



FIG. 1

Encephalartos chimanimaniensis with, left to right, Mr. R. C. Munch, Dr. I. C. Verdoorn, Mrs. Munch and Mr. J. A. Smit in Mr. Munch's garden near Rusape, Rhodesia.

ENCEPHALARTOS MANIKENSIS AND ITS NEAR ALLIES

by

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Melville (1957) contributed a useful account of the genus *Encephalartos* in Central Africa, but was more handicapped than we have been through lack of study material in the *E. manikensis* complex. He summarized his view on this group by saying that on the evidence available, "there does not appear to be more than one species in this area". In *Flora Zambesiaca*, Lewis (1960) takes a similar view.

On the initiative of Mr. R. C. Munch of the farm Mona, near Rusape, Rhodesia, we reopened investigations in 1966, on the species *Encephalartos manikensis* (Gilliland) Gilliland, and its allies. Our studies have covered a fairly wide range of living material in Mr. Munch's extensive natural rock-garden. By kind favour of the directors, we have seen specimens in the herbaria at Salisbury, Rhodesia (SRGH), and at the Botanical Research Institute, Pretoria (PRE). We have not seen as wide a range of material as desired and none in the wild state. We have, however, been greatly helped by the field observations of Mr. Munch, Mr. L. C. Leach, Mr. J. A. Smit and others. The notes of the late H. B. Christian, who left his garden "Ewanrigg", near Salisbury, to the Government of Rhodesia as a public garden, have also proved useful. We are greatly appreciative of all this assistance.

We are unlikely to have an opportunity of pursuing these investigations in much greater detail than we have done, nevertheless, the facts so far established and our conclusions seem worthy of publication. Our studies have confirmed the presence of several distinctive forms from *E. manikensis*, of which four are given specific status. They are *E. pterogonus*, *E. concinnus*, *E. chimanimaniensis* and *E. munchii*.

As is usually the case, the new species recognized here are distinguished by a combination of characters. But the variability in the size of plants, their leaves, the spacing of leaflets, angle of insertion on the rachis, venation, the number and size of marginal prickles etc., makes their diagnosis uncertain on vegetative characters alone. We have found that, to a greater or lesser degree, there is correlation between the main vegetative differences and the character of the cones and cone scales, particularly in the male sex. Thus the distinction of the newly recognized species is based mainly on the characters of the male cones.

Of the four new species *E. chimanimaniensis* and *E. concinnus* are the extremes both in size and character. In the former the bulla of the male scale is markedly differentiated from the fertile portion, the upper surface of which is deeply concave even when fresh. This appearance becomes somewhat accentuated on drying, with the result that the margins curve upwards exposing the pollen cells in side view. In *E. concinnus* there is little distinction in texture between the bulla and basal portion. A ridge runs uninterrupted from the upper facet of the bulla along the convex-curved upper surface practically to the base. There is no upcurving of the margins and little exposure of the pollen cells in side view. These observations should be borne in mind when making comparisons with the related species.

To facilitate the interpretation of the cone scale characters, drawings are reproduced of average median scales. Fresh material was not available in all cases and, since shrinkage in drying is likely to have been fairly uniform, it was considered preferable to use dry material in all cases, rather than a mixture of fresh and dry.

There is considerable shrinkage during drying out, but it is not uniform for all parts as will be observed from the following measurements of a male cone of *E. munchii*. The cone was the longest of 6, the first cones to be produced by an 18-year-old plant grown by Mr. Munch under his garden No. 107. The fresh cone was measured on its arrival at the Botanical Research Institute on the 15th February, 1967, and again when dry on 3rd April, 1967.

	<i>Fresh cone</i>	<i>Dry cone</i>
Peduncle length	23 cm.	23 cm.
Cone, length	66 cm.	58 cm.
diam.	10 cm.	7 cm.
Median scale, length	3.5 cm.	3.25 cm.
breadth	3 cm.	2.25–2.5 cm.
thickness	1.5 cm.	1–1.25 cm.
Terminal facet	1.2 × 1.0 cm.	1 × .7–.8 cm.

After a study of available records it seemed that, as well as to *E. manikensis*, the present newly described species are related to *E. gratus* Prain, *E. tegulaneus* Melville and *E. bubalinus* Melville, to which brief reference will be made.

E. gratus from Malawi is of robust habit. It has long narrowly ovate-acuminate median leaflets up to 26 cm. long and 2.3–3.5 cm. broad, with 2–7 prickles on the upper margin, often with 3–4 on the basal curve, and 0–6 smaller teeth on the lower margin. The male and female cone-scales are relatively small and have a distinctive dark puberulence on the face of the bulla.

E. tegulaneus from Kenya, known to us from description only, with a trunk over 20 ft. high, is among the taller species of the genus. The median leaflets are up to 22 cm. long and 1.6–2.8 cm. broad with none or only 1–3 short prickles near the base of the upper margin and occasionally 1 on the lower margin. The median male cone scales are 4.5–5.0 cm. long, 2.4–2.8 cm. broad, deflexed and “overlapping like the tiles on a roof” hence the name *tegulaneus*. This tile-like appearance is seen only in *E. concinnus* of the newly described species. The latter has narrower scales, oblong for almost the full length and the plants themselves are apparently less robust on the average.

E. bubalinus, from the northern province of Tanzania, also known to us from description only, has a trunk up to about 5 ft. long and about 1 ft. diam. which tends to become procumbent with age. The median leaflets are linear, 10–20 cm. long, 10–20 mm. broad, with 2–14 teeth towards the base of the upper margin and sometimes with 1 on the lower margin. The male cones are notable for their small size of 11–22 cm. long and up to 6 cm. diam. Female cones are not described but the scales have distinctive features according to Melville.

