

A new species of *Encephalartos* (Zamiaceae) in Sudan

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Encephalartos mackenziei Newton is described as a new cycad species occurring in south-east Sudan. It is characterized by its branching at the base to produce up to ten trunks per plant and by its broad leaflets, as well as some details of the cone scales. The population is large and widespread, and the presence of small seedlings indicates successful regeneration. © The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2002, 140, 187–192.

ADDITIONAL KEY WORDS: Africa – cycad – taxonomy – protologue.

INTRODUCTION

The taxon described in this paper is from a small area in south-east Sudan. Until recently the only cycad species known from south-east Sudan and neighbouring northern Uganda was *Encephalartos septentrionalis* Schweinf. (Melville, 1958), but further exploration in the area has revealed several previously unknown populations, some of which seem to be distinct (Osborne, 1997). A few years ago some plants in north-east Uganda were described as *E. macrostrobilus* Scott Jones & Wynants (1997). Details of the locality of the new species described below are withheld, in order to protect the plants from illegal collecting. It is a considerable distance from the nearest known locality of *Encephalartos septentrionalis* in Sudan and also from the nearest of the other populations in northern Uganda.

MATERIAL AND METHODS

Material of the taxon described below was collected in 1995 by Paul Mackenzie and Peter Heibloem (Heibloem, 1999), and initial observations were made on fresh leaf and cone material given to me by Mackenzie soon after his return from the expedition. This material was preserved for the herbarium after examina-

tion, and deposited in the East African Herbarium, Nairobi (EA). I had hoped to visit the area of collection myself to study variation in the population, but this was not possible because of escalation in the civil war in south-east Sudan. Further observations were therefore made on ten living plants in Mackenzie's Nairobi garden a few years after they were established in cultivation. For comparison with other taxa, studies were made on living plants in Mackenzie's garden and on herbarium material in the East African Herbarium, Nairobi (EA), and the herbarium of the Royal Botanic Gardens, Kew (K). The study involved comparative morphology, based mainly on the characters described by Melville (1958).

DESCRIPTION

ENCEPHALARTOS MACKENZIEI L. E. NEWTON SP. NOV.

E. septentrionalis Schweinfurth affinis, sed caulibus longioribus, numerosis, foliis latioribus, viridibus, microsporophylliis grandibus, glabris, seminibus aurantiacis differt.

STEM to 3.5 m long, 35 cm diameter, erect for 1.5 m, then reclining and becoming procumbent, branching from base, the largest plants with up to 10 stems. LEAF elongate-elliptic, to 150 cm long, 32 cm wide, light green with indumentum when emerging, becom-

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ing darker green with little indumentum when mature; rachis not grooved, up to 15 mm wide at middle of leaf, green with a little white indumentum on both surfaces; median leaflets ovate to slightly falcate, 15–17 cm long, 27–35 mm wide, green, both surfaces with sparse, short, white indumentum, 3–5 marginal prickles near base of upper edge, 0–1 marginal prickles near base of lower edge, apex a short, forward pointing prickle (i.e. pointing towards apex of entire leaf). Leaflets inserted laterally on rachis at an angle of 60°, at 45° to the plane of the rachis, those on opposite sides forming a V, then spreading in more or less flat plane parallel to that of rachis, articulation 8–10 mm long, 23–28 mm apart; basal leaflets progressively smaller, with 3–4 transitional structures, the lowermost being single prickles 8–10 mm long. MALE CONE: ovoid-cylindrical, up to 22 cm long, 9 cm wide, green, becoming olive-brown to yellow on maturity; up to ten produced together; peduncle up to 30 cm long, 2 cm diameter, densely pubescent, light brown, with prominent rounded cataphylls, 5 mm long and wide; median microsporophylls glabrous, horizontal, triangular, 30 mm long, the distal face 28–31 mm wide, terminal facet 14–16 mm laterally, 9–11 mm vertically, slightly concave. FEMALE CONE: ovoid, up to 40 cm long, 16–18 cm diameter, green, becoming olive-brown to yellow on maturity; up to 4 produced together; peduncle 10–15 cm long; median megasporophylls glabrous, 40 mm long, distal face 55–60 mm wide, angle of inclination to pedicel 52°, terminal facet rhomboid, 28–31 mm laterally, 15–18 mm vertically, sagittal crest of coarse, rounded warts, seminal ridges tuberculate dentate, lateral lobes triangular, 8 mm long. Seed oblong, 35 mm long, 25 mm diameter, sarcotesta orange.

Typus. Sudan, Equatoria Province, 11.iv.1995, P. C. Mackenzie s.n. (EA, holotype); also seen all along another road in the area.

