

ENCEPHALARTOS IN CENTRAL AFRICA.

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The cycads, with their large leaves and bulky cones are awkward rather than difficult plants to collect for the herbarium. They are, in consequence, poorly and usually inadequately represented even in large national collections. When a study of the genus *Encephalartos* was undertaken for the Flora of Tropical East Africa, the need for supplementary collecting was at once obvious. After a preliminary survey, a set of instructions to collectors was drawn up, with the object of reducing, so far as possible, the labour of collecting and, at the same time, of achieving a more complete representation of the morphology of these plants, within the compass of standard sized herbarium sheets. The instructions have been modified in the light of experience and now take the following form.

Notes on Collecting Cycad Material for the Herbarium.

1. A photograph to show the habit is useful.
2. Note height and diameter of trunk, overall length and breadth of leaves, kind of indumentum on leaf bases and rachis.
3. Leaf collections should include :—
 - (a) the leaf tip,
 - (b) the leaf base showing the transition from leaflets to spines.
 - (c) The basal portion of the petiole if not included with b. This may be slit longitudinally to facilitate drying,
 - (d) a portion of the mid-region of the leaf to show typical leaflets. In large leaves, the pinnae on one side may be cut away $\frac{1}{4}$ – $\frac{1}{2}$ in. from the rachis in order that complete pinnae with undamaged tips may be preserved on the other side.
 - (e) note whether the rachis is smooth, grooved or ridged between the pinnae.
 - (f) several of the sterile scales from the trunk, that alternate with the leaves.
4. Cones. Note length and breadth of body of cone and length of stalk. Entire cones should be preserved if possible, otherwise, take for
 - (a) male cones : 2 transverse slices from the middle of the cone, to show entire rings of cone scales and 2–3 ins. of the base cut in half longitudinally.
 - (b) Female cones : 2 transverse slices as in male cones and several separate cone scales with seeds, note shape of cone or sketch shape in outline. Note colour of seeds.
 - (c) When practicable, a few cone scales of both sexes should be pickled in spirit, formalin or other liquid preservative, as shrinkage and distortion on drying are often considerable. A piece of the rachis, about 10 cms. long, from the middle of a leaf may also be included.

5. Male and female specimens from the same locality are particularly desirable.

The description of *Encephalartos* cones is not a simple task. It is often difficult to visualise, from existing descriptions, the critical features of the female cone scales and there seems to be a need for a more detailed system of terminology on which critical comparative descriptions may be based. Morphologically, the female cone scale is a single sporophyll bearing two ovules. It is not homologous, therefore, with the cone scales of pines, which consist of a fused seed-scale complex. The expanded head of pine cone scales is termed an *apophysis* and this term has been used, also, for the heads of *Encephalartos* scales. In view of the different origins of these structures, it is preferable to employ a distinctive name for the head of the *Encephalartos* scale. The term *bulla* is here proposed; it has been used in classical literature for the boss of a shield, which the heads of some *Encephalartos* scales resemble. Among the tropical African species the cone scales have a relatively slender quadrangular pedicel and a massive bulla which is faceted and ornamented in a variety of ways. Names are required for many of these features. The nomenclature adopted in this paper will be clear by reference to the diagrams of Fig. 1, including the use of the terms breadth, height, and depth.

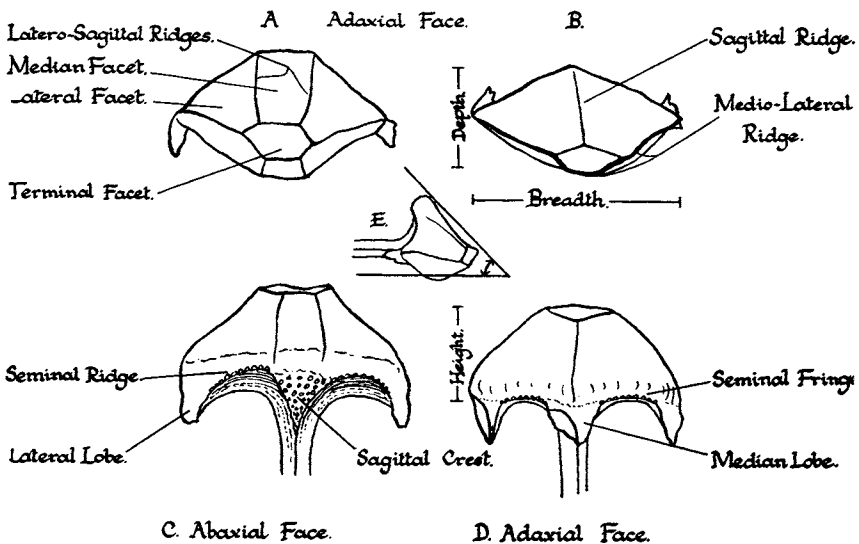


FIG. 1. Terms used in the description of the bulla of the cone scales of *Encephalartos* illustrated by diagrams of the female cone scales of *E. hildebrandtii*, A, C; *E. gratus*, B, D.

An adaxial and an abaxial face can be distinguished on the bulla—*facies adaxialis et abaxialis*. The adaxial face may consist of two trapezoidal lateral facets separated by a central, or more or less eccentric ridge, or this ridge may be partly, or completely replaced by a median facet. In some contexts the term *latus* has been used for a "face", but in this sense it refers rather to the whole side of an object than to a facet on a side. The term *vulticulus*, meaning "a little face" is here proposed. We have then, two *vulticuli laterales* separated either by a sagittal ridge—*costa sagittalis*, or by a *vulticulus medianus* and two latero-sagittal ridges—*costae*

latero-sagittales. The tip of the bulla is truncated and provided with a terminal facet—*vulticulus terminalis*. The adaxial and abaxial faces are separated laterally by more or less acute ridges—*costae laterales*—which are continuous with the lower edges of the terminal facet, forming a continuous medio-lateral ridge—*costa medio-lateralis*. The bulla is usually more or less reflexed on the pedicel and the adaxial face is inclined to the axis of the pedicel so that an angle of inclination of the bulla can be distinguished—*inclinatio bullae* which in some species is about 90° and in others 40–60° in the dry cone scales. As seen on the intact cone, the abaxial face is usually receding and more or less hidden. It may be faceted similarly to the adaxial face, but more often the facets are poorly developed. At the lateral margins of the bulla there is a lateral lobe—*lobus lateralis*—at either side, extending backwards towards the cone axis between the seeds. In *E. gratus*, a median lobe—*lobus medianus*—is also developed on the adaxial side of the bulla, but in most species there is no more than a slight protrusion on the median angle—*angulus medianus*—which is ornamented in various ways, forming a sagittal crest—*crista sagittalis*—at the distal end of the pedicel. Similarly, a sagittal crest is commonly developed on the abaxial side of the bulla. Between the lateral lobes and the sagittal crest on the adaxial side of the bulla, the base of the seed pushes out and compresses the warts or tubercles ornamenting the margin of the bulla, forming a seminal fringe—*fimbria seminalis*. On the abaxial side, pressure of the seeds of the adjacent scale causes the development of a more or less distinct ridge on either side of the sagittal crest, the seminal ridge—*costa seminalis*. The seminal ridge may be fringe-like when it is formed by the compression of tubercles.

The facets of the bulla may be comparatively smooth, or their surfaces may be more or less irregular, by the presence of ridges, tubercles or warts. The height and density of the various forms of ornamentation increases to the margins of the bulla. The diversity of the marginal ornamentation and of the different combinations of the various kinds of protuberances, provide characters of specific value. Ridges may be relatively broad and rounded, or acute, or thin and flattened and often sinuous. They may be erect or inclined to the surface. A broad inclined ridge becomes step-like and for it the term *costa scamniformis* is proposed—from *scamnus*, a step. Similarly, there is great variation in the shapes of warts and tubercles. It seems desirable to restrict the term *verrucose* to more or less irregular warty protuberances. Protuberances taking the form of small rounded hillocks can aptly be called *colliculae* and hence the surface colliculate—*colliculatus*. When the hillocks are pointed and more or less conical, the surface may be called conicose—*conicosus*. Tubercles may be distinguished from colliculae and conae by the fact that their sides arise more or less vertically from the surface. They may be short and rounded or elongated, with the shape varying from awl shaped—*subulatus*—to blunt and slightly tapered or finger shaped—*dactyloid*, *dactyliformis*—or more or less cylindrical—*teretus*. The tips of either long or short tubercles may have a central pit, when they become umbilicate—*umbilicatus*.

The scales of the male cones possess an expanded limb—*lamina*—on the lower surface of which the sporangia are borne. The lamina is usually sessile, or nearly so, on the cone axis and bears a reflexed bulla at its distal

end. The bulla is faceted in a manner similar to the bulla of female scales and the same terminology can be employed, so far as it applies. There is little or no ornamentation and, consequently, the male cones provide fewer characters of taxonomic value than the female cones.

The cone scales of both male and female cones become more or less distorted and atypical towards the base and the apex of a cone. It is important, therefore, to compare only median scales from the middle regions of the cones. In the present paper, the features of median scales alone are described. Occasionally the bulla of female cone scales may be attacked by fungal or insect pests, when the resultant swelling and distortion can be misleading, if its origin is not realised.