The fact that Melville (1957) distinguished these northern species from the *E. manikensis* complex, to which our study is restricted, is sufficient reason for us not to labour the question of relationship with

them further. From our knowledge of the more southern species, dealt with in the Flora of Southern Africa (1966), we conclude that no close affinity of the *E. manikensis* complex occurs in this region. In saying this we disagree with Lewis who has identified specimens in SRGH of authentic *E. lebomboensis* Verdoorn from Swaziland with *E. manikensis* (*sensu lat.*). In *E. lebomboensis* the leaves are pubescent when young, not densely woolly as in the species of the *E. manikensis* complex. The male cones, when fresh, are subcylindric or more or less elliptic in outline, up to nearly 50 cm. tall and 13 cm. diam.; the scales are densely packed; the median scales are about 3.5 cm. long, 4 cm. broad above and 3 cm. broad near base; the bulla is about 1.5 cm. prominent, decurved, and the receding lateral angles are toothed or irregularly lacinate. When dry the cones are usually less than 10 cm. broad, the median scales contract to about 3 cm. broad and long and less than 5 mm. thick vertically, which is appreciably smaller than in typical *E. manikensis*. The female cones are apricot-yellow, about 44 cm. long and 22 cm. diam.; median scales are 6 cm. long, 4.8 cm. broad; the bulla protrudes 1–1.5 cm., the lateral angles are sometimes indistinct and extend into incurved lacinate lobes 1–1.8 cm. long; upper facet sometimes has 1 or 2 indistinct receding ridges; terminal facet is more or less central on bulla, 10–20 × 5–10 mm., concave or excavate, pubescent with greyish or foxy hairs. All in all there is no cause for confusion.

The following key, based on the dry male cones and their median scales, reflect the basis of our revised classification of *E. manikensis* and its near allies.

Key based on male cones

Cones narrowly ovoid or subcylindric mostly 30–60 cm. long, 8–15 cm. diam., with tightly set scales concealing the axis:

Scales as broad as long or nearly so, usually 4–5 cm. broad across the bulla shoulders, scales spreading at about right-angles from axis, cones somewhat resembling female cones externally:

Scales subrectangular, limb truncate or cordate at base, sporangia usually absent from a 2–3 mm. wide margin, bulla with sharp lateral ridges
1. *manikensis*

Scales triangular-cuneate to a fairly acute angled base, sporangia spread to margin, bulla with sharp wing-like and often toothed or lobed lateral ridges which project further forward than the terminal facet
2. *pterogonus*

Scales narrowly oblong-cuneate, much longer than broad, up to about 5 cm. long and 2 cm. broad, spreading-decurved 3. *concinus*

Cones subcylindric-elongate, 35–65 cm. long, 7–9 cm. diam., with mature scales set apart exposing axis, quite unlike female ones externally:

Scales slightly deflexed from attachment with axis, then curving upwards and concave on the upper surface terminating in an enlarged deflexed duck's-bill-like bulla, scales more or less oblong, 3–4 cm. long, 2.75–3.5 cm. broad, and 2–3 cm. thick vertically 4. *chimanimaniensis*

Scales spreading more or less at right-angles to axis, relatively thin vertically, obovate, 3.5–4 cm. long, 2.5–3 cm. broad and 1 cm. thick vertically
5. *munchii*

It must be emphasized again that the measurements are taken from dried material.

In the hope that it may be of some practical use, a key follows for the recognized species based on average leaf characters and median leaflets: It is the best guide we can devise at the moment from vegetative characters, but is by no means infallible.

Key based on vegetative characters

Leaflets light or dark green without bloom, drying rather hard with rigid margin when mature, variably prickly:

Prickles on margin of leaflets slender, rarely up to 5 mm. long, sometimes absent:

Leaves with somewhat elliptic outline, leaflets 15–22 cm. long, usually in open or nearby open venetian-blind position, well spaced with insertions on rhachis 2–3 cm. apart 4. *chimanimaniensis*

Leaves with mainly narrowly oblong outline, leaflets 10–15 cm. long, spaced or slightly overlapping, with insertions on rhachis usually less than 2 cm. apart, leaflets in half-open to nearly closed venetian-blind position:

Leaflets narrowed more or less gradually to the base, apex oblique 3. *concinus*

Leaflets narrowed rather abruptly to the base, margins narrowing more or less equally to apex 1. *manikensis*

Prickles on margin rather prominent, often towards base, mainly over 5 mm. long, rarely some leaflets without spines; outline of leaves mainly narrowly oblong:

Leaflets mostly with margins not or only slightly overlapping, arranged in about half-open venetian-blind formation, spreading, directed slightly upwards towards apex 1. *manikensis*

Leaflets fairly regularly overlapping and arranged in closed or nearly closed venetian-blind formation, often directed upward from the rhachis towards apex in V position 2. *pterogonus*

Leaflets somewhat dull glaucous until maturity, strongly prickly on upper margin, densely overlapping in upward V position from the rhachis, drying rather thin, with flexible margin and becoming yellowish with age 5. *munchii*

DESCRIPTION OF SPECIES

1. ***Encephalartos manikensis*** (Gilliland) Gilliland in Trans. Rhod. Sc. Assn. 37: 133 (1939); Melville in Kew Bull. 1957: 256 (1957) in part; Lewis in Fl. Zamb. 1: 79 (1960) in part. *E. gratus* Prain var. *manikensis* Gilliland in J. S. Afr. Bot. 4: 153 (1938).

