAART 1998 ISSN 1012-9987



CYCAD SOCIETY OF SOUTH AFRICA

BROODBOOM VERENIGING VAN SUID-AFRIKA

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COVER / VOORBLAD : Correspondent Leland Miyano in Hawaii recently returned from a collecting trip to the *Lost World*, and brought some of its postage stamps along. He reported that attempts to collect seed of this *Encephalartos*-like cycad for our seedbank were frustrated by the beast just visible in the upper left-hand corner. See also p. 19–20.

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KYK ASSEBLIEF **KENNISGEWING** EN **VERSOEKE** OP GEKLEURDE BLADSYE AGTERIN HIERDIE UITGAWE

FROM THE PRESIDENT

Four years ago Prof. Hannes Robbertse was welcomed as the new president of the Cycad Society. In the "*Encephalartos*" of December 1993 he was introduced as someone who was exceptionally well qualified for the position of president. His research into cycads not only resulted in a large number of publications, but for years he also conducted lectures about the anatomy and morphology of cycads. Furthermore his research was especially focused on the development and germination of seed. For the past four years Prof. Robbertse has demonstrated that he was indeed an exceptionally good choice. During his term a number of visible innovations were introduced and the organisation of the affairs of the Society was streamlined in many respects. His call upon members for informal research is just as sensible as his warning against ill-considered and unplanned hybrids. Similarly, his strong opinions on the conservation of cycads in their natural habitat is just as recommendable as his plea for the freer flow of seedlings and seed. On behalf of the Cycad Society I want to thank you sincerely for all the contributions through which you pointed the way forward. Thank you for succeeding in combining the wisdom of Solomon with the patience of Job.

Prof. Robbertse was preceded by Prof. Nat Grobbelaar. The contribution of this exceptionally gifted botanist and enthusiastic cycad expert to the expansion of knowledge about cycads is widely appreciated and respected. Virtually no issue of "*Encephalartos*" appears without an interesting contribution from Prof. Grobbelaar. His value for the whole cycad fraternity lies to a great extent in his ability to share his enormous scientific knowledge, observations and suggestions in a comprehensible manner with fellow scientists and laymen.

Prof. Grobbelaar succeeded the pioneer scientist and founder of the Cycad Society of South Africa, Dr. Roy Osborne. The valuable research of Dr. Osborne is widely known. Cycad lovers noted with great interest his effort to increase *Encephalartos woodii* in an unconventional manner. He also gave impetus to cycad literature with the glossy edition about the cycads of the Durban Botanic Gardens. Fortunately his departure to Australia has not put a stop to his valuable contributions in "*Encephalartos*".

It is not easy for a jurist to follow exactly in the footsteps of three nationally esteemed and internationally renowned natural scientists. On the contrary, it is impossible. Using the tested proverb "cobbler, stick to your last" as guideline, my approach for the next two years will have to be somewhat different. My

VAN DIE PRESIDENT

Vier jaar gelede is prof. Hannes Robbertse as nuwe president van die Broodboom Vereniging verwelkom. In die "*Encephalartos*" van Desember 1993 word hy bekendgestel as iemand wat buitengewoon goed vir die amp van president gekwalifiseer is. Nie alleen het sy navorsing oor broodbome in 'n hele aantal publikasies neerslag gevind nie, maar hy het ook vir jare lesings oor die anatomie en morfologie van plante aangebied. Daarbenewens was sy navorsing veral op die ontwikkeling en ontkieming van saad toegespits. Gedurende die afgelope vier jaar het prof. Robbertse getoon hoe 'n buitengewoon goeie keuse hy inderdaad was. In sy termyn is talle merkbare nuwighede ingevoer en is die organisasie van die Vereniging se sake in verskeie opsigte meer vaartbelynd gemaak. Sy oproep tot lede om informele navorsing te doen is net so verstandig soos sy waarskuwing teen onbesonne en onbeplande kruisings. Eweneens is sy streng standpunt vir die bewaring van broodbome in hulle natuurlike habitat net so prysenswaardig soos sy pleidooi vir 'n vryer vloei van saailinge en saad. Namens die Broodboom Vereniging wil ek u hartlik bedank vir al u rigtinggewende bydraes. Dankie dat u kennelik daarin geslaag het om Salomo se wysheid met Job se geduld te kombineer.

En voor prof. Robbertse was daar prof. Nat Grobbelaar. Hierdie buitengewoon begaafde plantkundige en geesdriftige broodboomkenner se bydrae tot die uitbreiding van kennis oor broodbome word alom gewaardeer en gerespekteer. Feitlik geen uitgawe van "*Encephalartos*" verskyn sonder 'n interessante bydrae van prof. Grobbelaar nie. Sy waarde vir die totale broodboombroederskap lê tot 'n groot mate daarin dat hy sy enorme wetenskaplike kennis, waarnemings en wenke op 'n verstaanbare wyse met medewetenskaplikes en leke kan deel.

Prof. Grobbelaar weer het die baanbreker wetenskaplike en stigter van die Broodboom Vereniging van Suid-Afrika, dr Roy Osborne, opgevolg. Dr Osborne se waardevolle navorsing is alom bekend. Broodboomliefhebbers het veral met groot belangstelling en hunkering kennis geneem van sy poging om *Encephalartos woodii* op onkonvensionele wyse te vermeerder. Daarbenewens het hy broodboomliteratuur 'n hupstootjie gegee met die glansuitgawe oor die broodbome in die Durbanse Botaniese tuin. Gelukkig het sy vertrek na Australië nie die einde van sy waardevolle bydraes in "*Encephalartos*" beteken nie.

