

## *Encephalartos middelburgensis* (Zamiaceae): a new species from the Transvaal

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*Encephalartos middelburgensis* Vorster *et al.* is described from the upper reaches of the Olifants River. It resembles *E. graniticolus* Vorster *et al.*, *E. eugene-maraisii* Verdoorn, *E. verrucosus* Vorster *et al.*, *E. lehmannii* Lehm., *E. princeps* R.A. Dyer, and to some extent *E. cupidus* R.A. Dyer by its stiff, pungent, glaucous fronds; but differs from them all by its combination of well-developed petioles and proximal leaflets reduced in size to entire prickles towards base of frond. Anatomically it shows an affinity to *E. graniticolus*, *E. eugene-maraisii*, and *E. cupidus* on account of its isobilateral, amphistomal leaflets.

*Encephalartos middelburgensis* Vorster *et al.* word beskryf vanaf die bolope van die Olifantsrivier. Dit stem ooreen met *E. graniticolus* Vorster *et al.*, *E. eugene-maraisii* Verdoorn, *E. verrucosus* Vorster *et al.*, *E. lehmannii* Lehm., *E. princeps* R.A. Dyer, en tot 'n mate *E. cupidus* R.A. Dyer wat betref die stywe, stekelpuntige, blougrys blare; maar verskil van hulle almal deur die kombinasie van 'n goed-ontwikkelde petiolus en proksimale pinnae wat na die basis toe kleiner word om gaafrandige stekels te vorm. Anatomies toon dit ooreenkoms met *E. graniticolus*, *E. eugene-maraisii*, en *E. cupidus* op grond van sy isobilaterale, amfistomale pinnae.

**Keywords:** *Encephalartos*, new species, Zamiaceae

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An evaluation of plants from the Middelburg area of the Transvaal led to the conclusion that they represent a distinct and undescribed species:

*Encephalartos middelburgensis* Vorster *et al.*, sp. nov.

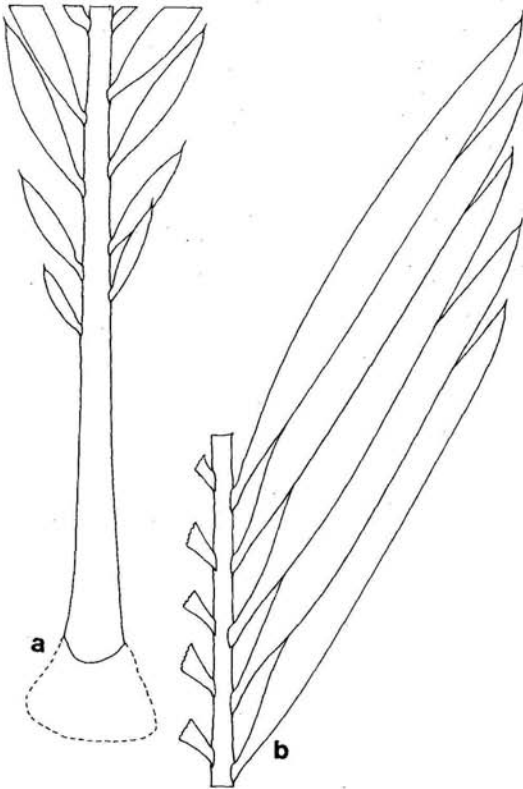
Plantae arborescentes. *Fronde* rigidae petiolatae rectae glaucae pungentes; foliola opposita adulta plicata fere contingentia inermia anguste elliptica ad basim ad aculeoris simplicibus redacta. *Macrostrobbili* cylindracei; superficies squamarum glabrae virides et interdum trichomatibus rursus tectae. *Microstrobbilatae squamae* superficies glabrae virides interdum trichomatibus rursus tectae, paginis in rostro demisso extensis.

*Encephalartos eugene-maraisii* Verdoorn, *E. graniticolo* Vorster *et al.*, et *E. cupido* R.A. Dyer frondibus isobilateralibus amphistomatophoris similis, sed ab *E. eugene-maraisii* macrostrobbilibus 4-8 cylindraceis viridibus vice 2 ovoideoorum ferrugineorum; ab *E. verrucoso* macrostrobbili ovoidei verrucosi habenti; ab *E. graniticolo* squamis rostratis microstrobbili et frondibus petiolatis foliolis proximalibus simplicibus redactis vici frondium ferum sessilium foliolis proximalibus ad aculeis dentatis redactis differt.

TYPUS.—Transvaal: Farm 'Doornkop', 20 km north of Middelburg, 1 400 m alt., 26th June 1970 (frond and female cone), Vorster, Codd, & Melville 1898b (excluding photographs of male cones and male plant) (PRE, holo.; K).