Plant branched from the base with age; trunks up to 1.5 m. tall and about 30 cm. diam., protected by alternating series of persistent leaf-bases and bracts. *Leaves* narrowly ovate-lanceolate to oblong, 100–190 cm. long with about 60 pairs of pinnae; petiole and rhachis subterete with rounded under surface, woolly when young, glabrescent; pinnae gradually reduced to prickles at the base; median leaflets 12–15 cm. long, 2–2.5 cm. broad, lanceolate-ovate, subarcuate ending in a forward directed spine and with 1 or 2 diverging spines on the upper and lower margins; upper leaflets narrowly lanceolate-arcuate, entire or frequently with 1 or 2 diverging spines on upper or lower margin. *Male cones* 1–4 together, pedunculate, 25–60 cm. long and 8–15 cm. diam., narrowed to rounded apex; peduncle up to about 15 cm. long, 5 cm. diam., subtended by about 8 triangular-ovate tomentose bracts; scales slightly spaced in mature fresh state, subrectangular, limb truncate or cordate at base, with a flattened rhomboid slightly decurved apex, about 4–6 cm. long and 3.5–5.8 cm. broad, 2.5 cm. thick vertically; upper facet ridged but not umbonate. *Female cone* about 30–45 cm. long, 20–25 cm. diam., pedunculate; peduncle about 6 cm. long, 4.5 cm. diam., loosely woolly; scales rhomboid, about 5.5 × 4 cm., the inner margin of the incurved lobes and adaxial margin of bulla papillose; seed angled by compression, more or less ovoid, 2.5–3.5 cm. long, 1.5–2 cm. diam.



FIG. 2
E. manikensis, male plant from type locality of Gorongowe Mt., Rhodesia, cult.,
Mr. Munch's Garden No. 49. ;

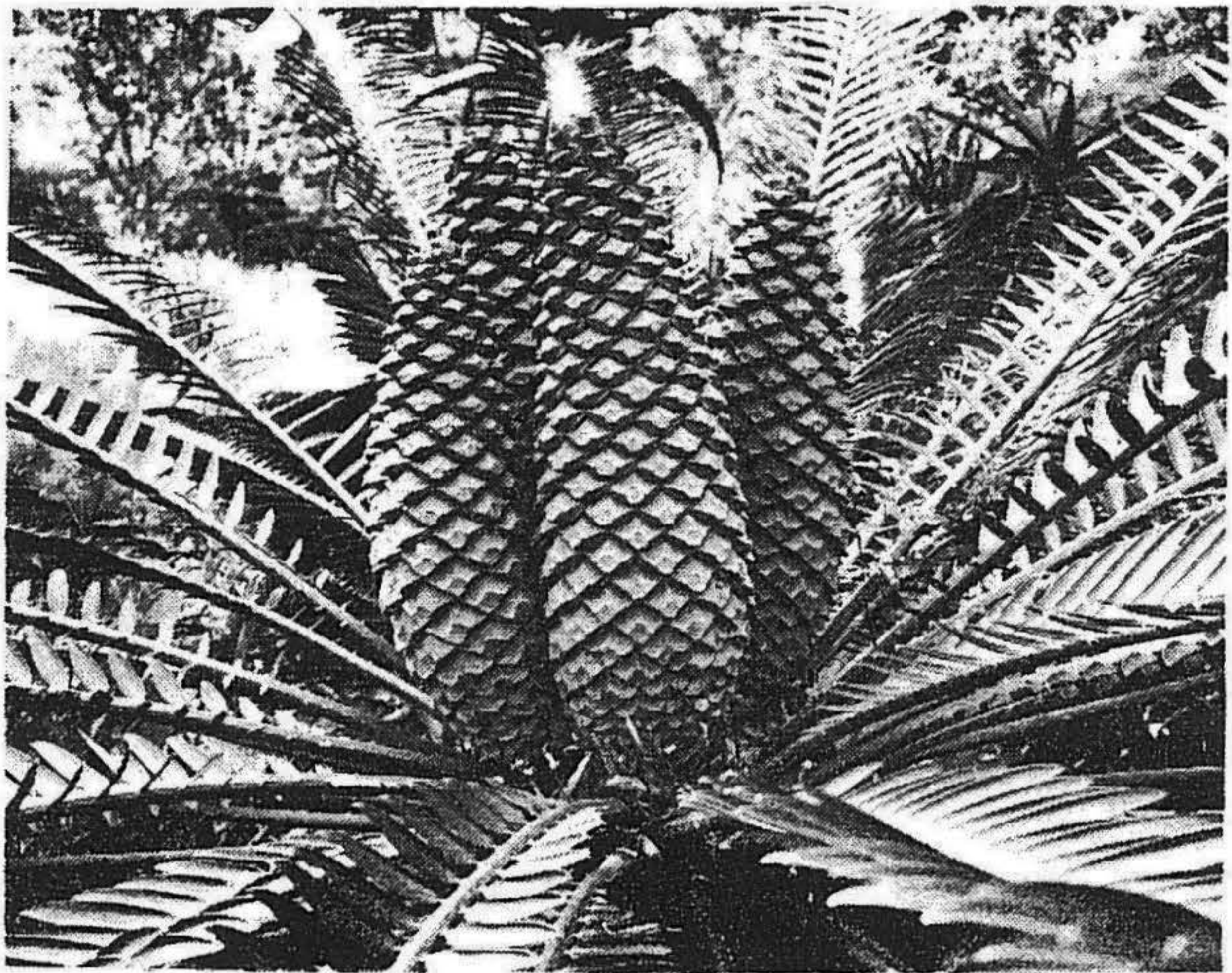


FIG. 3
E. m. nikensis, male cones on plant in garden of Mr. Munch, from near Bandula,
Mozambique.