Dit is nie maklik vir 'n regsgeleerde om presies in die voetspore van drie nasionaal gerekende en internasionaal bekroonde natuurwetenskaplikes te volg nie. Trouens, dit is onmoontlik. Met die getoetste spreekwoord "skoenmaker, hou jou by jou lees" as riglyn, sal my

contributions will put the emphasis on the legal and interhuman within the Cycad Society. You could, for example, expect from me to try to improve contact between cycad fanatics and specifically between scientists and laymen.

Of course scientific and laymen research into cycads must continue unabated. Every cycad garden is after all a challenging outdoor laboratorium. Far too many secrets are still confined in the roots, stems, leaves and cones of these primordial plants. These secrets offer provoking challenges to science. The published observations and experiences of laymen are, however, of equal value because they can serve as stimulus for the scientific analysis of a complex type of plant.

I am looking forward to meeting many of you during my two-year term of presidency and to learn much from you.

Frederick de Jager

benadering vir die volgende twee jaar noodwendig ietwat anders moet wees. My bydraes sal die klem hoofsaaklik op die wetlike en die intermenslike binne die Broodboom Vereniging moet laat val. Van my sou u byvoorbeeld kan verwag om die kontak tussen broodboomfanatici en spesifiek tussen wetenskaplikes en lekelede te probeer bevorder.

Dit spreek vanself dat wetenskaplike en leke broodboom navorsing onverpoosd moet voortgaan. Elke broodboomtuin is immers 'n uitdagende opelug laboratorium. In die wortels, stamme, blare en keëls van dié oerplante lê nog veels te veel geheimenisse opgesluit. Hierdie geheimenisse bied tergende uitdagings aan die wetenskap. Maar die gepubliseerde waarnemings en ervarings van lekelede is ewe waardevol. Want dit kan as stimulus vir die wetenskaplike ontrafeling van 'n komplekse plantsoort dien.

Ek sien daarna uit om in my tweejarige presidentstermyn talle van u te ontmoet en baie van u te leer.

Frederick de Jager

SHORT COMMUNICATIONS / KORT MEDEDELINGS

NUUS OOR DIE TRANSVAALSE STREEKTAK VAN DIE VERENIGING

Hanneke Grobbelaar
Posbus 15357, 0039 Lynn-oos

Ontvang 9 Januarie 1998

PROGRAM VIR 1998

SATERDAG 18 APRIL: Besoek aan die buitengewone broodboomtuin van **mnr Jan van Vuuren**. Vergader om 14h00 in die M34 digby die punt waar dit die R101 ontmoet voor die Veritas Tuinsentrum. Neem die Clubview/Lyttelton afrit vanaf die R28 (Ben Schoeman) snelweg en ry in 'n westelike rigting op die M34 (Lytteltonweg) deur Lyttelton tot by die R101 (Ou Johannesburg/Pretoria pad). Bring asseblief u eie verversings.

SATERDAG 2 MEI: Weens die feit dat dit deel uitmaak van 'n langnaweek is hierdie byeenkoms gekanselleer.

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, PRTORIAa: 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.

Tydens ons algemene jaarvergadering wat op 1 November 1997 plaasgevind het, is die volgende bestuurslede verkies: Voorsitter, Hanneke Grobbelaar; Ondervoorsitters, Derek en Lynnette Minnaar; Tesourier, Johan du Preez. Die vergadering het besluit om die poste van Sekretaris en die van Saad- en Stuifmeelbeampte af te skaf en nie meer addisionele bestuurslede te benoem nie.

Nat Grobbelaar het 'n praatjie oor eienaardighede van *Encephalartos inopinus* se vroulike keëls gelewer. Die inhoud van die praatjie was gebaseer op die artikel deur hom wat in *Encephalartos* **52**: p22 gepubliseer is. Hy het ook die meganisme verduidelik waarop meeste *Encephalartos* vroulike keëls uiteindelik spontaan uitmekaarval. Laasgenoemde deel van die praatjie is volledig in die *South African Journal of Botany* **55**: pp581–585 gepubliseer.

Na 'n lewendige bespreking, is die jaar se verrigtinge met 'n gesellige braai afgesit.

[NEWS: TRANSVAAL REGIONAL BRANCH

As this is only in the interest of South African members there is no need for an English summary. - **Editor.]**

ONGEWONE VROULIKE KEËLONTWIKKELING BY *ENCEPHALARTOS LONGIFOLIUS*

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

Ontvang 9 Januarie 1998

'n Vroulike *Encephalartos longifolius* in die Pretoria-tuin van 'n vriend het gedurende 1997 'n reuse keël gevorm en ek is genooi om dit te bestuif. Alhoewel ek die keël weekliks ondersoek het, kon ek nooit agterkom dat dit oopgemaak het nie. Sowat ses weke nadat soortgelyke keëls in ander Pretoria-tuine gereed was vir bestuiwing, is 'n paar skubbe uit die bopunt van die halsstarrige keël verwyder en is die keël 'n paar keer met tussenposes van drie dae bestuif deur die droë stuifmeel in die keël in te blaas. Die stuifmeel was sowat twee maande vroeër versamel en droog in 'n vrieskas geberg.