The scale leaves, that alternate on the trunk with the foliage leaves, have been much neglected. They vary considerably in shape from one species to another and bear the characteristic indumentum, which is usually evanescent on the foliage leaves. The shape of the leaf outline connecting the tips of the leaflets should be noted by collectors in the field. The apex is commonly rounded, but may taper somewhat; the base varies more widely, sometimes tapering gradually, sometimes abruptly. The transition in the lower part of the leaf from typical leaflets to spines provides some features of taxonomic value. The spines may continue up to the swollen leaf base on the trunk, or a length of bare petiole may occur. These features can be represented in herbarium specimens by appropriate selection of material. Certain others must be noted by the collector in the field, including the presence or absence of grooves or ridges on the leaf rachis between the leaflets, as these are masked by shrinkage in dry material. The colour and texture of leaflets and colours of cone scales and seeds should be noted also.

As a genus, *Encephalartos* is widely scattered through Central Africa, but the species are restricted in their distribution and doubtless represent the relicts of former much more widespread populations. In many areas, such as southern and central Tanganyika, the genus appears to be absent in spite of the existence of suitable habitats. Sufficient botanical exploration has been made of this region to have revealed any widespread species of such a conspicuous plant as *Encephalartos*. If any remain there at all, they must be confined to remote and localised habits, and are likely to represent unknown species. It is hoped that persons travelling in such country will make a special effort to collect any *Encephalartos* seen.

Fire is undoubtedly one of the important factors leading to the extermination of *Encephalartos*. Although seedlings are readily destroyed by fire, adult plants are resistant and survive all but the most intense fires. Where conditions are favourable, regeneration by seeds occurs readily. The seeds are eaten by animals and monkeys, baboons and elephants have been reported to feed upon them. Of these, baboons are by far the most important and in some areas are probably more devastating than fire in the destruction they cause. Baboons pull the cones to pieces, often before they are ripe, damage the plants and pull up young seedlings to eat the remnants of the seed within the testa. By preying upon the baboons, leopards help to preserve the balance in favour of *Encephalartos*, but, with the advance of civilisation, leopards are shot to prevent their depredations on farm stock and for the value of their skins. It seems

possible that this disturbance of the balance by man may result in the extermination of *Encephalartos*, at least in some areas, unless recent legislation to protect the leopard reverses the process.

Key to female plants.

All cone scale characters refer to median scales.

Angle of inclination of bulla of cone scales to pedicel about 80°, height of bulla small (7–10 mm. in dry specimens).

Bulla triangular or triangular truncate, adaxial margin rounded, obscurely ridged with sagittal crest tuberculate, median leaflets linear lanceolate with straight tip and 20–24 parallel nerves

1. *barteri*

Bulla rhomboid

Adaxial margin of bulla, rounded, obscurely ridged, with sagittal crest of coarse rounded warts, median leaflets oblong lanceolate, with forwardly arching tips and 26–43 parallel nerves

2. *septentrionalis*

Adaxial margin of bulla, with numerous small rounded ridges passing to ± flattened blunt tubercles along the inner margin and sagittal crest, median leaflets, glaucescent, apiculate, with 18–24 parallel nerves 3. *poggei*

Angle of inclination of bulla of cone scales to pedicel 40–60°, height of bulla considerable (over 10 mm. in dry specimens)

Bulla of mature cone scales rhomboid, ± uniformly puberulent

Adaxial margin of bulla with a well developed median lobe 4–12 mm. long, leaves 90–150 cm. long, with 30–70 pairs of leaflets

8. *gratus*

Adaxial margin of bulla with a sagittal crest of warty, finger-like processes, leaves 4–7 m. long, with about 120 pairs of leaflets

5. *laurentianus*

Bulla of mature cone scales rhomboid or subtriangular, ± glabrous

Bulla sub-triangular, truncate, abaxial angle of pedicel ± replaced by a ridged and tuberculate facet, scale leaves lanceolate acuminate to linear, covered, as on the swollen petiole bases, by a soft brown-buff, woolly tomentum 6. *tegulaneus*

Bulla rhomboid, angles of pedicel acute

Sagittal crest of adaxial side of bulla of flattened sinuous ridges, scale leaves triangular acuminate, covered, as on the swollen petiole bases, by a pale fawn, dense woolly tomentum.

9. *manikensis*

Sagittal crest of adaxial side of bulla at least partly of short umbilicate tubercles

Adaxial margin of bulla with step like ridges radiating from the sagittal crest, scale leaves triangular to ovate, acuminate, thick, keeled, covered, as on the swollen petiole bases, by a dense buff-brown felt 7. *bubalinus*

Adaxial margin of bulla with irregular warts or rounded, sometimes umbilicate, tubercles, scale leaves linear or cuneate, swollen petiole base glabrous at maturity . 4. *hildebrandtii*

Key to male plants.

All cone scale characters refer to median scales.

Mature cone scales with bulla \pm uniformly puberulent

Cone scales spreading \pm horizontally, limb narrow to broad cuneate.

Cone peduncle without scattered scales

Bulla narrowly triangular to truncate triangular, sometimes rostrate, median leaflets linear-lanceolate with straight tip and 20–24 parallel nerves 1. *barteri*

Bulla rhomboid to broadly triangular or plano-convex, median leaflets oblong lanceolate, with forward arching tips and 26–43 parallel nerves 2. *septentrionalis*

Cone scales ascending at about 60° to the cone axis, limb sub-quad-rangular to oblong or lyrate oblong, bulla rhomboid to subtriangular, peduncle with or without scattered scales

Cone peduncle without scales, leaves 90–150 cm. long with 30–70 pairs of leaflets, leaflet margins with 2–7 teeth mainly towards the base 8. *gratus*

Cone peduncle with scales, leaves 4–7 m. long with about 120 pairs of leaflets, leaflet margins with 9–15 teeth uniformly distributed

5. *laurentianus*

Mature cone scales with bulla glabrous or nearly so.

Cone scales ascending at about 60° to the cone axis, bulla rhombic to sub-triangular, cone peduncle with scattered scales.

Terminal facet of bulla distinct, bulla \pm convex, leaves 2–3 m. long, tapering gradually to the base, with 50–70 pairs of leaflets, green 4. *hildebrandtii*

Terminal facet of bulla indistinct, bulla \pm concave with tip out-turned, leaves, 70–150 cm. long, tapering abruptly at the base, with 20–60 pairs of leaflets, glaucescent 3. *poggei*

Cone scales deflexed or spreading \pm horizontally, leaves linear ob-lanceolate to oblanceolate or linear oblong, 60–180 cm. long.

Cone scales deflexed, bulla truncate-triangular with a raised quad-rangular median facet, scale leaves lanceolate acuminate to linear, as on the swollen petiole bases, covered by a soft brown-buff woolly tomentum 6. *tegulaneus*

Cone scales spreading \pm horizontally

Limb of cone scale broad cuneate, nearly straight, bulla sub-triangular to rhomboid, scale leaves triangular to ovate, acuminate, thick, keeled, as on the swollen petiole bases, covered by a close buff felt 7. *bubalinus*

Limb of cone scale sub-rectangular, cordate, strongly arched, concave, bulla rhomboid, scale leaves triangular acuminate, as on the petiole bases, covered with a pale fawn, floccose tomentum

9. *manikensis*

1. **E. barteri** Carruth. ex Miq. in Arch. Néerl., **3**, 243 (1868), as to Barter's plant only ; Prain in Fl. Trop. Afr. **6** (2), 348 (1917) ; Hutchinson and Dalziel, Fl. W. Trop. Afr. **1**, 45 (1927) ; Schuster, Pflanzenreich, **4** (1), 123 (1932) ; Chevalier, Fl. Viv. Afr. Occ. Fr., **2** (1938). Type : Nigeria, Jeba, Barter 1692 (K. iso. !).