FIG. 4

E. manikensis, female cone on plant in Ewanrigg Botanical Garden near Salisbury, from type locality, Gorongowe Mt.

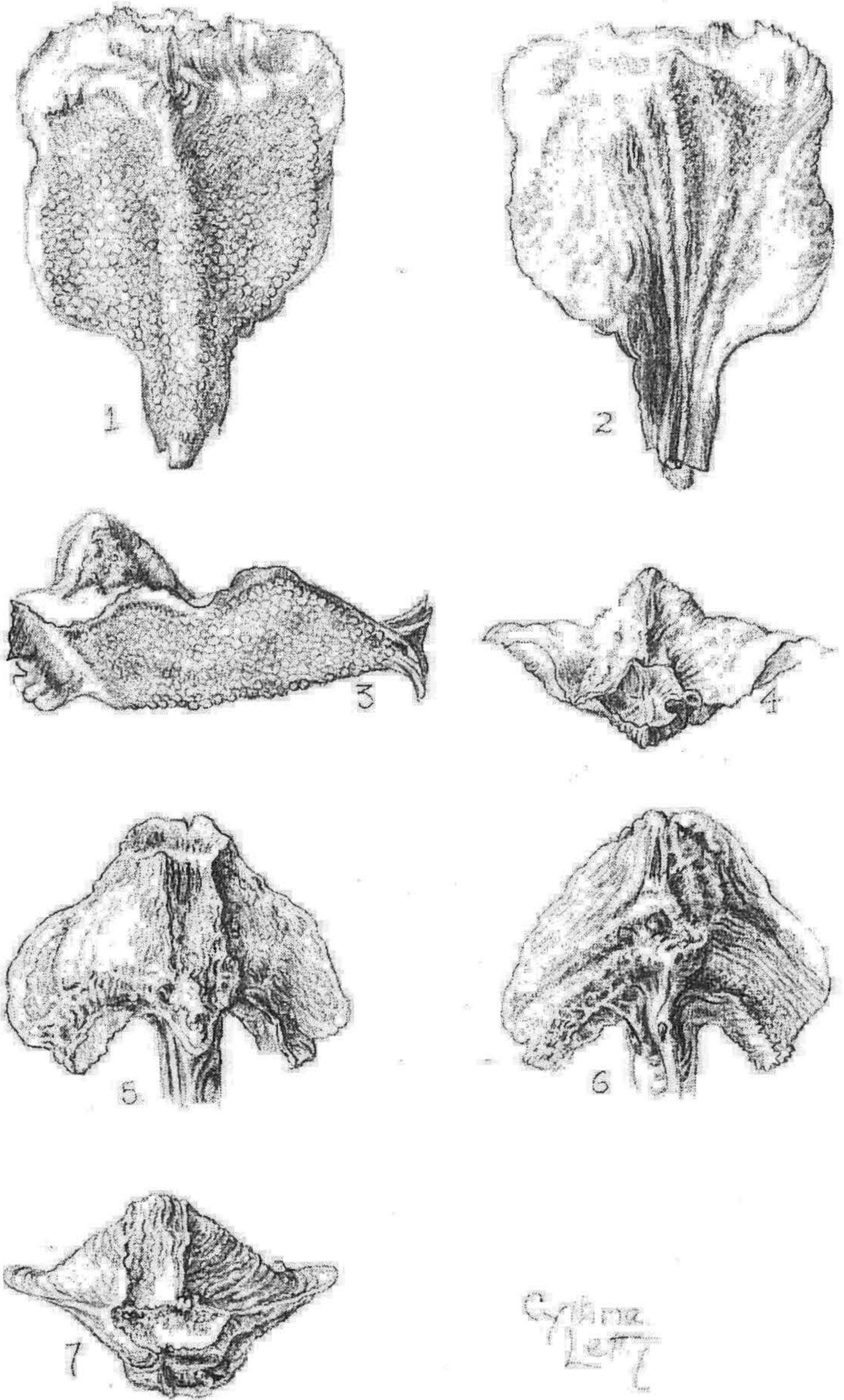


FIG. 5
E. manikensis, 1-4, male cone scale; 1, under side with pollen cells; 2, upper side; 3, side view; 4, front view with terminal facet; 5-7, female cone scale; 5, upper side; 6, lower side; 7, front view with terminal facet.