Toe die keël spontaan gedurende Augustus uitmekaar geval het, was ek verbaas om te sien dat alhoewel die omnule ("sade") min of meer normaal voorgekom het slegs sowat 10 van hulle pitte (omnelle) van normale grootte bevat het. Al die ander honderde omnule se pitte was maar sowat 10 mm lank (kyk Figuur 1). Deur die pitte deur te sny, kon daar nie in een van die pitte van normale grootte 'n embrio waargeneem word nie. Verskeie van die onontwikkelde pitte is ook deurgesny en soos verwag is, het hulle ook nie 'n embrio bevat nie. Al die omnule was dus korruptule (onbevrugte saadknoppe).

Die onderdele van die saadknoppe van *Encephalartos* spesies groei normaalweg tot feitlik die grootte wat hulle in die volwasse sade het voordat die keël gereed is om bestuif te word. Dit is gevolglik vreemd dat in hierdie geval die weefsels binnekant die sarkotesta (vlesige buitenste gedeelte) min gegroei het alhoewel dit tog 'n

Figuur 1 Ses normale-grootte *E. longifolius* pitte saam met 'n klompie van die onontwikkelde pitte wat in meeste van die keël se omnule ("sade") voorgekom het. / Figure 2 Six normal-sized *E. longifolius* kernels together with several of the under developed kernels that occurred in the majority of the cone's omnules ("seeds").

harde sklerotesta (horingagtige dop) gevorm het. Omdat die bestuiwing ongetwyfeld te laat gedoen is, is dit nie verbasend dat geen embrio's selfs in die normale-grootte pitte ontwikkel het nie.

Indien lesers ook al sodanige ervarings met een of ander *Encephalartos* spesie gehad het sal ek graag daarvan wil verneem sodat mens 'n idee kan vorm tot watter mate hierdie verskynsel in die genus voorkom.

Summary

UNUSUAL FEMALE CONE DEVELOPMENT IN *ENCEPHALARTOS LONGIFOLIUS*

During 1997 a Pretoria friend invited me to pollinate a huge *Encephalartos longifolius* female cone in their garden. Although I inspected the cone regularly at weekly intervals, it never appeared to open. About six weeks after similar cones in the area were receptive to pollination, a few of the apical sporophylls (scales) of the recalcitrant cone were surgically removed and the cone pollinated a few times with 3-day intervals by blowing dry pollen into the cone. The pollen was harvested about two months earlier and was stored dry in a deep freeze.

When the cone disintegrated spontaneously in August, I was surprised to see that although the omnules ("seeds") superficially appeared to be fairly normal, only about 10 of them contained normal-sized kernels (omnels). The several hundred remaining omnules contained kernels that were only about 10 mm long (see Figure 1). Bisecting the normal-sized kernels did not reveal an embryo in any of them. As expected, none of the several abnormal kernels that were bisected yielded an embryo. All the omnules therefore were corruptules (unfertilized ovules).

In the genus *Encephalartos* the component parts of the ovule usually develop almost to the size they eventually attain in the mature seed before the cone is receptive to pollination. It therefore is surprising that in this instance the tissue underlying the sarcotesta (fleshy outer part) did not enlarge normally although it developed a hard sclerotesta (horny shell). Because the pollination was carried out late, it is not surprising that no embryos could be detected, even in the normal-sized kernels.

If any of the readers had a similar experience with an *Encephalartos* species, I would like to hear about it. In that way one can get an impression of the frequency with which this phenomenon occurs in the genus.

Nat Grobbelaar
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BEKAMPING VAN 'N LASTIGE ONKRUID

Nat Grobbelaar
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Ontvang 9 Januarie 1998

Nothoscordum inodorum of te wel "basterknoffel" is 'n lastige onkruid wat aan die leliefamilie (Liliaceae) behoort (Figuur 1). Na die kieming van die saad verskyn 'n lang dun lintvormige blaartjie wat 'n mens maklik met die van 'n gras of uintjie kan verwar. Die plant vorm diep onder die grond 'n bol en vorm weldra 'n dik bos lang lintvormige blare en lang bloeiasse waarop klein wit blommetjies gedra word. Met die swaaiing van die bloeistele in die wind word die ryp sade oor 'n wye gebied versprei.

'n Besending pragtige sanderige leemgrond wat ek eenkeer vir my kwekery bekom het was ongelukkig kwaai met die saad van hierdie onkruid besmet. Ek het aanvanklik van die onkruid in die plastieksakkies probeer ontslae raak deur die blare gereeld te probeer uittrek. Hulle breek gewoonlik net naby grondvlak af en agtergeblewe dele van jong blare groei net verder uit terwyl nuwe blare tussen die basisse van die afgebreekte blare uitgroei.

Uiteindelik het ek 'n eenvoudige en goedkoop metode gevind om die probleem die hoof te bied. 'n Stuk swart plastiekpyp sowat 15 cm lank met 'n groter deursnee as die van die plant by grondvlak se een punt word ligdig verseël. Dit kan op verskillende wyses gedoen word solank die prop of deksel nie maklik weggedruk kan word nie. Ek gebruik meestal 'n noupassende kurk- of houtprop. As dit nodig is vou ek 'n paar lae swart plastiek om die prop om dit stywer in die pyp te laat pas. Die blare van die onkruid word nou net bokant die grondoppervlak afgesny en die pyp word met sy oop punt vertikaal oor die plant vir sowat 25 mm in die grond ingedruk. As die rand van die pyp by die oop

Figuur 1 Volwasse *Nothoscordum inodorum* in sakkie saam met 'n *Encephalartos villosus*. / **Figure 1** Mature *Nothoscordum inodorum* in bag with *Encephalartos villosus*.