DISCUSSION

A few African cycad species are quite widespread, such as *Encephalartos hildebrandtii* A. Braun & C. D. Bouché in the dry forests a little way inland from the East African coast, from Kenya to Tanzania (Melville, 1958), and *E. barteri* Carruth. in rocky grassland localities from Ghana to Nigeria (Keay, 1954). Populations of many other cycads have a more restricted distribution, sometimes being found on single isolated mountains or mountain ranges, and these are usually treated as distinct species (see comments by Lavranos & Goode, 1988). In recently published lists of cycads (Hill & Stevenson, 1999; Pienaar & van Rensburg, 2002) it is seen that very few infraspecific taxa are

recognized. In both lists, for the genus *Encephalartos* no varieties are included and only *E. barteri* is shown with subspecies, though the recently published subspecies of *E. tegulaneus* Melville (Miringu & Beentje, 2001) can now be added (listed erroneously as a separate species by Pienaar & van Rensburg, 2002). After their long isolation, relict populations of cycads are now distinguished by morphological discontinuity, or with slight overlap in some characters, though it is not known if they have also achieved reproductive isolation. Biosystematic studies to determine the genetic relationships between the isolated populations might result in a reassessment of their taxonomic treatment in the future. However, as the plants are slow-growing and seedlings take many years to reach maturity and start producing cones, a programme of crossing experiments would be a long-term study. When describing a new subspecies in Kenya, Miringu & Beentje (2001) commented that one referee had suggested that specific status might be more appropriate, but that they were following the precedent set by Newton (1978). The new taxon described by Newton in 1978, *Encephalartos barteri* ssp. *allochrous*, was given subspecific status because it was based on vegetative characters and a difference in altitudinal distribution, the cones being indistinguishable from those of the type of the species to which it was assigned. *Encephalartos mackenziei* differs from *E. septentrionalis* in both vegetative and reproductive structures, as well as its geographical isolation, and so specific status is given here.

When not in cone, *Encephalartos mackenziei* (Fig. 1) is easily distinguished from *E. septentrionalis* (Table 1) by the longer (to 3.5 m) and more numerous (to 10) stems, and the broader leaflets (to 35 mm wide) (Figs 4–6). The green colour of *E. mackenziei* leaves contrasts with the greyish-blue colour of leaves of *E. septentrionalis*. Male cones of *E. mackenziei* (Figs 3,5) have larger microsporophylls (to 30 mm long × 31 mm wide), which are glabrous. Ripe seeds (Fig. 5) are orange. The recently described Ugandan species *E. macrostrobilus* (Jones & Wynants (1997) differs principally in having usually a single trunk (occasionally with basal offsets), narrower leaflets (to 25 mm wide, given erroneously as 190–250 mm in the protologue), and much larger female cones (to 80 cm long). *Encephalartos mackenziei* is well illustrated in colour (as '*Encephalartos* sp. Sudan') by Heibloem (1999).

Heibloem (1999) and Mackenzie (pers. comm.) reported that *E. mackenziei* is distributed over a wide area around the type locality and the colony is large. Trunks are burnt black from frequent fires, and the previous season's leaves are usually burnt off. A new flush of leaves emerges after burning (Fig. 2). Cones mature around September. Many seedlings are

Table 1. Main differences between *Encephalartos septentrionalis* and *E. mackenziei*

	<i>E. septentrionalis</i>	<i>E. mackenziei</i>
Stem	to 2 m long, 30 cm diameter suckering sparsely at base, 2 or 3 stems per clump	to 3.5 m long, 35 cm diameter suckering from base, the largest plants with up to 10 stems
Leaf rachis	distinctly grooved between leaflets	not grooved
Median leaflets	greyish-blue 1–8 (usually 3–6) marginal prickles on both edges, often crowded to the base.	green 3 marginal prickles near base of upper edge;
Median microsporophylls	puberulent 12–22 mm long distal face 15–25 mm wide	0–1 marginal spines near base of lower edge glabrous 30 mm long distal face 28–31 mm wide
Median megasporophylls	distal face 14–17 mm wide.	distal face 55–60 mm wide
Seed	dark red	orange