Trunk to 30 m. high, 20–25 cm. diameter, covered with grey tomentose leaf bases and scale leaves. *Scale leaves* linear to narrowly triangular, 4·5–6·0 cm. long, 7–15 mm. wide, externally grey tomentose, internally smooth, reddish brown. *Leaves* linear-oblong, 94–165 cm. long, 15–26 cm. wide, apex rounded, base gradually tapered, rachis \pm deeply grooved between the leaflets, swollen petiole base externally shaggy grey tomentose, internally with straight appressed hairs. *Median leaflets* linear-lanceolate, 10–16 cm. long, 10–15 mm. wide, flexible, tapering uniformly from the lower $\frac{1}{3}$ – $\frac{1}{2}$ to the straight spinescent tip, abruptly contracted to the narrow basal attachment 1·5–4 mm. wide, margins with 0–2–3–6 spiny teeth \pm regularly spaced, lower surface finely striate, with 20–24 parallel nerves, lower leaflets lanceolate, passing below to simple spines terminating 6–10–20 cm. above the swollen petiole base. *Male cones* sybcylindrical, tapering slightly at the base, 8–23 cm. long, 3–5 cm. diameter, peduncles 8–20 cm. long, 5–9 mm. diameter (dry), glabrous or \pm tomentellous : *median scales* \pm horizontal, 15–20 mm. long, 12–17 mm. wide, limb triangular, tapering to the base, sporangia densely crowded ; *bulla* puberulent, deflexed, truncate-triangular, sometimes acuminate and \pm rostrate ; adaxial face with two, often oblique, latero-sagittal ridges 2–5 mm. apart ; median facet rectangular ; terminal facet rhomboid to polygonal, 4–8 mm. wide, 2–4 mm. deep ; medio-lateral ridge acute, forming the lower visible margin of the bulla ; abaxial face receding, 2–3 mm. deep in the centre, or up to 6 mm. in rostrate bullae, tapering laterally, with a prominent sagittal ridge. *Female cones* oblong-ellipsoid, 12–35 cm. long, 8–15 cm. diameter, dark olive green, peduncle 5–12 cm. long, 1·5–3·5 cm. diameter : *bulla of median scales* glabrous deflexed 4·5–5·6 cm. wide, 2·0–3·8 cm. deep, truncate triangular, *adaxial face* with two, often oblique latero-sagittal ridges 5–12 mm. apart ; median facet rectangular ; adaxial margin straight or with an obtuse median angle, rounded, slightly undulate, with a few colliculae and an ill-defined seminal fringe ; sagittal crest not prominent, with a few rounded tubercles ; *terminal facet* compressed hexagonal, 10–30 mm. wide, 5–14 mm. deep ; *abaxial face* crescentic, 5–12 mm. deep in the middle, \pm undulate and with a few colliculae along the inner margin ; seminal ridge ill-defined ; *lateral lobes* triangular to irregularly quadrangular, \pm flattened, 10–15 mm. long, outer facets with low undulate ridges, or \pm verucose, angles acute, sub-entire or \pm dentate ; *pedicel* quadrangular 15–17 mm. long. *Seeds* ovoid to subglobose \pm 3-angled, 21–30 mm. long, 18–23 mm. diameter, scarlet, with a semi-ovate to semielliptic attachment scar 7–10 mm. long.

Distribution : Ghana, Dahomey, Nigeria, Sudan, Uganda.

Hitherto, *E. barteri* has been regarded as a purely West African species. Its recent collection in north west Uganda and in the adjacent parts of the Sudan is of some phytogeographical interest, although paralleled by similar distributions in other genera such as *Indigofera* and *Cochlospermum*. In its eastern habitats *E. barteri* is sometimes associated with *E. septentrionalis* and further more complete collections of both plants are needed to determine whether there is any intergrading and whether there are recognisable differences between plants from western and eastern localities.

Among material hitherto identified as *E. barteri* is a specimen collected by Chipp West of Abene (Gold Coast). This differs from typical *E. barteri* in the shape and other features of the female cone scales. Plants that appear to be similar, have recently been reported by Mr. G. K. Berrie to be in cultivation at Vom in Nigeria. These are believed to have originated from Bokkos on the plateau some 30 miles away and it is hoped to obtain complete material of the native plants for investigation.

2. ***E. septentrionalis*** Schweinf. in Bot. Zeit., **29**, 334 (1871) ; Prain Fl. Trop. Afr., **6** (2) 350 (1917) ; Schuster, Pflanzenreich **4** (1) 122 (1932) ; Chevalier, Fl. Viv. Afr. Occ. Fr., **3** (1938) ; Eggeling, Ind. Trees Uganda, 55 (1940) ; Andrews, Fl. Plts. A.-E. Sudan, **1**, 1 (1950).

Syntypes : Sudan ; Gumango, Schweinfurth 2952 (K !) ; near Nganye, Schweinfurth 3992 (K !).

Trunk globose or up to 2 m. high and 30 cm. diameter. *Leaves* linear-oblong, 90–150 cm. long, 20–28 cm. wide, with rounded apex and tapering base, at first grey tomentose, finally \pm glabrous, swollen petiole base with dense, persistent, woolly, grey to grey-buff tomentum, rachis distinctly grooved between the leaflets. *Median leaflets* oblong to lanceolate, 10–18 cm. long, 17–28 mm. wide, margins slightly reflexed, with 2–4–7 spiny teeth, often crowded towards the base, upper margin straight or arching forward at the apex, lower margin curving upwards to the forwardly directed pungent apex, basal attachment rather broad, 5–9 mm. wide, lower surface finely striate, with 26–43 parallel nerves ; lower leaflets coarsely spiny, passing from ovate-lanceolate to ovate, then to tri- and bi-furcate spines and to simple spines terminating just above the swollen petiole base. *Male cones*, 4–10, narrowly ellipsoid, or tapering in the upper half, 12–20 cm. long, 3.0–4.5 cm. diameter, pedicels slender, 10–15 cm. long, 5–12 mm. diameter : *median scales* horizontal, limb triangular, 12–22 mm. long, tapering to the base, with straight or slightly convex margins, sporangia densely crowded ; *bulla* 15–25 mm. wide, 6–10 mm. deep, deflexed, rhomboid to semi-elliptic, puberulent ; adaxial face with an ill-defined sagittal ridge or with 2 latero-sagittal ridges 1–4 mm. apart, sometimes eccentric and oblique, surface \pm uniform except at the wrinkled adaxial margin, which is straight or obtusely angled ; terminal facet lenticular to rhomboid or compressed hexagonal, $\frac{1}{3}$ – $\frac{2}{3}$ the breadth of the bulla, 6–15 mm. wide, 2–6 mm. deep, lower margin angular or arching ; lateral ridges acute, straight or arched ; abaxial face receding, depth \pm uniform, 3–4 mm., with a prominent sagittal ridge or a triangular median facet 4–8 mm. deep. *Female cones* cylindrical, base rounded, 23 cm. long, 11 cm. diameter, pedicel short,

3–4 cm. diameter : *bulla* of median scales rhomboid, deflexed, angle of inclination to pedicel, in dry scales, 80–90°, 4.5–5.0 cm. wide, 2.0–2.7 cm. deep ; *adaxial face* puberulent, subrhomboid, with an ill-defined sagittal ridge or a narrow triangular median facet 1–2 mm. wide, and obtuse median angle ; lateral ridges acute, arched ; surface \pm uniform passing at the rounded, obscurely ridged adaxial margin to the low rounded colliculae or verrucae of the seminal fringe and sagittal crest ; *terminal facet* rhomboid to semi-elliptic 14–17 mm. wide, 5–7 mm. deep ; *abaxial face* receding, in the dry scale forming, by shrinkage, arched to straight folds \pm parallel with the medio-lateral ridge, as an apparent lower margin to the bulla, with, below, a prominent sagittal ridge bearing a narrow, irregularly ridged to verrucose sagittal crest ; seminal ridge crenate-dentate, of compressed rounded verrucae ; *lateral lobes* 3–6 mm. long, triangular to irregular, outer facets undulately ridged to bluntly verrucose and angles dentate to crenate-dentate ; *pedicel* quadrangular 20–25 mm. long. *Seeds* ellipsoid to ovoid or subglobular, \pm 3–4 angled, 23–34 mm. long, 16–24 mm. diameter, scarlet, with a semicircular to broadly semiovate attachment scar 7–15 mm. long, 5–10 mm. wide.

Distribution : Uganda, Sudan, Ubangi-Uele (Congo Belge), Haut Chari.

The above description has been pieced together from a number of collections, none of which was complete in itself. The characters of the female cone are based mainly on Anthony 700, from the Zande Districts, Equatoria Province Anglo-Egyptian Sudan. For the male cones, the appropriate part of Anthony 700 was used, with Eggeling 3578, from the Imatong Mountains, Uganda and F.D. 2055 from the Era Reserve, West, Madi District, Northern Province, Uganda. The two latter collections differ in that Eggeling 3578 has a densely buff-tomentose peduncle and scales with rhomboid bullae, while F.D. 2055 has the cone peduncle glabrous and scales with semi-elliptic bullae. These differences may not be due entirely to differences in the maturity of the cones and further collection and field work is necessary.

3. ***E. poggei*** *Aschers.* in Verh. Bot. Brandenburg **20**, XXXV (1878) ; Prain, Fl. Trop. Afr. **6** (2) 349 (1917) ; Schuster, Pflanzenreich **4** (1), 122 (1932) ; Robyns, Fl. Congo Belge **1**, 3 (1948). Type : Belgian Congo, between the Luisa and Casserigi Rivers, Pogge, s.n., 1876.

Syn. *E. lemarinelianus* De Wild. et Th. Dur. in Bull. Soc. Roy. Bot. Belg. **39** (4), 80, 1900 (1901) ; De Wild. in Ann. Mus. Congo Belge, Bot., Ser. 5, **1**, 9, tt. 23–4 (1903). Type : Belgian Congo, right bank of the Lubi, Le Marinel 1891, cult. Lusambo, coll. Laurent 1896. (Brussels, holo. !).