Figuur 2 *Encephalartos* saailinge elk met 'n saailing van *Nothoscordum inodorum*. Die onkruidsaailing in die linkerkantse sakkie is met 'n plastiekpyp ligdig bedek. / **Figure 2** *Encephalartos* seedlings each with a seedling of *Nothoscordum inodorum*. The weed seedling of the bag on the left has been capped with a light tight plastic tube.

kant skerp gevyl word, kan die pyp makliker in die grond ingedruk word. Los nou die pyp oor so 'n plant vir verskeie weke, afhangende van die grootte van die plant en die heersende temperatuur.

Die onkruid sal nuwe blare tussen sy oues vorm wat deur die oues gelei word om mooi in die pyp op te groei en bo teen die prop vas te druk. Omdat die nuwe blare egter in die donker is sal hulle wit wees en sal hulle nie kan fotosintetiseer nie. Die plant sal mettertyd al sy reserwe energie uitput in 'n poging om nuwe groen blare te maak wat in die lig kan fotosintetiseer. En so sal die plant mettertyd van uithongering doodgaan.

Basterknoffelsaailinge met net een blaartjie (Figuur 2) sal sommer na twee weke in die donker doodgaan. Ou gevestigde plante moet liefs vir meer as 'n maand in die somer en vir nog langer in die winter donker gehou word. Hierdie metode van uitroeiing behoort ook vir ander onkruide met dieselfde groeiwyse as basterknoffel goed te werk. Die belangrike ding is net dat die nuwe blare op 'n voorspelbare plek wat vooraf verdonker kan word, moet uitgroei.

Summary

FIGHTING A TROUBLESOME WEED

Nat Grobbelaar
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Nothoscordum inodorum or "Fragrant False Garlic" is a member of the Liliaceae and it is a most troublesome weed (Figure 1). After germination it puts out a long narrow ribbon-like leaf that can easily be confused with that of a grass or nutgrass. The plant forms a bulb well below the soil's surface which eventually subtends a dense tuft of long ribbon-shaped leaves and a tall inflorescence with many small white flowers. The mature seeds are scattered over a wide area by the swaying of the inflorescence in the wind.

After several frustrating attemps at fighting the weed, I have eventually found a simple and inexpensive method that works very well. Lengths of approximately 15 cm of black plastic tubing of various diameters are cut. The one end of each piece is tightly closed to prevent light from entering the tube. I usually use cork or wooden bungs and if they fit too loosely, I wrap them in bits of black plastic sheeting to ensure a tight fit. The leaves of the weed are now cut off just above soil level and the open end of a pipe that is wider than the weed at soil level, is pushed vertically over the plant and into the soil to a depth of about 25 mm. Sharpeningg the edge of the pipe at the open end facilitates the pipe's implantation into the soil. Now leave the pipe in place for several weeks depending on the size of the plant and the ambient temperature.

The weed will put out new leaves which will grow upwards between the remains of the old ones into the pipe and up against the stopper which should not give way to the pressure. Because the new leaves will be in darkness, they will be white and unable to photosynthesize. The plant will eventually deplete its

reserves in the production of new leaves - none of which will benefit the plant by producing carbohydrates through photosynthesis. Consequently the plant will eventually succumb through starvation.

Seedlings of the weed with only one leaf are killed within two weeks by this method (Figure 2). Old established plants must be capped for more than a month in summer and for much longer during winter. This method of killing the weed should work equally well for other noxious weeds with a similar growth habit. The important thing is that the growth habit must enable one to predict the spot at which future leaves will emerge from the soil.

ENCEPHALARTOS LANATUS SEX RATIO

Nat Grobbelaar
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Received 9 January 1998

In June 1987 a sample of 448 mature *Encephalartos lanatus* individuals were permanently labelled in an undisturbed part of the Botshabelo Nature Reserve near Middelburg in the Mpumalanga province of the Republic of South Africa. During November of the same year, which is the pollen shedding time for this cycad species, the labelled plants were inspected for cones. The labelled plants were monitored for cones during November of all subsequent years. By 1997, 86% of the labelled plants had coned at least once. From the results at hand, the ratio of male to female plants for the population under scrutiny is 1.1.

As in the case of *E. transvenosus* (see *Encephalartos* **52**) it was found during the present study that the male plants of *E. lanatus* cone more frequently than do their female counterparts. As a consequence, one can assume that the majority of the 14% of the labelled plants *that* have not yet coned, will turn out to be females. The resultant sex ratio for the *E. lanatus* population at the Botshabelo Nature Reserve will therefore probably turn out to be even closer to 1.0 than the presently obtained value of 1.1.

DIE GESLAGSVERHOUDING VAN BROODBOOMSAAILINGMONSTERS

Nat Grobbelaar
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Ontvang 9 Januarie 1998

Broodboomversamelaars wil dikwels weet hoeveel saailinge van 'n besondere spesie hulle moet aanskaf om 100% seker te wees dat dit manlike sowel as vroulike plante sal insluit. Kortweg is die antwoord: " 'n Oneindige groot getal omdat dit hier oor toevallige kombinasies van die twee geslagte gaan". Selfs al sou mens met 1000 saailinge begin, is dit moontlik, alhoewel dit baie onwaarskynlik is, dat al 1000 plante óf manlik óf vroulik kan wees!! As ons egter weet wat die normale verhouding van die twee geslagte in 'n groot bevolking van saailinge is, kan ons bereken wat die waarskynlikheid is dat die plante in 'n bepaalde groep óf almal manlik óf almal vroulik óf 'n mengsel van die twee geslagte sal wees.