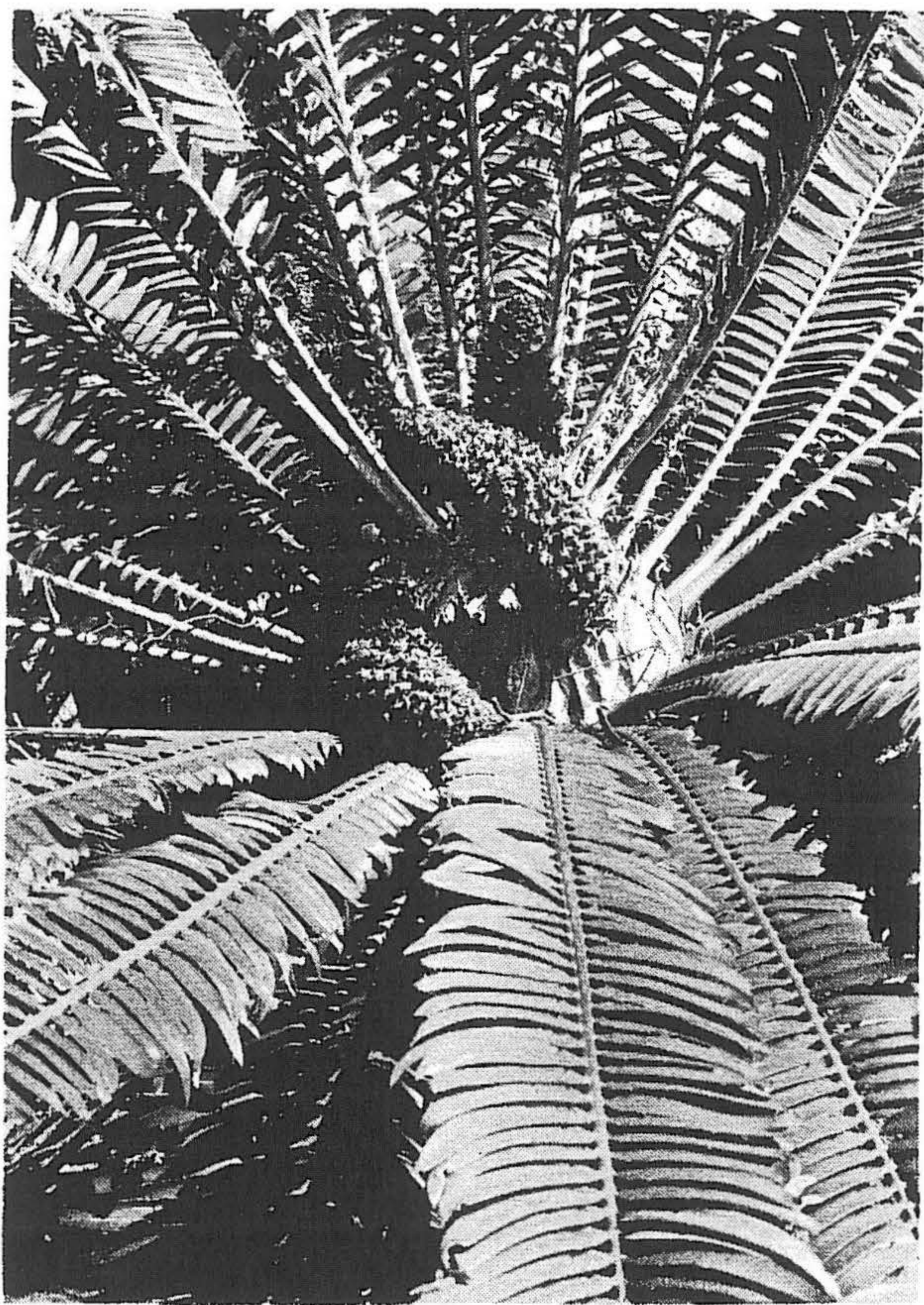


FIG. 6
E. pterogonus, male plant from type locality, Mruwere Mt., Mozambique, cult.,
Mr. Munch's garden No. 105.