Trunk globular or cylindrical, to 1 m. high. *Leaves* linear oblanceolate, tapering rather abruptly at the base, 70–150 cm. long, 14–27 cm. wide, with 18–60 pairs of leaflets, rachis slightly arched above, deeply arched below, ridged between the leaflets, swollen petiole base with shaggy greyish tomentum. *Median leaflets* linear lanceolate, straight or falcate, 8–15 cm. long, 7–13 mm. wide, glaucescent, apex pungent, apiculate,

base tapered abruptly above the 7–10 mm. wide basal attachment, margins unarmed or with 1–4 spiny teeth, usually near the base, striate below with 18–24 parallel nerves ; lower leaflets lanceolate, 5.5–4.0 cm. long, passing abruptly to bifurcate and simple spines, terminating about 5 cm. above the swollen petiole base. *Male cones* cylindrical, greenish to yellowish, 10–30 cm. long, 3–7.5 cm. diameter, peduncle 8–21 cm. long, 8–20 mm. diameter, with scattered bracts in the upper part : *median cone scales* ascending, lamina cuneate to sub-quadrangular, apex acute, 18–36 mm. long, 14–26 mm. wide, concave above, densely covered by sporangia below, except for a margin 0.5–1.5 mm. wide ; *bulla* sharply deflexed with its flattened to concave face \pm receding and the adaxial median angle projecting, rhomboid to sub-triangular, 18–26 mm. wide, 14–18 mm. deep, the facets often poorly differentiated ; adaxial face with 2 latero-sagittal ridges 2–5 mm. apart enclosing a triangular or quadrangular median facet ; adaxial margin subacute with an obtuse to sub-acute median angle ; terminal facet indistinct, concave, hexa- or pentagonal, $\frac{2}{3}$ – $\frac{3}{2}$ as wide as the bulla ; medio-lateral ridge acute, forming the lower, visible edge of the bulla, with an obtuse or truncate median angle ; abaxial face receding, hidden, of two narrow triangular facets meeting in a distinct, obtuse sagittal ridge 3–7 mm. long. *Female cones* ovoid-oblong, green, finally rose-salmon, 17–23 cm. long, 9–12 cm. diameter, base rounded or truncate, apex slightly tapering, peduncle short, 2–5 cm. diameter. *Bulla of median scales* deflexed, rhomboid, 4–5 cm. wide, 2.0–2.7 cm. deep, the facets often poorly differentiated ; *adaxial face* with 2 trapezoidal facets and an obscure sagittal ridge, or with 2 latero-sagittal ridges 7–20 mm. apart, one often very eccentric and the lateral facets of very unequal size, surface uniform, passing at the adaxial margin into plicate ridges and to \pm compressed dactyloid tubercles at the seminal fringe ; *terminal facet* rhomboid to 5–6-gonal, sometimes laterally elongated, $\frac{1}{2}$ – $\frac{2}{3}$ as wide as the bulla, medio-lateral ridge \pm acute with the lateral ridges straight or arched ; *abaxial face* receding, \pm hidden, crescentic, with a sagittal ridge 5–8 mm. long, or 2 latero-sagittal ridges, surface uniform, passing at its inner margin into low ridges and to irregularly plicate rounded ridges at the sagittal crest, with flattened dactyloid tubercles along the seminal ridge ; *lateral lobes* triangular to irregular, 4–10 mm. long, with the angles acute, entire or \pm dentate, outer facets with low, rounded, irregular ridges ; *pedicel* quadrangular, 2.0–2.5 cm. long. *Seeds* ellipsoid to oblong-ellipsoid or ovoid, 20–33 mm. long, 17–23 mm. diameter, red.

Distribution : Congo Belge, Kasai, Bas Katanga : Angola.

4. ***E. hildebrandtii*** A. Br. et Bouché in Ind. Sem. Hort. Berol. 18 (1874) ; Engler, Pflanzenwelt Ost-Afr. **C**, 92 (1895) ; Prain, Fl. Trop. Afr. **6** (2) 351 (1917) ; Peter, Fl. Deutsch Ost. Afr. 99 (1929) ; Schuster, Pflanzenreich **4** (1) 118 (1932) ; Brenan, Check List T.T., **I**, 80 (1940). Type : Kenya, Mombasa, Hildebrandt s.n. (B. holo, K. iso. !).

Syn. *E. laurentianus* Auct. non De Wild., Prain et Robyns loc. cit. supra, in part, as to Uganda plant, et Eggeling, Indig. Trees Ugand. 55 (1940).

Trunk to 6 m. high and 30 cm. diameter. *Scale leaves* linear to narrowly triangular, 10–15 cm. long, 4–20–35 mm. wide, densely fulvous tomentose outside, glabrous, chestnut brown inside except for the tomentose tip. *Leaves* linear oblanceolate, 2–3 m. long, 30–65 cm. wide tapering slightly to the rounded apex and gradually to the base, rachis rounded above, not or very shallowly grooved between the leaflets, swollen petiole base at first fulvous, woolly-tomentose, exposed parts glabrous at maturity. *Median leaflets* linear lanceolate, 15–35 cm. long 13–45 mm. wide, apex acuminate, pungent or with 2–3 spiny teeth, base nearly straight below, arching above, margin with 1–4–9 spreading spiny teeth on each side, often crowded near the base, coriaceous, glossy dark green above, paler below and obscurely striate with 26–40 parallel nerves; lower leaflets palmate, spiny, passing to trifurcate, bifurcate and simple spines extending to the swollen petiole base. *Male cones* cylindrical to subconical or fusiform, 20–50 cm. long, 5–9 cm. diameter, greenish to dull red, peduncle 5–25 cm. long, 1.5–3.0 cm. diameter, with scattered scale leaves; *median cone scales* ascending, lamina oblong, tapering to the base, 20–36 mm. long, 23–28 mm. wide, margins straight or contracted to the pedicel; *bulla* deflexed, compressed rhomboidal to sub-triangular, 19–28 mm. wide, 9–17 mm. deep, glabrous, adaxial face of 2 trapezoidal facets and a sagittal ridge or with an eccentric, rectangular, median facet 3–6 mm. wide; adaxial margin rounded; terminal facet rhomboid, $\frac{1}{3}$ – $\frac{1}{2}$ as wide and as deep as the bulla; lateral ridges acute, straight or arched; medio-lateral ridge forming the lower margin of bulla; abaxial face receding, smooth, with a blunt sagittal ridge and 2 \pm oblong lateral facets. *Female cones* cylindrical, 28–60 cm. long, 15–25 cm. diameter, dull yellow, apex rounded or abruptly tapering, base rounded, peduncle 4–6 cm. long, 4–6 cm. diameter: *bulla* of median scales deflexed, rhomboid, 3.5–5.0 cm. wide, 2.0–3.3 cm. deep; *adaxial face* with 2 trapezoidal facets and a median rectangular facet 11–14 mm. wide, with obtuse latero-sagittal ridges; surface smooth except at the adaxial margin where it becomes irregularly verrucose or passes into irregular ridges and then to smaller verrucae or to simple or umbilicate tubercles, compressed at the seminal fringe; lateral ridges obtuse, straight or \pm arching; *terminal facet* compressed hexagonal or pentagonal, 12–23 mm. wide, 8–15 mm. deep, \pm concave; *abaxial face* receding, sub-crescentic, with 2 obscure latero-sagittal ridges, smooth, except at the inner margin where the ornamentation is similar to that of the adaxial margin, seminal ridge ill-defined; *lateral lobes* triangular to irregular, 7–15 mm. long, with lateral facets verrucose or tuberculate and angles acute, \pm irregularly dentate; *median lobes* not developed; *pedicel* quadrangular, 2.2–3.0 cm. long; *seeds* vermilion, ovoid, truncate 20–38 mm. long, 16–26 mm. diameter.

var. **hildebrandtii**: squamae masculinae et femineae costis medio-lateralibus bullarum edentatis.

In coastal evergreen bushland from sea level to 450 m. Uganda: Toro District. Kenya: Kilifi District.

Tanganyika: Lushoto District, E. Usambaras: Tanga District. Zanzibar.

var. **dentatus** Melville, var. nov. a var. *hildebrandtio* squamae masculinae et femineae costis medio-lateralibus bullarum lateribus divaricato-dentatis differt.

Type : Wigg 1044, Dar-es-Salaam, cult. (K. Holo. !).

Known only from cultivated specimens.

The plants from the Mpanga River in the Toro District of Western Uganda are to some extent intermediate between *E. laurentianus* De Wild. of the Congo basin and the typical *E. hildebrandtii* of the coastal areas of Kenya and Tanganyika. They are placed here under *E. hildebrandtii* as the mature female cone scales are glabrous and in their ornamentation they more closely resemble that species, although Prain, Eggeling and Robyns had accepted them as *E. laurentianus*. It seems likely that these Congo, W. Uganda and East Coast forms at one time formed a topocline of which only the remnants survive today. I have seen only scanty and incomplete specimens of the two western forms and it is possible that when fuller material is available, their status will have to be reconsidered. If the clinal concept is correct, the plant of the Duki River locality, cited by Schuster in his monograph, should come close to the Mpanga River form.