Uit werk wat oor die normale geslagsverhouding van *Encephalartos transvenosus* (kyk "*Encephalartos*" **52**) en *E. lanatus* (kyk bl. 8 in hierdie uitgawe van "*Encephalartos*") asook 'n paar *Zamia* spesies gedoen is, kan mens aflei dat 'n groot, normale saailingbevolking van broodbome uit eweveel manlike en vroulike plante saamgestel sal wees. As dit inderdaad so is, kan ons nou bereken wat die waarskynlikheid is dat 'n bepaalde grootte saailingmonster 'n besondere geslagsamestelling sal hê. Die resultate van sodanige berekeninge vir saailingmonsters vanaf 1 tot 8 plante word hier in tabelvorm voorsien (M = manlik; V = vroulik) (Tabel 1).

Tabel 1 Die waarskynlike geslagsverhouding van broodboomsaailingmonsters van 1 tot 8 individue sterk, uitgedruk as persentasies. (**Table 1** The probable sex ratios of cycad seedling samples varying in size from 1 to 8 plants, expressed as percentages.)

Monstergroottes (Sample size)	Waarskynlike geslagsamestellings met die voorkomskanse onder as persentasies aangegee. (Probable sex compositions with the chances for its occurrence provided below as a percentage.)
1 plant	M; V. 50% 50%
2 plante	2M; 1M+1V; 2V 25% 50% 25%
3 plante	3M; 2M+1V; 1M+2V; 3V 12,5% 37,5% 37,5% 12,5% Som van alle M+V groeperings = 75% (Sum of all M+V combinations = 75%)
4 plante	4M; 3M+1V; 2M+2V; 1M+3V; 4V 6,3% 25% 37.5% 25% 6,3% Som van alle M+V groeperings = 87,5% (Sum of all M+V combinations = 87.5%)
5 plante	5M; 4M+1V; 3M+2V; 2M+3V; 1M+4V; 5V 3,1% 15,6% 31,3% 31,3% 15,6% 3,1% Som van alle M+V groeperings = 93,8% (Sum of all M+V combinations = 93.8%)
6 plante	6M; 5M+1V; 4M+2V; 3M+3V; 2M+4V; 1M+5V; 6V 1,6% 9,4% 23,4% 31,3% 23,4% 9,4% 1,6% Som van alle M+V groeperings = 96,9% (Sum of all M+V combinations = 96.9%)
7 plante	7M; 6M+1V; 5M+2V; 4M+3V; 3M+4V; 2M+5V; 1M+6V; 7V 0,8% 5,5% 16,4% 27,3% 27,3% 16,4% 5,5% 0,8% Som van alle M+V groeperings = 98,4% (Sum of all M+V combinations = 98.4%)
8 plante	8M; 7M+1V; 6M+2V; 5M+3V; 4M+4V; 3M+5V; 2M+6V; 1M+7V; 8V 0,4% 3,1% 10,9% 21,9% 27,3% 21,9% 10,9% 3,1% 0,4% Som van alle M+V groeperings = 99,2% (Sum of all M+V combinations = 99.2%)

Hieruit volg dit dat as ons 100 monsters van sê 4 *E. lanatus*-saailinge elk, voor die voet neem, kan ons verwag om te vind dat by 6 van die monsters, alvier die plante per monster manlik sal wees; dat 25 van die monsters elk uit 3 manlike en 1 vroulike plante saamgestel sal wees; dat 38 van die monsters elk uit 2 manlike en 2 vroulike individue saamgestel sal wees; dat 25 monsters elk uit 1 manlike en 3 vroulike plante sal bestaan; terwyl 6 monsters slegs uit vroulike (elk 4 vroulike) plante sal bestaan. Van die 100 saailingmonsters kan ons dus verwag dat 88 uit 'n mengsel van manlike en vroulike individue sal bestaan waarvan die verhouding van manlike tot vroulike individue sal wissel van 3M+1V tot 1M+3V.

Om 99% seker te wees dat 'n saailingmonster uit beide manlike en vroulike individue sal bestaan, sal 'n mens minstens 8 saailinge moet aanskaf. In so 'n monster mag dit blyk dat slegs een van die 8 plante manlik (of vroulik) mag wees, maar die waarskynlikheid dat dit sal gebeur is klein. Die monster sal volgens die wette van die waarskynlikheidsleer mees waarskynlik uit 4M+4V plante bestaan. Trouens, waar die saailingmonster uit 'n ewe getal saailinge bestaan, is die waarskynlikste

kombinasie altyd eweveel manlike en vroulike plante. Vir 'n 8-plant monster is die waarskynlikheid hiervoor 27,3%.

Summary

THE SEX RATIO OF CYCAD SEEDLING SAMPLES

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Cycad enthusiasts often want to know how many seedlings of a given species they have to aquire to be 100% sure that they will have both sexes of that species in the sample. The short answer is: "An infinitely large number because we are dealing with chance combinations." Even if you start off with 1000 seedlings of a species, there is a possibility, no matter how remote, that all 1000 of the plants will turn out to be male or female!! However, if we know the ratio in which the two sexes normally occurs within a large number of seedlings, we can calculate what the probability is that a given set of seedlings will be all male, all female, or partly male and partly female.