Plant arborescent, unbranched but often suckering from base. *Stem* erect or procumbent with age, up to 6 m long

and 250-400 mm in diameter. *Fronde* 1 100-1 500 mm long, glaucous, straight, rigid, with well-developed trigonous and unarmed petiole 100-200 mm long; leaflets directed towards apex of frond at angle of 45° or less with rachis, opposing leaflets set at angle of less than 45° to each other (i.e. almost folded together), basal leaflets spaced 25-50 mm apart and not overlapping, reduced in size towards base of frond to form entire spines, median leaflets slightly succubously overlapping or not at all, 180-190 mm long and 14-19 mm wide, very narrowly elliptic, very slightly S-shaped and falcate in plane view, tapering to both ends, apices oblique and pungent, margins unarmed (or rarely in young plants with one or two prickles on upper and/or lower margin, cf. *Mogg* 23933). *Cones* dimorphous, superficially glabrous but sometimes with sparse, short, fine, reddish-brown indumentum in places, bright green except for localized reddish-brown overlay of indumentum; male cones 5-8 per stem, narrowly ovoid, 300-350 mm long and 85-120 mm wide, on a peduncle 50-170 mm long, median scale faces ca. 25 mm wide by 15 mm high and drawn out into drooping lips; female cones 4-5(-8) per stem, shortly cylindrical, 350-450 mm long and 170-200 mm wide, apparently sessile but with peduncles of up to 150 mm long buried amongst cataphylls in stem crown, median scale faces hexagonal, 60-75 mm wide and 35-45 mm high, with the central facet about half the horizontal diameter of scale, superficially smooth but lateral facets finely, unevenly and indistinctly wrinkled with ridges radiating from central facet. (Figures 1 & 2).



**Figure 1** *Encephalartos middelburgensis*: (a) proximal part of frond showing well-developed petiole and lower leaflets reduced to entire prickles; (b) succubously overlapping median leaflets; both  $\times 0.5$ . After Vorster & Robbertse 2945. Del. E.C. Vorster.

### Flowering and reproduction

In June plants carried still-intact but dried male cones and fully grown female cones. It is thus presumed that cones are produced in midsummer and that pollination occurs in about April, as is also the case with *E. graniticolus* Vorster *et al.* and *E. verrucosus* Vorster *et al.* Indications are that coning takes place infrequently with intervals of several years. In some localities fertile seed is produced, but at the type locality where there are five groups consisting of a total of some 32 individuals, all seeds were found to be infertile in spite of the presence of both sexes coning together. Elsewhere in a large population consisting of some 200 individuals, seedlings were virtually absent — this may be the result of the activities of plant collectors, but the situation needs closer scrutiny.

### Diagnostic features and affinities

Vegetatively *E. middelburgensis* resembles *E. eugene-maraisii* Verdoorn (Verdoorn 1945), *E. verrucosus* (Robbertse *et al.* 1988b), *E. lehmannii* Lehm., *E. princeps* R.A. Dyer (Dyer 1965a, b), and especially *E.*