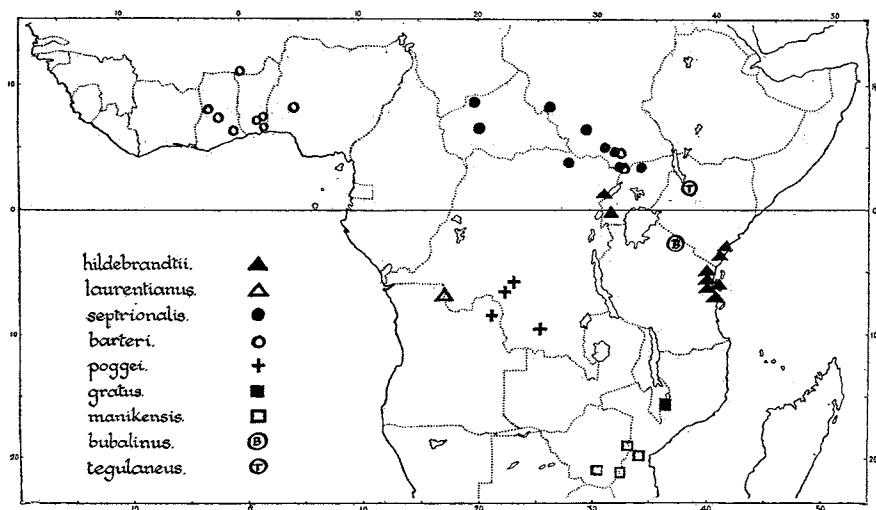


FIG. 2. Distribution of *Encephalartos* in Central Africa.

5. ***E. laurentianus*** De Wild. in Ann. Mus. Congo Belge, Bot. Ser. V (1), 10, t. 25 (1903) et Nat. Pl. Util. Congo, **1**, 392, tt. 27-28 (1904) ; Gentil, Rev. Hort. Belge **30**, 7 (1904) ; Prain, Fl. Trop. Afr., **6** (2), 354 (1917), excluding the Uganda plant ; Lebrun in Rev. Zool. Bot. Afr., **19**, 384, f. 1-5 (1930) ; Schuster, Pflanzenreich, **4** (1), 121 (1932), excluding the Uganda plant ; Robyns, Fl. Congo, Belge, **1**, 2 (1948), excluding the Uganda plant, non Eggeling, Indig. Trees Uganda, 55 (1940). Type : Belgian Congo, Kasongo, Kwango River, Gentil 98, Aug. 1902 (Brussels, holo. !).

Trunk to 15 m. long and 125 cm. diameter, often decumbent and serpentine, whitish, marked by scars of the leaf bases. Leaves linear-

oblong, 4–6 m. long, 50–90 cm. wide, apex rounded, tapering gradually to the base, with about 120 pairs of leaflets, rachis keeled above, rounded below, rachis and swollen petiole base covered at first with a reddish tomentum. *Median leaflets* linear lanceolate, 35–50 cm. long, 4–7 cm. broad, apex acuminate, pungent, or tridentate, margins slightly reflexed, with 9–15 spreading or forwardly directed pungent teeth \pm evenly distributed, base with anterior margin rounded and posterior margin straight, lower surface with 45–65 parallel nerves, basal attachment 13–15 mm. wide; lower leaflets ovate-lanceolate, passing gradually to divaricately spiny-palmate, 3–4 cm. long, then to bifurcate and to simple spines terminating 30–40 cm. above the swollen petiole base. *Male cones* 2–6 or 8, ellipsoid to subconical 17–35 cm. long, 6–10 cm. diameter, peduncle 25–30 cm. long, 4–5 cm. diameter, red tomentose, with scattered scales towards the top. *Median cone scales* ascending, limb subquadrangular to oblong, 2–3 cm. long, 20–25 mm. wide, \pm tapering to the base, margins acute, arching, lower surface with a marginal band 2–3 mm. wide free from sporangia; *bulla* reflexed, reddish puberulent, rhomboid to subtriangular, 18–25 mm. wide, 10–13 mm. deep; adaxial face with a sagittal ridge or 2 latero-sagittal ridges enclosing a rectangular median facet 4–5 mm. wide, or a small triangular facet; adaxial margin rounded; terminal facet $\frac{2}{3}$ – $\frac{1}{2}$ as wide as the bulla, rhomboid to pentagonal or subtriangular; abaxial face receding, crescentic, with a sagittal ridge or a triangular median facet. *Female cones* 2–4 ellipsoid to oblong-ovoid, 35–45 cm. long, about 20 cm. diameter, apex rounded, base truncate, peduncle short, about 7–8 cm. diameter; *bulla* of median scales, rhomboid, deflexed, with dark reddish puberulence; *adaxial face* with 2 trapezoidal facets and a rectangular median facet about 12–14 mm. wide; surface smooth, passing at the abaxial margin to irregular ridges and to umbilicate tubercles at the sagittal crest, which is sometimes replaced by a small, irregularly triangular median lobe with rounded verrucae and dactyloid tubercles; lateral ridges acute, straight or arching; *terminal facet* subrhomboid, hexagonal or pentagonal, $\frac{1}{3}$ – $\frac{1}{2}$ as wide as the bulla; *abaxial face* receding, with an obtuse sagittal ridge or 2 latero-sagittal ridges 10–15 mm. apart, surface uniform, passing to irregular ridges and folds and to umbilicate tubercles along the seminal ridge; *lateral lobes* subtriangular, 18–22 mm. long, the outer facets with small irregular ridges, angles acute, irregularly dentate to sub-entire; *pedicel* quadrangular, about 3.5 cm. long. *Seeds* vermilion, oblong-ellipsoid, 40–50 mm. long, 24–28 mm. diameter, attachment scar semi-ovate, 17–19 mm. long, 10–12 mm. wide.

Distribution: Congo Belge; Angola. Valley of the Kwango from its confluence with the Fufu southwards, to that with the Kikasu and tributary valleys on both sides of the border.

6. **E. tegulaneus** *Melville*, sp. nov. Truncus 7 m. altus, 33–50 cm. diametro. Cataphylla acuminato-lanceolata vel linearia extra tomento bubalino-lanoso dense induta. Folia lineari-oblancoolata, basi sensim attenuata, 120–180 cm. longa, 30–40 cm. lata, circa 90–95 jugis foliorum praedita, basibus petiolorum lana bubalina indutis. Foliola mediana oblongo-lanceolata, pungentia, 16–32 cm. longa, 16–28 mm. lata, marginibus edentatis vel 1–3-dentatis, basibus aequaliter attenuatis.

Strobilus masculus cylindricus, circa 42 cm. longus, 13 cm. latus, pedunculo 20 cm. longo, 2.5 cm. lato, ebracteato ; microsporophylla mediana deflexa, rhomboidea, 45–50 mm. longa, 24–28 mm. lata ; bullae truncato-triangulares, 22–25 mm. latae, 14–16 mm. profundae, facierum adaxialium vulticulo mediano 4–8 mm. lato elevato, vulticulis terminalibus

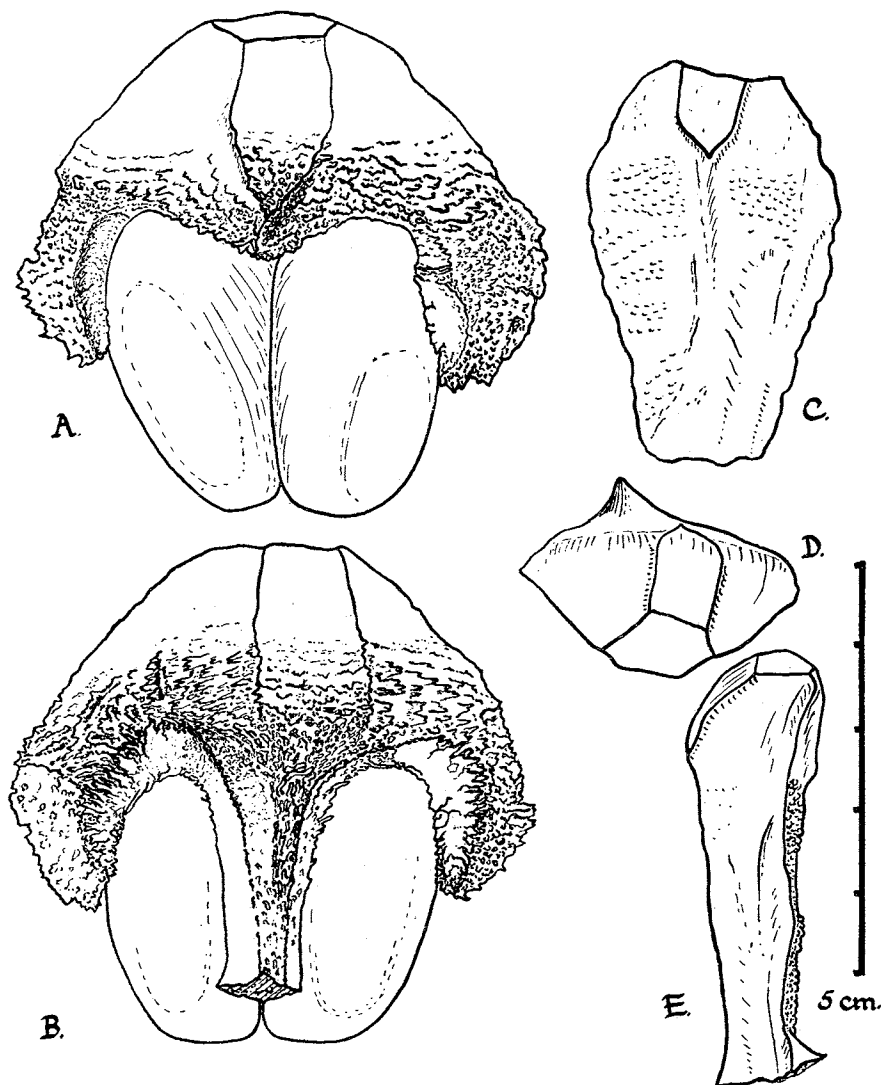


FIG. 3. *Encephalartos tegulaneus* Melville. Median scale of the female cone : A, adaxial face ; B, abaxial face. Median scale of the male cone : C, adaxial face ; D, distal end showing adaxial face of bulla ; E, lateral view.