From the work that was done on the sex ratio of *Encephalartos transvenosus* (see "*Encephalartos*" **52**) and *E. lanatus* (see p. 8 in this issue of "*Encephalartos*"), as well as a few studies on the sex ratio of certain *Zamia* species, it would appear that the normal ratio of male to female cycads is one and that a large seedling population should therefore consist of equal numbers of male and female plants. If that is indded so, we can now calculate what the probability is that a seedling sample of a given size, will have a particular sex composition. The results of such calculations for samples from one to eight plants are presented in tabular form (male = M; female = V).

So, for instance, see Table 1, if we randomly select 100 samples, each containing 4 *E. lanatus* seedlings, then we should expect to find that in 6 of the samples all four the seedlings will be males; that 25 of the samples will be composed of 3 males and 1 female each; that 38 of the samples will consist of 2 males and 2 females each; that 25 of the samples will be composed of 1 male and 3 females each, whilst 6 of the samples will consist solely of females (4 each). Of the 100 samples, we can therefore expect to have 88 samples that will contain both sexes but in varying proportions (from 3 males + 1 female to 1 male + 3 females).

To be 99% sure that you will have both sexes in your sample, you will have to aquire a sample of at least 8 seedlings. In such a sample you might discover that it contains only one male or only one female, but the chances for this is small. It is most likely that you will find that your 8 plants consist of 4 males and 4 females because the probability for a combination of equal numbers of males and females, where this is possible, is always the highest - in this 8 member sample it is 27.3%.

CYCADS OF THE WORLD FOR THE LAYMAN

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This list of described cycad species was compiled from various publications and personal communications. In our opinion many of our members would be interested in such a list, especially our foreign members who are collecting cycads from all over the world.

Bowenia

1. *B. serrulata*	Queensland, Australia
2. *B. spectabilis*	Queensland, Australia

Ceratozamia

1. *C. euryphyllidia*	Mexico
2. *C. hildae*	San Luis Potosi and Queretaro, Mexico

3. *C. kuesteriana*	Tamaulipas, Mexico
4. *C. latifolia*	Mexico
5. *C. matudae*	Chiapas, Mexico
6. *C. mexicana*	Mexico
7. *C. microstrobila*	Mexico
8. *C. miqueliana*	Mexico
9. *C. norstogii*	Chiapas, Mexico
10. *C. plumosa*	Mexico
11. *C. robusta*	Mexico
12. *C. sabatoi*	Mexico
13. *C. whitelockiana*	Oaxaca, Mexico
14. *C. zaragozae*	Mexico

Chigua

1. *C. bernalii*	Colombia
2. *C. restrepoi*	Colombia

Cycas

1. *C. angulata*	Western Australia
2. *C. apoa*	New Guinea; Indonesia
3. *C. arenicola*	Western Australia
4. *C. armstrongii*	Western Australia
5. *C. arnhemica* subsp. *arnhemica*	Northern Territory, Australia
6. *C. arnhemica* subsp. *muninga*	Australia
7. *C. arnhemica* subsp. *natja*	Australia
8. *C. badensis*	Australia
9. *C. baguanheensis*	China
10. *C. balansae*	Vietnam
11. *C. basaltica*	Western Australia
12. *C. beddomei*	New Britain; Solomon Islands
13. *C. bellefonti*	Southern India
14. *C. bougainvilleana*	Vietnam
15. *C. brunnea*	Northern Territory and Queensland, Australia
16. *C. cairnsiana*	Queensland, Australia
17. *C. calcicola*	Northern Territory, Australia
18. *C. campestris*	Papua New Guinea
19. *C. canalis* subsp. *canalis*	Northern Territory, Australia
20. *C. canalis* subsp. *carinata*	Northern Territory, Australia
21. *C. chamaoensis*	Thailand
22. *C. chamberlainii*	Phillipines
23. *C. chevalieri*	Vietnam
24. *C. circinalis* var. *circinalis*	South India
25. *C. circinalis* var. *orixensis*	Northern eastern Ghats, Indian State of Orissa
26. *C. circinalis* var. *swamyii*	India, Hassan District of Karnataka
27. *C. clivicola* subsp. *clivicola*	Thailand
28. *C. clivicola* subsp. *lutea*	Thailand
29. *C. conferta*	Northern Territory, Australia
30. *C. couttsiana*	Queensland, Australia
31. *C. curranii*	Phillipines
32. *C. diannanensis*	China
33. *C. fairylakea*	China
34. *C. furfuracea*	Western Australia
35. *C. guizhouensis*	China
36. *C. hainanensis*	Hainan Island, China
37. *C. hongheensis*	China
38. *C. inermis*	China
39. *C. javana*	Java; Indonesia