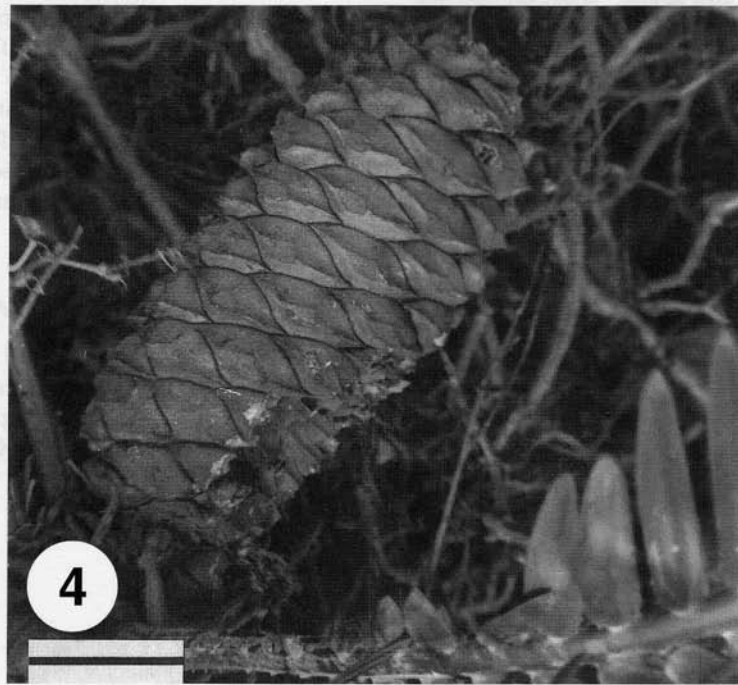
destroyed by the fires, but some seedlings were seen and so there is some regeneration. Although the area is greatly disturbed by local villagers, the rocky terrain is unsuitable for intensive agriculture and there is no reason to suspect that the cycad population will not continue to survive.

The new species is named for Mr Paul Mackenzie, proprietor of the Rosslyn River Garden Centre, Nairobi, who has travelled far and wide in tropical Africa in search of cycads in their natural habitats. The living reference collection that he has built up in Nairobi is freely available for study by botanists and others with an interest in cycads.

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Figure 1. A single-trunk specimen of *Encephalartos mackenziei* growing on rocks at the type locality. Scale bar = 0.5 m.



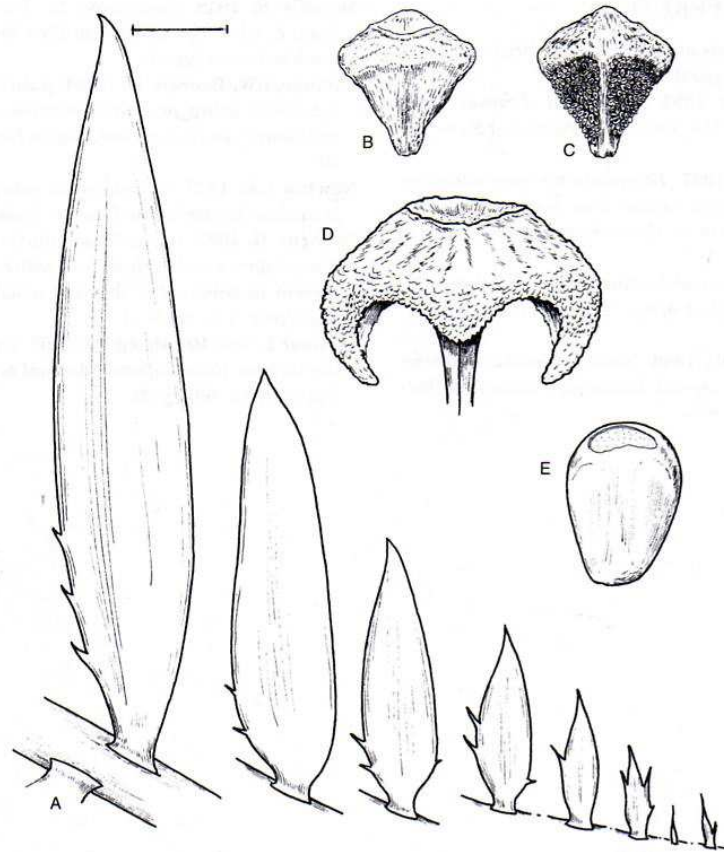


Figure 5. *Encephalartos mackenziei* sp. nov. A. Leaflets, from median leaflet to basal spine-like leaflets. B. Microsporophyll, adaxial view. C. Microsporophyll, abaxial view. D. Megasporophyll, adaxial view. E. Seed. All drawn to the same scale, scale bar = 2 cm.

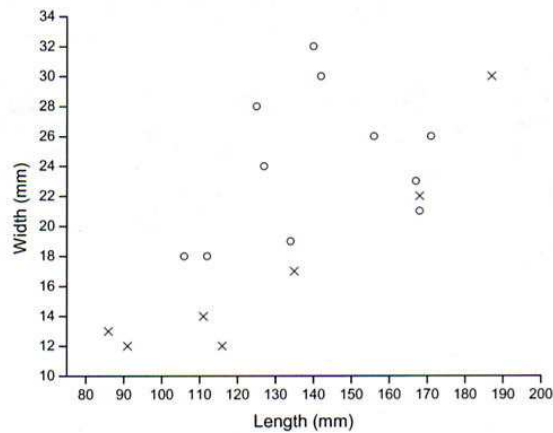


Figure 6. Comparison of median leaflet size in *Encephalartos mackenziei* (O) and *E. septentrionalis* (x).

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