pentagonis vel quadrangulis vel rhomboideis ; strobilus femineus cylindricus, apice rotundato, basi rotundato vel truncato, circa 40 cm. longus, 19 cm. latus, pedunculo 9 cm. longo, 3.5 cm. lato. Bulla megasporophyllorum medianorum subtriangularis, truncata, deflexa, 5.0–6.0 cm. lata, 23–32 mm. profunda, faciei adaxialis vulticulo mediano

elevato rectangulo 8–12 mm. lato, postice costis obliquis verrucosis et tuberculis dactyloideis praedita ; fimbriae seminales tuberculis dactyloideis applanatis praeditae ; vulticulus terminalis subrhomboideus vel hexa- vel pentagonus, 14–20 mm. latus, 8–15 mm. profundus ; facies abaxialis postice costis subacutis et tuberculis obliquis dactyloideis ; costa seminalis tuberculis applanatis ; lobi laterales triangulares vel quadranguli, 11–17 mm. longi, vulticulis exterioribus oblique costatis vel verrucosis ; pediculus \pm quadrangulus, 26–32 mm. longus, angulc abaxiali vulticulo irregulariter tuberculato substituto. Semina oblongo-ellipsoidea, 30–37 mm. longa, 18–23 mm. lata. Type : Kenya, Matthews Range, Lololokwe, 2300 m., J. Adamson, May 7, 1954 (Holo. K. !).

Trunk cylindrical, to 7 m. high, 30–50 cm. diameter, covered by scars of abscissed leaves and scale leaves in alternating bands, leaf scars flat or depressed rhomboid, tapering laterally 8–9 cm. wide, 3.0–3.7 cm. deep, scale leaf scars rhomboid to fusiform, 3.0–3.5 cm. wide, 1–2 cm. deep. *Scale leaves* lanceolate acuminate to linear, 8–18 cm. long, 0.5–3.5 cm. wide, externally with a dense woolly brownish-fawn tomentum, internally glabrous, brown. *Leaves* linear-oblancoelate, tapering slightly to the rounded apex and gradually to the base, 120–180 cm. long, 30–40 cm. wide, with about 90–95 leaflet pairs, rachis distinctly grooved between the leaflets, swollen petiole base densely covered with brownish-buff, woolly tomentum. *Median leaflets* oblong-lanceolate, 16–22 cm. long, 16–28 cm. wide, rigid, coriaceous, margins reflexed, edentate or with 1–3 short spiny teeth near the base on the anterior side and one on the posterior side, tip pungent with anterior margin straight or arched and posterior arched, base \pm uniformly tapered, basal attachment 8–12 mm. wide, lower surface \pm distinctly striate with 28–46 parallel nerves ; lower leaflets lanceolate to ovate lanceolate, with 3–6 spines on the anterior margin and 2–3 on the posterior, passing to spiny ovate and trifurcate leaflets and a few simple, just above the swollen petiole base. *Male cones* sub-cylindrical, tapering abruptly at the apex and gradually in the lower $\frac{1}{3}$ to the base, about 42 cm. long, 13 cm. diameter, peduncle 20 cm. long, 2.5 cm. diameter, ebracteate, tapering to the base, fawn tomentose in the lower $\frac{2}{3}$. *Median cone scales* deflexed, rhomboid, with the bulla arching downwards, 45–50 mm. long, 24–28 mm. wide, base 10–15 mm. wide, median longitudinal ridge distinct on the upper, prominent on the lower surface ; *bulla* 22–25 mm. wide, 14–16 mm. deep, truncate-triangular ; adaxial face with \pm unequal, triangular lateral facets and a raised quadrangular median facet 4–8 mm. wide ; terminal facet pentagonal to subquadrangular or rhomboid, 9–13 mm. wide, 5–8 mm. deep, flat or \pm concave ; medio-lateral ridge acute ; abaxial surface, hidden, receding, with a prominent acute sagittal ridge or a raised, elongated, quadrangular median facet tapering into the median longitudinal ridge of the limb. *Female cones* cylindrical, about 40 cm. long, 19 cm. diameter, apex rounded, base rounded-truncate, peduncle 9 cm. long, 3.5 cm. diameter, fawn tomentose below. *Bulla of median scales* subtriangular, truncate to truncate-sagittate with the lateral lobes, 5.0–6.0 cm. wide, 23–32 mm. deep ; *adaxial face* with 2 trapezoidal lateral facets and a subacute or narrowly triangular sagittal ridge, or with 2 unequal lateral facets and an acentric quadrangular median facet up to 12 mm. wide between raised, subacute latero-sagittal ridges ; surface smooth distally, passing to low

rounded irregular ridges and then to irregular, subacute laterally inclined ridges by the adaxial margin and to dactyloid tubercles along the seminal fringes and sagittal crest ; *terminal facet* subrhomboid, hexagonal or pentagonal, 14–20 mm. wide, 8–15 mm. deep, flat to concave, uniformly covered with small pits and furrows ; lateral ridges subacute, straight or slightly arched ; *abaxial face* receding, truncate-triangular, with facets similar to, but less distinct than those of the adaxial face ; surface smooth distally, passing to low rounded irregular ridges, then to irregular, acute, laterally inclined ridges, sometimes with dactyloid processes, and to dactyloid tubercles at the seminal ridge ; sagittal crest with low verrucae and appressed dactyloid tubercles ; *lateral lobes* triangular to quadrangular, 11–17 mm. long, lateral facets verrucose or verrucosely ridged, inner facets of smoothly compressed ridges and dactyloid tubercles running out to the irregularly dentate angles ; *pedicel* subquadrangular, 26–32 mm. long, lateral and adaxial angles \pm irregularly dentate in the distal half, abaxial angle more or less replaced by a triangular or quadrangular facet covered with appressed, short or long irregular to dactyloid tubercles. *Seeds* oblong, truncate, \pm 3-angled, scarlet, 30–37 mm. long, 18–23 mm. diameter, attachment scar ovate, 9–10 mm. long, 6–7 mm. wide.

The material on which the above description is based was collected by Mrs. Joy Adamson on Mount Lololokwe, known to the Samburu as Sabatchi, in the Matthews Range, about 35 miles north of Isiolo, Kenya. My thanks are due to her for the excellent and complete specimens that she obtained, which were accompanied by some fine photographs of the plants in their natural setting and a water-colour sketch. The mountain rises abruptly from about 3000 ft. up to about 7000 ft., where “ there is heavy cedar forest on top, date palms, and a few and huge candelabra Euphorbias. The Cycas palm grows either on bare rock or in thickest forest or near springs ”. The epithet *tegulaneus* refers to the scales of the male cone, which overlap like the tiles on a roof.

7. **E. bubalinus** *Melville*, sp. nov. Truncus erectus vel prostratus, ad 137 cm. altus, 33 cm. diametro. Cataphylla plantarum feminearum triangularia vel ovato-acuminata, 10–14 cm. longa, 40–45 mm. lata, 10–15 mm. crassa, carinata, faciebus abaxialibus lana coactili bubalina indutis, ea masculinarum linearia vel lanceolato-acuminata. Folia oblanceolata, 60–165 cm. longa, 20–30 cm. lata, jugis 50–90 foliolorum, apice rotundato, ad basin attenuata, basibus petiolorum lana coactili bubalina dense indutis. Foliola media linearia, apicibus pungentibus, basibus abrupte attenuatis in rhachin per 10–13 mm. decurrentibus, marginibus anterioribus prope basin 2–4-dentatis, posterioribus edentatis vel unidentatis. Strobilus masculus ellipsoideus vel subcylindricus, 11–22 cm. longus, 5.5–6.0 cm. latus, apice et basi rotundato, pedunculo ebracteato, diametro circa 1.5–2.0 cm. ; microsporophylla mediana late cuneata, patentia, 23–30 mm. longa, 20–25 mm. lata ; bullae deflexae, \pm applanatae, subtriangulares, vel rhomboideae, 20–25 mm. latae, 7–15 mm. profundae, faciebus adaxialibus costis latero-sagittalibus 2 leviter elevatis, vulticulo mediano rectangulo vel triangulati 2–6 mm. lato praeditis, vulticulis terminalibus rhomboideis vel hexagonis vel pentagonis. Strobilus femineus non visus ; bulla megasporophyllorum medianorum

deflexa, rhomboidea, circa 6 cm. lata, 3.6 cm. profunda ; facies adaxialis vulticulis lateralibus 2 trapezoideis et vulticulo mediano rectangulo 8–12 mm. lato instructa, margine adaxiali et crista sagittali tuberculis umbilicatis teretibus praeditis, fimbriis seminalibus, irregulariter dentatis tuberculis applanatis ; vulticulus terminalis rhomboideus vel hexagonus, circa 20–26 mm. latus, 10–14 mm. profundus ; facies abaxialis sublunata, margine interiore costis scamniformibus subacutis instructo, crista sagittali tuberculis umbilicatis brevibus vel verrucis ornata, costa seminali tuberculis applanatis ; lobi laterales triangulares, irregulares vel applanati, circa 10–13 mm. longi, vulticulis exterioribus tuberculis parvis plerumque umbilicatis vel verrucis parvis instructis ; pediculus acute quadrangulus angulis adaxialibus et abaxialibus sub crista sagittali tuberculato-dentatis. Semina ellipsoidea vel late ovoidea, 34–42 mm. longa, 21–26 mm. lata. Type : Tanganyika Northern Province, Masai District, Moluvane near Ol Doinyo Sambu, between Loliondo and Lake Natron, 2° 11' S., 35° 40' E., Bally 10600 (K. holo.!).