40. *C. lane-poolei*	Australia
41. *C. lindstromii*	Vietnam
42. *C. litoralis*	Myanmar; Thailand; Malaysia; Sumatra; Vietnam
43. *C. longipetiola*	China
44. *C. maconochiei* subsp. *maconochiei*	Australia
45. *C. maconochiei* subsp. *lanata*	Australia
46. *C. maconochiei* subsp. *viridis*	Australia
47. *C. macrocarpa* subsp. *macrocarpa*	Malaysia; Thailand
48. *C. macrocarpa* subsp. *brevidens*	Thailand; Vietnam
49. *C. media* subsp. *media*	Northern Territory, Australia
50. *C. media* subsp. *banksii*	Australia
51. *C. media* subsp. *ensata*	Australia
52. *C. megacarpa*	Queensland, Australia
53. *C. micholitzii*	Vietnam; China
54. *C. micronesia*	Mariana Island; Guam
55. *C. miquelii*	China
56. *C. multiovula*	China
57. *C. multifrondis*	China
58. *C. multipinnata*	China
59. *C. nathorstii*	Sri Lanka
60. *C. nongnoochii*	Thailand
61. *C. ophiolitica*	Queensland, Australia
62. *C. orientis*	Northern Territory, Australia
63. *C. panzhihuaensis*	China
64. *C. papuana*	Papua New Guinea
65. *C. parvulus*	China
66. *C. pectinata* var. *pectinata*	S.E. Asia; N.E. India; China
67. *C. pectinata* var. *elongata*	Vietnam
68. *C. platyphylla*	Queensland, Australia
69. *C. pranburiensis*	Thailand
70. *C. pruinosa*	Western Australia
71. *C. revoluta*	China, Japan
72. *C. riuminiana*	Phillipines
73. *C. rumphii*	S.E. Asia; Pacific Islands
74. *C. seemannii*	Fiji; Tonga; Vanuata; New Caledonia
75. *C. segmentifida*	China
76. *C. semota*	Australia
77. *C. scratchleyana*	New Guinea
78. *C. schumanniana*	Papua New Guinea
79. *C. shiwandashanica*	China
80. *C. siamensis*	S.E. Asia
81. *C. silvestris*	Queensland, Australia
82. *C. simplicipinna*	S.E. Asia
83. *C. stonensis*	China
84. *C. szechuanensis*	China
85. *C. taitungensis*	Taiwan
86. *C. taiwaniana*	China
87. *C. tanqingii*	China
88. *C. tansacha*	Thailand
89. *C. thouarsii*	Madagascar; Africa
90. *C. tuckeri*	Australia
91. *C. wadei*	Phillipines
92. *C. xipholepis*	Australia
93. *C. yorkiana*	Australia

Dioon

1. *D. califanoi*	Oaxaca, Mexico
2. *D. capitoi*	Puebla, Mexico

3. *D. edule* var. *edule*	Mexico
4. *D. edule* var. *angustifolium*	Nuevo Leon and Tamaulipas, Mexico
5. *D. holmgrenii*	Oaxaca, Mexico
6. *D. mejiae*	Honduras
7. *D. merolae*	Chiapas, Mexico
8. *D. purpusii*	Oaxaca, Mexico
9. *D. rzedowskii*	Oaxaca, Mexico
10. *D. spinulosum*	Vera Cruz and Oaxaca, Mexico
11. *D. tomasellii* var. *tomasellii*	S.W. Coast, Mexico
12. *D. tomasellii* var. *sonorense*	N.W. Coast, Mexico

Encephalartos

1. *E. aemulans*	KwaZulu-Natal, South Africa
2. *E. altensteinii*	E. Cape, South Africa
3. *E. aplanatus*	Swaziland
4. *E. arenarius*	E. Cape, South Africa
5. *E. barteri* subsp. *barteri*	Benin; Ghana; Nigeria; Sudan; Togo
6. *E. barteri* subsp. *allochrous*	Nigeria
7. *E. brevifoliolatus*	Northern Province, South Africa
8. *E. bubalinus*	Tanzania; Kenya
9. *E. caffer*	E. Cape, South Africa
10. *E. cerinus*	KwaZulu-Natal, South Africa
11. *E. chimanimaniensis*	Mozambique; Zimbabwe
12. *E. concinnus*	Zimbabwe
13. *E. cupidus*	Northern Province, South Africa
14. *E. cycadifolius*	E. Cape, South Africa
15. *E. delucanus*	Tanzania
16. *E. dolomiticus*	Northern Province, South Africa
17. *E. dyerianus*	Northern Province, South Africa
18. *E. equatorialis*	Uganda
19. *E. eugene-maraisii*	Northern Province, South Africa
20. *E. ferox*	KwaZulu-Natal, South Africa; Mozambique
21. *E. friderici-guilielmi*	E. Cape, South Africa
22. *E. ghellinckii*	KwaZulu-Natal, South Africa
23. *E. gratus*	Malawi; Mozambique
24. *E. heenanii*	Swaziland; Mpumalanga, South Africa
25. *E. hildebrandtii*	Kenya; Tanzania
26. *E. hirsutus*	Northern Province, South Africa
27. *E. horridus*	E. Cape, South Africa
28. *E. humilis*	Mpumalanga, South Africa
29. *E. inopinus*	Northern Province, South Africa
30. *E. ituriensis*	Zaire
31. *E. kisambo*	Kenya
32. *E. laeveifolius*	Mpumalanga, South Africa; Swaziland
33. *E. lanatus*	Mpumalanga and Gauteng, South Africa
34. *E. latifrons*	E. Cape, South Africa
35. *E. laurentianus*	Angola; Zaire
36. *E. lebomboensis*	KwaZulu-Natal and Mpumalanga, South Africa; Swaziland; Mozambique
37. *E. lehmannii*	E. Cape, South Africa
38. *E. longifolius*	E. Cape, South Africa
39. *E. macrostrobilus*	Uganda
40. *E. manikensis*	Zimbabwe; Mozambique
41. *E. marunguensis*	Zaire
42. *E. middelburgensis*	Mpumalanga and Gauteng, South Africa
43. *E. msinganus*	KwaZulu-Natal, South Africa
44. *E. munchii*	Mozambique
45. *E. natalensis*	KwaZulu-Natal, South Africa