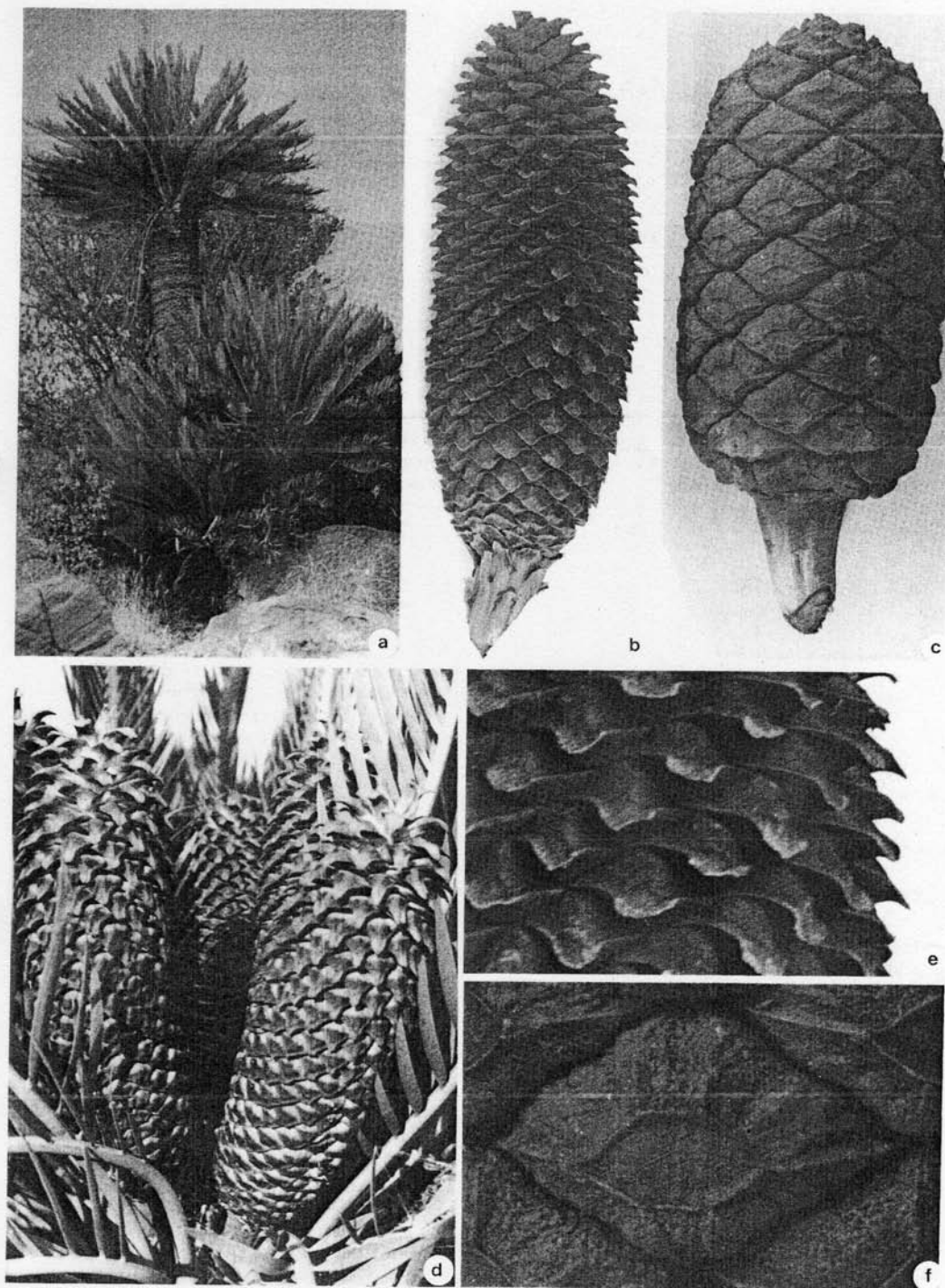
*graniticolus* (Robbertse *et al.* 1988a) on account of its stiff, pungent, glaucous fronds and arborescent habit (Figure 2a). It is distinguished from all these by its well-petiolated fronds of which the proximal leaflets are progressively reduced to unarmed prickles (Figure 1a). In all the other species, except *E. graniticolus*, the petiole is well developed, but although their proximal leaflets may be somewhat reduced in size, they are not reduced to spines in adult plants. Vegetatively *E. middelburgensis* and *E. graniticolus* are very similar indeed, both being large, robust plants with dense crowns of stiff, straight fronds, but can be distinguished by the bases of their fronds as the fronds of *E. graniticolus* are practically sessile with the proximal leaflets reduced to toothed rather than simple spines. *E. middelburgensis* and *E. graniticolus* are the only two of these six similar species having cylindrical rather than ovoid female cones (Figure 2c), with the cones of *E. graniticolus* lacking the patchy indumentum sometimes present in *E. middelburgensis* as well as the poorly defined radial ridges on the lateral facets of the scale faces. The male cones are however quite different: in *E. middelburgensis* the central facet of the cone scale face is drawn out into a drooping lip (Figure 2d), which is not the case in *E. graniticolus* (see Robbertse *et al.* 1988a, Figure 2d).

On account of the leaflet anatomy, *E. middelburgensis*, *E. graniticolus*, *E. eugene-maraisii*, and *E. cupidus* can be grouped together as being the only South African species in the genus with isobilateral, amphistomal leaflets (Koeleman *et al.* 1981). Furthermore, these four species occur geographically closely together in the Transvaal so that one may surmise their patristic evolution. *E. cupidus* is the only allied species with which *E. middelburgensis* is unlikely to be confused as it is a dwarf with dentate adult stage leaflets and practically sessile fronds (Dyer 1971; Giddy 1974). Like the adult-stage fronds, the first seedling fronds of *E. middelburgensis* have well-developed petioles, but we saw a young plant of the approximately ten-fronded stage which had sessile fronds and looked very much like *E. graniticolus*. This may well be indicative of a close phylogenetic relationship between the two species.

We recognize *E. middelburgensis* as separate from its presumed closest relative, *E. graniticolus*, because of the discontinuity in the variation of: the vegetative parts, the male cones, and to a lesser extent the female cones, as well as the discontinuity in the geographical distribution which is highly significant in terms of the established pattern in *Encephalartos*.