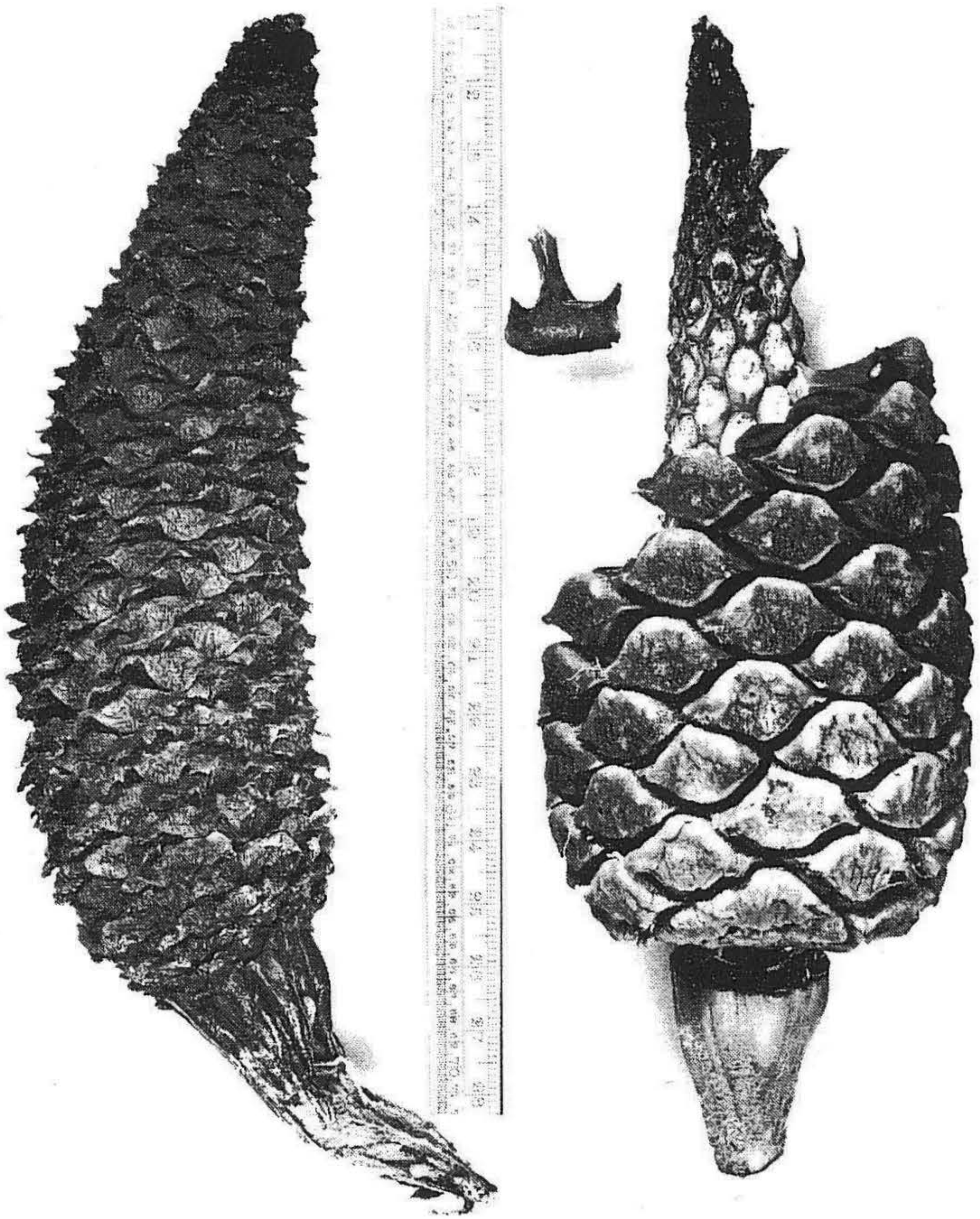
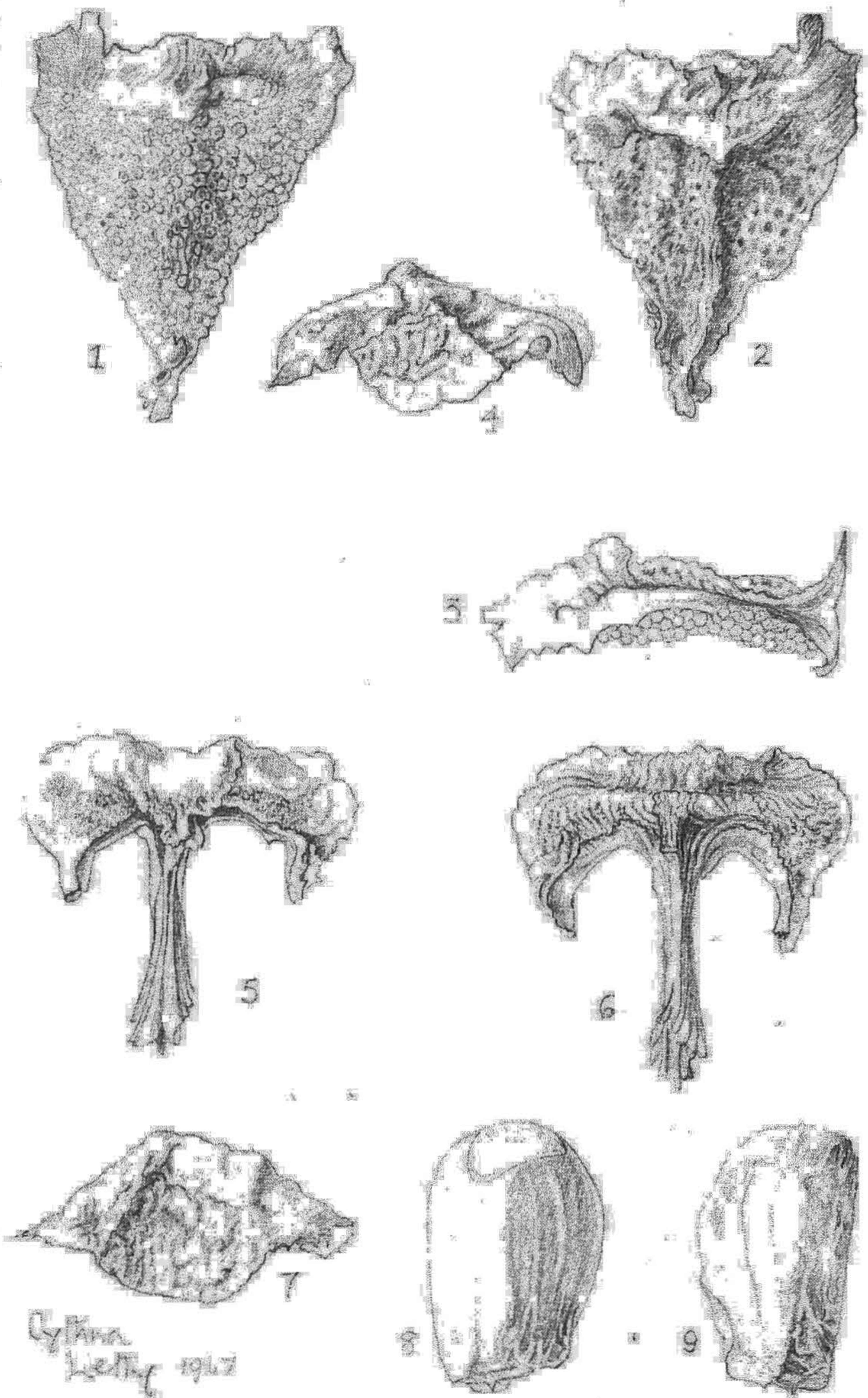


FIG. 7

E. pterogonus, left, male cone showing rather thinnish very tightly set scales with toothed lateral margins; right, basal portion of female cone from type locality, Mruwere Mt.



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 1967

FIG. 8

E. pterogonus, 1-4 male cone scale; 1, underside with pollen cells; 2, upper side; 3, side view; 4, front view with terminal facet; 5-7, female cone scale; 5, upper side; 6, lower side; 7, front view with terminal facet.

Rhodesia.—Mt. Gorongowe, *Gilliland* 2016 (J, syntype) (tip of leaf and seedling), *Finlay sub Christian* 265A (SRGH, PRE); *Meikle sub Christian* 265 (SRGH, PRE); *Munch* 448 (SRGH; PRE); *Wild* 5282 (SRGH).
Mozambique.—Mt. Nhaungue near Garuso, *Munch* 446 (SRGH, = *Dyer and Verdoorn* 5866; 5867 (PRE); *Wild* 6572 (SRGH); *Gilliland* 1862 (PRE); *Barzholz ex Schweickerdt* (PRE); *Leach* (PRE): Bandula, *Munch in Christian* 748A, B, C, D & E (SRGH; PRE); *James sub Christian* 645 (SRGH). Fig. 2-5.