46. *E. ngoyanus*	KwaZulu-Natal and Mpumalanga, South Africa; Swaziland
47. *E. nubimontanus*	Northern Province, South Africa
48. *E. paucidentatus*	Mpumalanga, South Africa; Swaziland
49. *E. poggei*	Angola; Zaire
50. *E. princeps*	E. Cape, South Africa
51. *E. pterogonus*	Mozambique
52. *E. schaijesii*	Zaire
53. *E. schmitzii*	Zaire
54. *E. sclavoi*	Tanzania
55. *E. senticosus*	Mpumalanga and KwaZulu-Natal, South Africa
56. *E. septentrionalis*	Zaire; Sudan
57. *E. tegulaneus*	Kenya
58. *E. transvenosus*	Northern Province, South Africa
59. *E. trispinosus*	E. Cape, South Africa
60. *E. turneri*	Mozambique
61. *E. umbeluziensis*	Swaziland; Mozambique
62. *E. villosus*	E. Cape, KwaZulu-Natal and Mpumalanga, South Africa
63. *E. whitelockii*	Western Uganda
64. *E. woodii*	KwaZulu-Natal, South Africa

Lepidozamia

1. *L. hopei*	Queensland, Australia
2. *L. peroffskyana*	N.S.W. and Queensland, Australia

Macrozamia

1. *M. communis*	N.S.W.
2. *M. conferta*	Queensland
3. *M. cranei*	Queensland
4. *M. crassifolia*	Queensland
5. *M. diplomera*	N.S.W.
6. *M. douglasii*	Queensland
7. *M. dyeri*	W. Australia
8. *M. fawcettii*	N.S.W.
9. *M. fearnsidei*	Queensland
10. *M. flexuosa*	N.S.W.
11. *M. fraseri*	Western Australia
12. *M. heteromera*	N.S.W.
13. *M. johnsonii*	N.S.W.
14. *M. lomandroides*	Queensland
15. *M. macdonnellii*	Central Australia
16. *M. machinii*	Queensland
17. *M. miquelii*	N.S.W. and Queensland
18. *M. moorei*	Queensland
19. *M. mountperriensis*	Queensland
20. *M. occidua*	Queensland
21. *M. parcifolia*	Queensland
22. *M. pauli-guilielmi*	Queensland
23. *M. platyrachis*	Queensland
24. *M. plurinervia*	N.S.W. and Queensland
25. *M. riedlei*	W. Australia
26. *M. secunda*	N.S.W.
27. *M. spiralis*	N.S.W.
28. *M. stenomera*	N.S.W.
29. *M. viridis*	Queensland

Microcycas

1. *M. calocoma*	W. Cuba

Stangeria

1. *S. eriopus*	E. Cape and KwaZulu-Natal, South Africa

Zamia

1. *Z. acuminata*	Nicaragua; Panama
2. *Z. amazonia*	Brazil; Colombia; Venezuela
3. *Z. amblyphyllidia*	Cuba; Jamaica; Puerto Rico
4. *Z. amplifolia*	Colombia
5. *Z. angustifolia*	Bahamas; Cuba
6. *Z. angustissima*	Cuba
7. *Z. boliviana*	Bolivia
8. *Z. chiqua*	Colombia; Panama
9. *Z. cremnophila*	Mexico
10. *Z. cunaria*	Panama
11. *Z. dressleri*	Panama
12. *Z. fairchildiana*	Costa Rica; Panama
13. *Z. fischeri*	Mexico
14. *Z. furfuracea*	Mexico
15. *Z. herrerae*	Mexico; Guatemala
16. *Z. inermis*	Mexico
17. *Z. integrifolia*	Florida and Georgia, U.S.A.; Bahamas; Cuba; Caiman Islands
18. *Z. ipetiensis*	Panama
19. *Z. lacondonis*	Mexico
20. *Z. lawsonia*	Mexico
21. *Z. lecointei*	Brazil
22. *Z. lindleyi*	Panama
23. *Z. loddigesii*	Mexico
24. *Z. lucayana*	Bahamas
25. *Z. manicata*	N. Colombia; S. Panama
26. *Z. montana*	Colombia; Venezuela
27. *Z. muricata*	Venezuela
28. *Z. neurophyllidia*	Panama
29. *Z. obliqua*	Colombia; S. Panama
30. *Z. paucijuga*	W. Mexico
31. *Z. picta*	Mexico; Belize; Guatemala
32. *Z. poeppigiana*	Peru; Ecuador
33. *Z. polymorpha*	Mexico; Belize
34. *Z. portoricensis*	Puerto Rico
35. *Z. pseudomonticola*	Costa Rica
36. *Z. pseudoparasitica*	Panama; Costa Rica
37. *Z. pumila*	Dominican Rep.; Florida, U.S.A.; Cuba
38. *Z. purpurea*	Mexico
39. *Z. pygmaea*	Cuba
40. *Z. roezlii*	Colombia
41. *Z. skinneri*	Panama
42. *Z. soconuscensis*	Mexico
43. *Z. spartea*	Mexico
44. *Z. splendens*	Mexico
45. *Z. standleyi*	Honduras
46. *Z. tuerckheimii*	Guatemala
47. *Z. ulei*	Brazil
48. *Z. variegata*	Guatemala