### Geographical distribution and habitat

*E. middelburgensis* is restricted to the upper drainage basin of the Olifants River, between Middelburg and Loskop Dam over a distance of some 45 km, at altitudes of 1 100 to 1 400 m (Figure 3). In view of their putative relationship to *E. middelburgensis* it is noteworthy that *E. graniticolus*, *E. cupidus*, and *E. verrucosus* also occur along the Olifants River drainage system. There is evidence (cf. Dyer 1965b: 448, 450) that river drainage



**Figure 2** *Encephalartos middelburgensis*: (a) part of a male plant at the type locality, longest stem ca. 4 m tall (cf. Vorster, *Cod & Melville 1898a*); (b) male cone just before anthesis, ca. 300 mm long; (c) female cone, ca. 350 mm long; (d) cluster of male cone at anthesis, showing scale faces drawn out into drooping lips, ca. 350 mm long; (e) detail of male cone, approximately life-size; (f) detail of female cone, approximately life-size. Photos: (a) by P. Vorster, (b-f) by Suzelle van der Westhuizen.

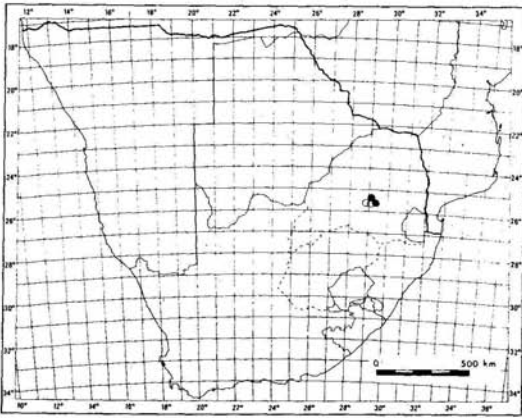


Figure 3 *Encephalartos middelburgensis*: known geographical distribution. ●: specimens seen, ○: specimens not seen.

systems may be indicative of ancient distribution patterns and migration routes, and by implication indicative of phylogenetic affinity between species occurring within the same drainage systems. *E. middelburgensis* is usually confined to rocky sites, mostly on steep slopes but more rarely on level terrain such as at the type locality (Figure 2a). It grows on somewhat acid quartzite substrata, in full sunlight, in association with typical Bankenveld species such as *Acacia caffra* (Thunb.) Willd., *Bequaertiodendron magalimontanum* (Sonder) Heine & Hemsley, *Cussonia transvaalense* Reyneke, *Dombeya rotundifolia* (Hochst.) Planchon, and *Elephantorrhiza burkei* Benth. At the type locality it occurs close to a large concentration of *Encephalartos lanatus* Stapf & Burtt Davy. The annual rainfall of the aforementioned localities is estimated to be about 600 mm. Summer temperatures vary from moderate on level areas to very high in closed north-facing ravines, and some of the plants probably experience winter frost.

#### Conservation status

A census conducted by the Transvaal Division of Nature Conservation and dated 1983 revealed a total of about 420 individuals of the then unnamed species. Of these, about half occurred in a single stand while the rest were grouped into 16 stands spaced one to several kilometers apart and ranging in size from two to 32 (average 14) individuals. These smaller stands are probably unviable, as fertile seeds are seldom borne. The long-term future of this species can hardly be considered to be secure, especially in view of the dearth of young plants.

#### A note on the type specimen

Two collections were made at the type locality, viz. Vorster, Codd & Melville 1898a and 1898b, taken from two plants a short distance apart. Collection 1898a consists of male cone material plus photographs of the cone and of the complete plant. Collection 1898b consists of frond material, female cone material and

photographs of the female cone and of the complete plant, and is designated as type. At PRE the frond specimen of 1898b is filed in the general herbarium, but the female cone which is considered to be an integral part of the collection, is stored apart in the cone collection with the male cone of collection 1898a. Neither the male cone material, nor the photographs of the male plant and male cone erroneously attached to collection 1898b, form part of the type specimen.

#### Material studied

About 17 stands of this species are known, but regrettably only five of these are represented by specimens in PRE:

—2529: Farm 'Doornfontein' 98 JS, 25 km south of Denilfontein (—AC), Vorster & Robbertse 2945 (FTG, K, LE, MO, NBG, PRE, PRU); 'The Hell' on farm 'Tweefontein' 236 JS, 15 km south-west of Loskop Dam wall (—AC), Dyer & Verdoorn 5858 (PRE); Farm 'Bankfontein' 261 JS, 18 km north-west of Middelburg (—CB), van Biljon s.n. sub PRE 32850 (PRE); Farm 'Doornkop' 273 JS, 10 km north-west of Middelburg (—CB), Codd & Verdoorn 10111 (PRE); Vorster, Codd & Melville 1898a (K, PRE); 1898b (K, PRE); Farm 'Langkloof' 265 JS, 15 km north-west of Middelburg (—CB), Mogg 23933 (PRE); 23933A (PRE); Prosser 1873 (PRE); 1874 (PRE).

Precise locality uncertain: Loskop Dam area, J. Bond & Mogg s.n. sub PRE 32873 (PRE).

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