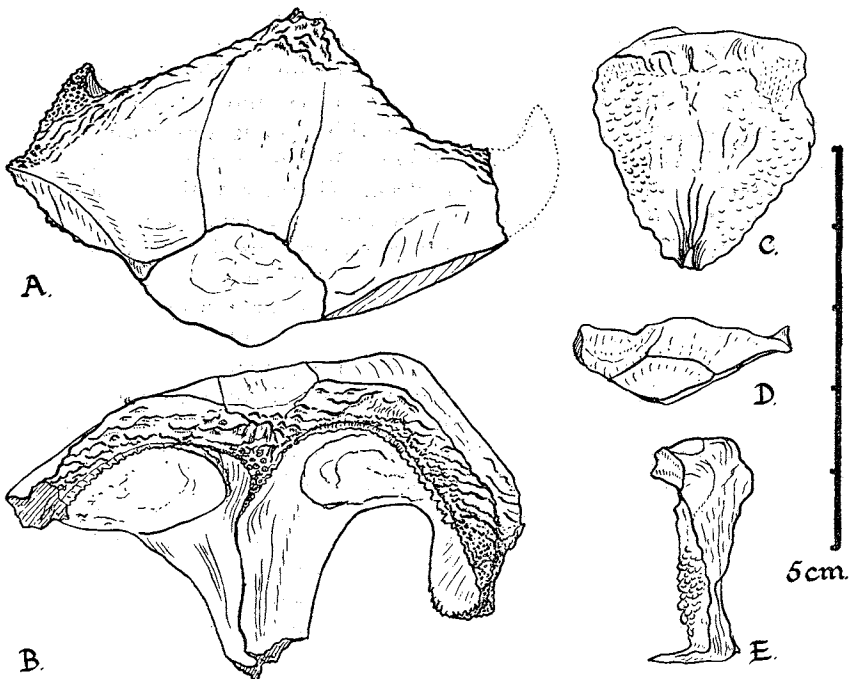


FIG. 4. *Encephalartos bubalinus* Melville. Median scale of the female cone : A, adaxial face of bulla ; B, adaxial view of the scale. Median scale of male cone, C, adaxial face ; D, distal end showing adaxial face of bulla, abaxial face almost completely hidden ; E, lateral view.

Trunk to 137 cm. high and 33 cm. diameter, erect or prostrate. *Scale leaves* on female :—triangular to ovate acuminate 10–14 cm. long, 40–45 mm. wide, keeled 10–15 mm. thick, abaxial face densely buff-felted, adaxial smooth, brown ; on male :—linear- to lanceolate-acuminate, 6–12 cm. long, 6–20 mm. wide, \pm flat to keeled. *Leaves* oblanceolate 60–165 cm. long, 20–30 cm. wide, with 50–90 leaflet pairs, apex rounded, tapering gradually to the base, rachis \pm keeled above, deeply rounded

below, with decurrent ridges between the leaflets, sparingly whitish tomentose, swollen petiole base densely buff-brown felted. *Median leaflets* linear, rigid, coriaceous, 10–20 cm. long, 11–20 mm. wide, apex gradually or abruptly pungent, straight or forwardly arched, upper margin with 2–4 forwardly directed spiny teeth above, near the base and 0–1 on the lower margin, base abruptly tapered to the decurrent basal attachment 10–13 mm. long, lower surface obscurely striate with 24–35 parallel nerves; lower leaflets passing from lanceolate to ovate with small spiny teeth, to small trifurcate or simple lanceolate and cuneate spines terminating at the swollen petiole base. *Male cones* ellipsoid to sub-cylindrical, 11–22 cm. long, 5.5–6.0 cm. diameter, apex and base rounded, peduncle smooth, about 1.5–2 cm. diameter; *median cone scales* spreading, limb broad cuneate, 23–30 mm. long, 20–25 mm. wide, *bulla* deflexed, \pm flattened, subtriangular to rhomboid, 20–25 mm. wide, 7–15 mm. deep; adaxial face with 2 trapezoidal lateral facets separated by 2 slightly raised latero-sagittal ridges enclosing a rectangular or triangular median facet 2–6 mm. wide; surface uniform; adaxial margin rounded; terminal facet, rhomboid to hexagonal or pentagonal, $\frac{1}{2}$ – $\frac{2}{3}$ as wide and as deep as the bulla; lateral ridges acute, straight or arching; abaxial surface hidden, subcrescentic with a sagittal ridge 4–8 mm. long or with 2 slightly raised latero-sagittal ridges and a rectangular or triangular median facet; lower surface with sporangia extending to the margins. *Female cones* not seen. *Bulla* of median scales deflexed, rhomboid, about 6 cm. wide and 3.6 cm. deep, *adaxial face* with 2 trapezoidal lateral facets and a rectangular median facet 8–12 mm. wide, between 2 indistinct latero-sagittal ridges; surface uniform, passing at the adaxial margin into low ridges or to higher acute ridges at the median angle; sagittal crest of \pm terete umbilicate tubercles; seminal fringes irregularly dentate, of flattened tubercles; *terminal facet* rhomboid to hexagonal, about 20–26 mm. wide and 10–14 mm. deep, lateral ridges subacute, straight to arching; *abaxial face* partly exposed, subcrescentic, with 2 indistinct \pm diverging latero-sagittal ridges about 9–12 mm. apart; surface uniform passing at the inner margin into a series of subacute \pm parallel step-like ridges and at the median angle into a sagittal crest with short umbilicate tubercles or warts; seminal ridge of compressed tubercles; *lateral lobes* subtriangular to irregular or flattened, about 10–13 mm. long, outer facets with small, usually umbilicate, tubercles or warts, passing to parallel ridges at the base, angles tuberculate dentate; *pedicel* sharply quadrangular, adaxial and abaxial angles \pm tuberculate dentate below the sagittal crests. *Seeds* ellipsoid to broadly ovoid, 34–42 mm. long, 21–26 m. diameter or 30×30 mm.

This species was discovered by Mr. P. R. O. Bally on September 17, 1944 between Loliondo and the northern end of Lake Natron in Tanganyika, about 7 miles from the Kenya border, near a place called Gwara on the maps. Today, the name "Gwara" seems unknown to the Wasonjo, the local tribe, who call the place Moluvane. The material then obtained (Bally 3829) included a male cone and leaf specimens, which appeared to represent an unknown species. Following a request for further material with female cones, Mr. Bally again visited the area on July 5th, 1956, but unfortunately found only very old male cones and no trace of female cones. The plants did not flower in 1956 and all that

could be discovered of the female cones was a few isolated cones scales and broken seed shells, the remnants left by baboons from some previous coning. In addition to the specimen (Bally 10600), monochrome and colour photographs were obtained of the plants and their habitat, for all of which I am much indebted to Mr. Bally. Two adults and four seedlings were taken back to Nairobi to attempt their cultivation.

By questioning the local natives, it was ascertained that the area of distribution of the plant extends for about 15 miles between Loliondo and Loiyogaz on the west and Ol Doinyo Sambu on the east. This country of the Nguruman Hills consists of a series of quartzite hills with an altitude of 4000–5000 ft. Associated with the *Encephalartos* were species of *Acacia*, *Ziziphus*, *Dombeya*, *Dolichos* and *Aloe volkensii* and grasses in open bushland. The epithet *bubalinus* refers to the closely felted indumentum of the scale leaves and leaf bases which has the appearance of buff suède leather.

8. **E. gratus** Prain in Kew Bull., 1916, 181 (1916) et Fl. Trop. Afr., **6** (2), 352 (1917); Schuster, Pflanzenreich **4** (1), 121 (1932). Type : Nyasaland, Mt. Mlanji, Davy 417 (K. lecto. !).