The type material of *E. manikensis* was collected in the Stapleford Forest Reserve of Rhodesia on Mt. Gorongowe, where it was recorded as dominant at about 4,500 ft. Gilliland (1938) first regarded it as a variety of *E. gratus* Prain, but within a year he received additional material on which he raised it to specific status (1939). He drew special attention to the breadth of the male cone scales which may be over 5 cm. broad in the fresh state. For his original description Gilliland had a male and no female cone. It was only in his amplified description that he was able to supply details of the female cone scales and then from a damaged cone. Normal male and female cones are unusually alike externally, the male being quite readily mistaken for a female. In male plants 1-4 cones are produced, while 2 are not uncommon on female plants.

The habitat illustrations accompanying the first description by Gilliland show the leaves to be mainly oblong with the leaflets not or only slightly overlapping and in a nearly closed venetian-blind position.

We have included under *E. manikensis* specimens from several localities, some miles distant in Mozambique, from places such as Bandula, Garuso, Vanduzi, Nhaungue, Chinyazange. From among the specimens from these areas, H. B. Christian had suggested the segregation of at least two other species, but the records are still incomplete. When full records have been gathered, however, his views may be judged to have been well founded.

2. *Encephalartos pterogonus* Dyer and Verdoorn, sp. nov., *E. manikensi* Gilliland affinis, sed bullis brevioribus angulis lateralibus megasporophyllorum acutioribus microsporophyllorum alatis nonnumquam dentatis, vulticulis terminalibus minus prominentibus differt.

Planta e basi ramosa, truncis usque 1.5 m. altis cylindricis, circa 40 cm. diam. *Folia* oblongo-elliptica, basin versus attenuata, circa 1.5 m. longa, foliolis infimis spinosis reductis, petiolo lanato glabrescenti sed pulvino extus permanent lanato; foliola mediana 15-18 cm. longa, 2-2.5 cm. lata, pungentia, marginibus utrinque prope basin 3-4-dentatis. *Strobilus masculus* oblongo-ovoideus compactus, circa 38 cm. longus, 11 cm. diam., pedunculo circa 10 cm. longo, lanato; microsporophylla mediana horizontaliter disposita, triangulari-cuneata, circa 3.5 cm. longa; bulla usque 4.5 cm. lata, 1.5 cm. crassa, angulis lateralibus alatis nonnumquam dentatis, vulticulo terminali circa 2 × 1.5 cm. *Strobilus femineus* subcylindricus circa 40 cm. longus, 17 cm. latus, pedunculo circa 8 cm. longo; megasporophylla mediana circa 4 cm. longa; bulla 5.5 cm. lata, 2 cm. crassa, angulis lateralibus acutis nonnumquam dentatis, vulticulo terminali circa 2 × 1.5 cm.

Mozambique.—Mt. Mruwere north of Vila Pery, October, 1949, *Munch* 451 (SRGH; PRE, holotype) (= *Dyer and Verdoorn* 5862; 5863; 5864; PRE). Fig. 6-8.

Stems stout branching from base, up to about 1.5 m. tall and about 40 cm. diam., covered by alternate series of leaf-bases and bracts; bracts narrowly ovate, acuminate, woolly when young. *Leaves* about 1.5 m. long, oblong-elliptic in outline, slightly narrowed to apex and more gradually so to base; rhachis more or less straight and suberect at first, spreading with age; petiole-like base 9–18 cm. long, variably prickly to base, woolly towards base, glabrescent; pulvinus 6–7 cm. wide and thick, woolly externally; leaflets green, rather thick in texture, crowded and overlapping, especially in upper half of leaf, directed towards apex in V position; median leaflets inserted 1.5–2 cm. apart, 15–18 cm. long, 2–2.5 cm. broad, somewhat unequal-sided at the base, with 3 or 4 strong prickles on the upper and lower margins usually towards base, apex usually upturned, pungent. *Male cones* narrowly ovoid-oblong, up to about 38 cm. long, 11 cm. diam., peduncle about 10 cm. long with woolly covering, scales tightly arranged and not exposing axis; median scales spreading more or less horizontally, triangular-cuneate, about 3.5 cm. long, 4.5 cm. broad above and 1.5 cm. thick vertically; sporangia produced almost to lateral margins of lower surface; bulla about 1 cm. deep to sporangial surface, slightly puberulent on terminal facet; lateral angles protruding beyond terminal facet, wing-like and often toothed or lobed, upper facet slightly humped with indefinite receding ridge; terminal facet about 2 cm. broad and 1.5 cm. vertically. *Female cone* subcylindric or barrel-shaped, up to about 40 cm. long and 17 cm. diam. towards the base; peduncle about 8 cm. long, woolly; median scales about 4 cm. long; bulla 5.5 cm. broad, 2 cm. thick vertically, projecting about 1 cm.; lateral angles sometimes protruding more than terminal facet, sharply angled, sometimes slightly toothed, incurved into lobes about 1 cm. long; upper facet humped to a height of about 1 cm. usually with 2 obscure receding ridges; lower facet rough on inner margin; terminal facet about 2 cm. broad and 1.5 cm. vertically, glabrous; seed scarlet or orange-red, 3.5–4 cm. long, 2 cm. diam. with fleshy covering.