Trunk globose or up to 120 cm. high and 60 cm. diameter, covered with leaf bases and scale leaves clothed in floccose tomentum. *Scale leaves* triangular, long acuminate, 8–12 cm. long and 3–4 cm. wide at the base, midrib keeled on the abaxial face and with a low ridge on adaxial face, apex with abortive leaflets, grey-buff to brown-buff tomentose except for the smooth brown base on the adaxial side. *Leaves* oblanceolate to linear oblong, 90–180 cm. long, 34–44 cm. wide with 30–70 pairs of leaflets, apex rounded, base abruptly tapered, rachis subterete, smooth or with decurrent ridges from the leaflet bases, swollen petiole base with a close brownish-buff tomentum. *Median leaflets* lanceolate acuminate, 18–26 cm. long, 23–35 mm. wide, dull green, rigid, coriaceous, apex pungent, straight or arching forward, base rounded or broad cuneate above, cuneate below, anterior margin with 2–7 \pm divaricate spiny teeth, often 3–4 on the basal curve, lower margin with 0–6 spiny teeth, lower surface indistinctly striate with 30–48 parallel nerves, basal attachment 4–7 mm. wide, 1–2 pairs of lower leaflets subpalmate, divaricately spiny, 1.5–2.5 cm. long, passing to trifurcate and finally simple spines terminating 6–18 cm. above the swollen base. *Male cones* narrowly ovate to cylindrical, 10–40 cm. long, 4.5–10.0 cm. diameter, greenish yellow, finally reddish brown or dull brown, peduncle 3.5–19.0 cm. long, 1–3 cm. diameter; lamina of *median scales* lyrate to oblong, tapering to the base, 18–32 mm. long, 13–22 mm. wide, margins convex, contracted below the bulla or straight; *bulla* deflexed, rhomboid to subtriangular, 13–20 mm. wide, 7–10 mm. deep, puberulent; adaxial face of 2 trapezoidal facets separated by a sagittal ridge; terminal facet rhomboid to nearly semi-circular, 6–10 mm. wide, 3–5 mm. deep, about $\frac{1}{3}$ – $\frac{1}{2}$ as wide and as deep as the bulla; lateral ridges acute, straight or concave, lower margin of bulla formed by the medio-lateral ridge; abaxial face receding, about 5–6 mm. deep in the centre, with a prominent, blunt sagittal ridge separating 2 subtriangular facets. *Female cones*, cylindrical to subconical, 55–68 cm. long, 15–20 cm. diameter, greenish yellow, finally brown, peduncle 10–14 cm. long, 6–7 cm. diameter. *Bulla of median scales* deflexed, 4.6–5.7 cm. wide, 22–37 mm. deep; *adaxial face* of 2 flat trapezoidal

facets with an obtuse sagittal ridge, sometimes bifurcate in the abaxial $\frac{1}{2}$ – $\frac{1}{4}$; surface puberulent, \pm uniform passing at the rounded adaxial margin to low, irregular verrucose ridges and tubercles; seminal fringes of flattened ridges and tubercles; lateral ridges acute, straight to slightly convex; *terminal facet* rhomboid to compressed pentagonal or suborbicular, 7–18 mm. wide, –10 mm. deep, flat to concave; *abaxial face* sub-crescentic, receding with an obtuse or rounded sagittal ridge; surface uniform passing at the inner margin to low verrucose ridges, irregular warts and laterally to small irregular warts or blunt irregular plicate folds; sagittal crest of larger, subconical warts and seminal ridge of compressed warts and short dactyloid tubercles; *lateral lobes* 9–15 mm. long, triangular with acute \pm irregular blunt-dentate angles and outer facets with small warts or low verrucose ridges; *median lobe*, adaxial, 4–12 mm. long, triangular to irregularly quadrangular, similar to lateral lobes; *pedicel* quadrangular, 2.5–3.0 cm. long, with acute angles sometimes sparingly tuberculate-dentate at the distal end. *Seeds* angular ellipsoid, blunt, 30–40 mm. long, 14–20 mm. diameter, cinnabar red, attachment scar, semiovate to semicircular, 11–14 mm. long, 7–8 mm. wide.

Distribution : Nyasaland, Mount Mlanje.

9. ***E. manikensis*** (Gilliland) Gilliland in Trans. Rhodes, Sci. Ass., **37**, 133 (1939). Type : Southern Rhodesia, Mt. Gorongowe, Gilliland 2016, July 1937. (B.M. holo. !).

Syn. *E. gratus* Prain var. *manikensis* Gilliland, in J.S. Afr. Bot. **4**, 153 (1938).

Trunk to 1.5 m. high and 30 cm. diameter. *Scale leaves* triangular acuminate, with tip inrolled, 2.0–2.5 cm. wide at the base, 6+ cm. long, externally with dense fawn woolly tomentum, internally, smooth, brown. *Leaves* linear-oblong, 1–2 m. long, 22–34 cm. wide, apex rounded, tapering rather abruptly to the base, with about 60 pairs of leaflets, rachis smooth or with decurrent ridges from the leaflet bases, swollen petiole bases, covered with a pale fawn floccose tomentum. *Median leaflets* lanceolate to linear lanceolate, acuminate, \pm arcuate to the spiny tip, 12–18 cm. long, 20–33 mm. wide, margin with 2–4 divaricate spiny teeth towards the base on each side, lower surface \pm distinctly striate with 30–45 parallel nerves; *lower leaflets* lanceolate to ovate, 5–2 cm. long with large divaricate spiny teeth, passing to spiny palmate, 5–3–2 furcate leaflets 2–1 cm. long and to lanceolate and finally awl shaped spines terminating 5–10 cm. above the swollen petiole base. *Male cones* subconical 22–60 cm. long, 7–10 cm. diameter about $\frac{1}{3}$ above the base, apex \pm rounded, base truncate, peduncle 13–15 cm. long, 3.5–5.0 cm. diameter, floccose tomentose, with a few ovate-triangular bracts. *Median cone scales* spreading \pm horizontally, 30–35 mm. long, 33–50 mm. wide, limb subrectangular, with cordate base, flat above but sharply upturned to the centre of the bulla, forming a recess; densely covered with sporangia below except for a marginal band 2–3 mm. wide; *bulla* rhomboid, deflexed 30–50 mm. wide, 16–25 mm. deep; adaxial face smooth, with a well defined sagittal ridge; adaxial margin rounded; terminal facet rhomboid 16–20 mm. wide, 10–13 mm. deep; lateral ridges acute; abaxial face receding, + crescentic smooth with an obtuse sagittal ridge.

Female cones cylindrical 32–53 cm. long, 14–18 cm. diameter, apex rounded, base truncate, peduncle 6–9 cm. long, 4.5 cm. diameter floccose tomentose : *bullae of median scales* deflexed, rhomboid, 40–50 mm. wide, 22–30 mm. deep ; *adaxial face* with 2 latero-sagittal ridges 4–8 mm. apart, enclosing a rectangular or triangular median facet, or a single sagittal ridge ; surface uniform, passing at the adaxial margin to irregular, compressed, plicate ridges and compressed tubercles, increasing in height to the seminal fringe of compressed tubercles and to the prominent, triangular sagittal crest ; lateral ridges acute, arched or straight, joining the terminal facet in its middle or upper $\frac{1}{3}$, *terminal facet* polygonal to compressed hexagonal, 10–16 mm. wide, 8–12 mm. deep ; *abaxial face* receding, subcrescentic, passing inwards to irregular compressed ridges and strongly compressed tubercles along the seminal ridge ; pedicel quadrangular, 23–28 mm. long. *Seeds* broadly ellipsoid to ovoid-ellipsoid, truncate, 29–36 mm. long, 18–25 mm. diameter, scarlet, attachment scar broadly semiovate to rounded-triangular or elliptic, 13–15 mm. long, 9–11 mm. wide.

Distribution : Southern Rhodesia : Mt. Gorongowe ; Belingwe ; Portuguese East Africa : Chimanimani Mountains ; Bandula ; Mt. Garuzo.

Several names have been employed by Mr. B. Christian in manuscripts and on herbarium sheets to *Encephalartos* collections from localities in Portuguese East Africa. None of these collections is "complete" in the sense of the notes on collecting given in this paper, even when taken from cultivated plants at Ewanrigg. On the evidence available, there does not appear to be more than one species in this area. Some confusion is likely to be caused by distorted female cone scales, that appear to have been attacked and galled either by an insect or a fungus. More complete collections are highly desirable, but it is often difficult to obtain female cones owing to the depredations of baboons.

Your New Garden.*—This is the third edition of a book first published in 1935. It has been entirely revised by A. G. L. Hellyer, editor of "Amateur Gardening", who with his wide experience of horticulture and his undoubted knowledge of the difficulties that befall the amateur gardener, is fully qualified to give advice on the subject. Into this book he has compressed a great deal of information. The purpose of the book is to present a plan for all those who wish to make new gardens. The chapters are grouped into three parts, part 1 deals with the first year's work, part 2 with the second year, and part 3 with the third. Thus we have a schedule of work spread over a period of three years which should enable those who follow it to develop a garden where none existed before. The numerous operations involved in making such a garden are described in simple language and many are illustrated by excellent photographic illustrations.

H. S. MARSHALL.

* *Your New Garden*. By A. G. L. Hellyer. London : W. H. & L. Collingridge Ltd., New York : Transatlantic Arts Inc. ed. 3 (rev.) 1957. Pp. 256. Illus. photographs and line drawings.