E. pterogonus is known only from Mr. Mruwere, north of Vila Pery, where Mr. Munch found a uniform colony. The specific epithet is in reference to the acute, sometimes wing-like and toothed lateral angles of the bulla, particularly of the male cone scales. The comparatively short nose to the bulla results in the terminal facet appearing somewhat recessed. It is noteworthy also that there is no significant difference in the size and shape of the terminal facet in the two sexes. The male cones have tightly packed scales which are even denser than in *E. manikensis* and are quite unlike the lax ones of *E. munchii* and *E. chimanimaniensis* in this respect.

3. **Encephalartos concinnus** Dyer and Verdoorn, sp. nov., *E. manikensi* Gilliland affinis, sed microsporophyllis plurimis angustioribus, bullis microsporophyllorum minoribus, vulticulis terminalibus minoribus differt.

Planta e basi ramosa, truncis usque 2.5 m. altis cylindricis, 35–45 cm. diam. *Folia* plus minusve oblonga, basin versus attenuata, circa 1.5–2 m. longa, foliolis infimis spinosis reductis; petiolus lanatus glabrescens sed pulvino extus permanente lanato; foliola mediana 9–15 cm. longa, 2–2.25 cm. lata, pungentia, marginibus edentatis vel superioribus prope basin 1–2 vel utrinque 1–3(7)-dentatis. *Strobilus masculinus* anguste ovoideus vel sub-cylindricus, usque 50 cm. longus, 7.5–10 cm. diam., pedunculo circa 12 cm. longo; microsporophylla plurima dense compacta



FIG. 9

E. concinnus, plant in natural surroundings about 20 miles S-E. of West Nicholson, Rhodesia. (Photo: L. C. Leach.)

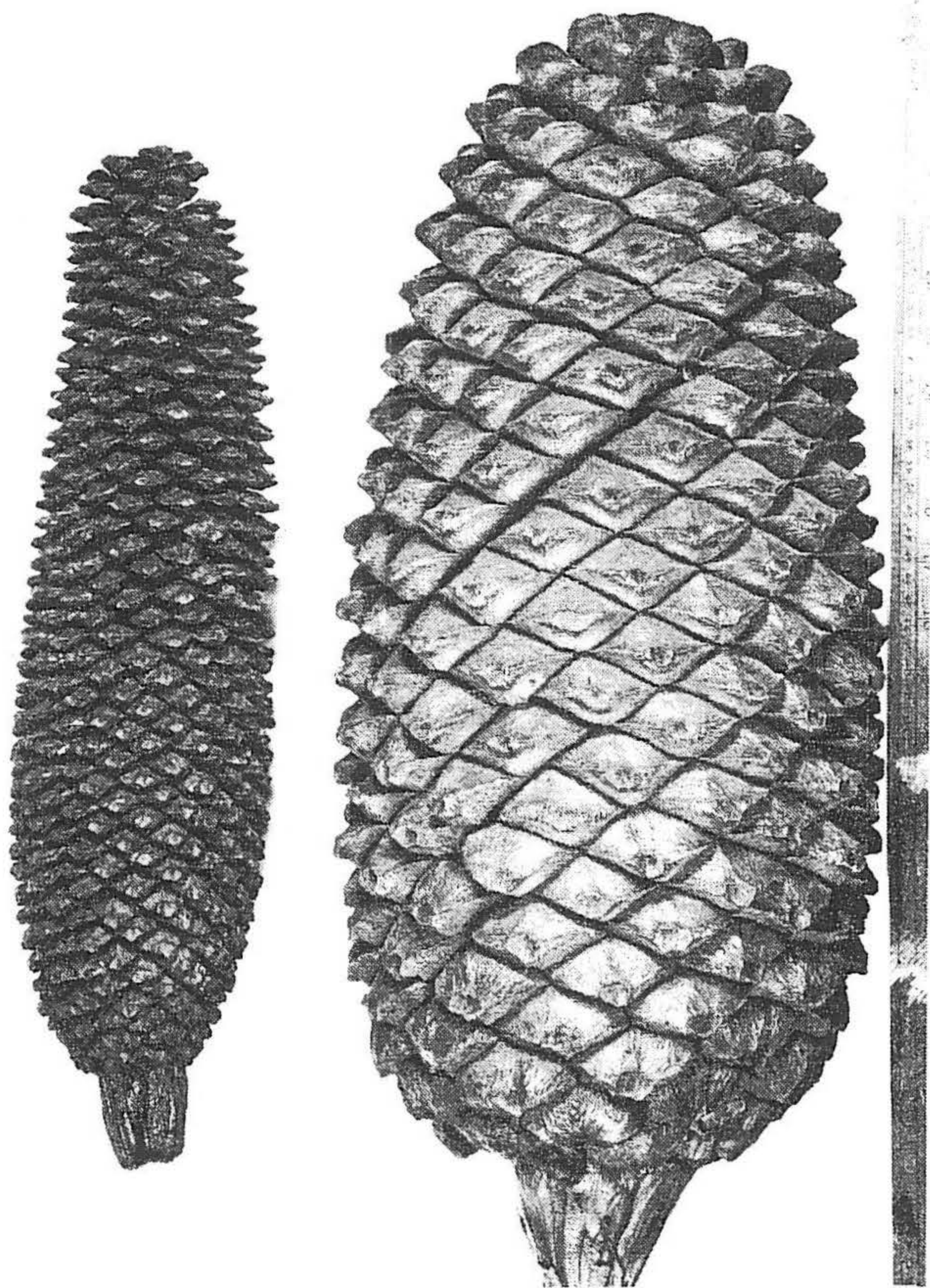


FIG. 10
E. concinnus, left, male cone, right, female cone, collected by Mr. J. A. Smit, south of Belingwe, Rhodesia, type locality. (Photo: H. J. Schlieben.)

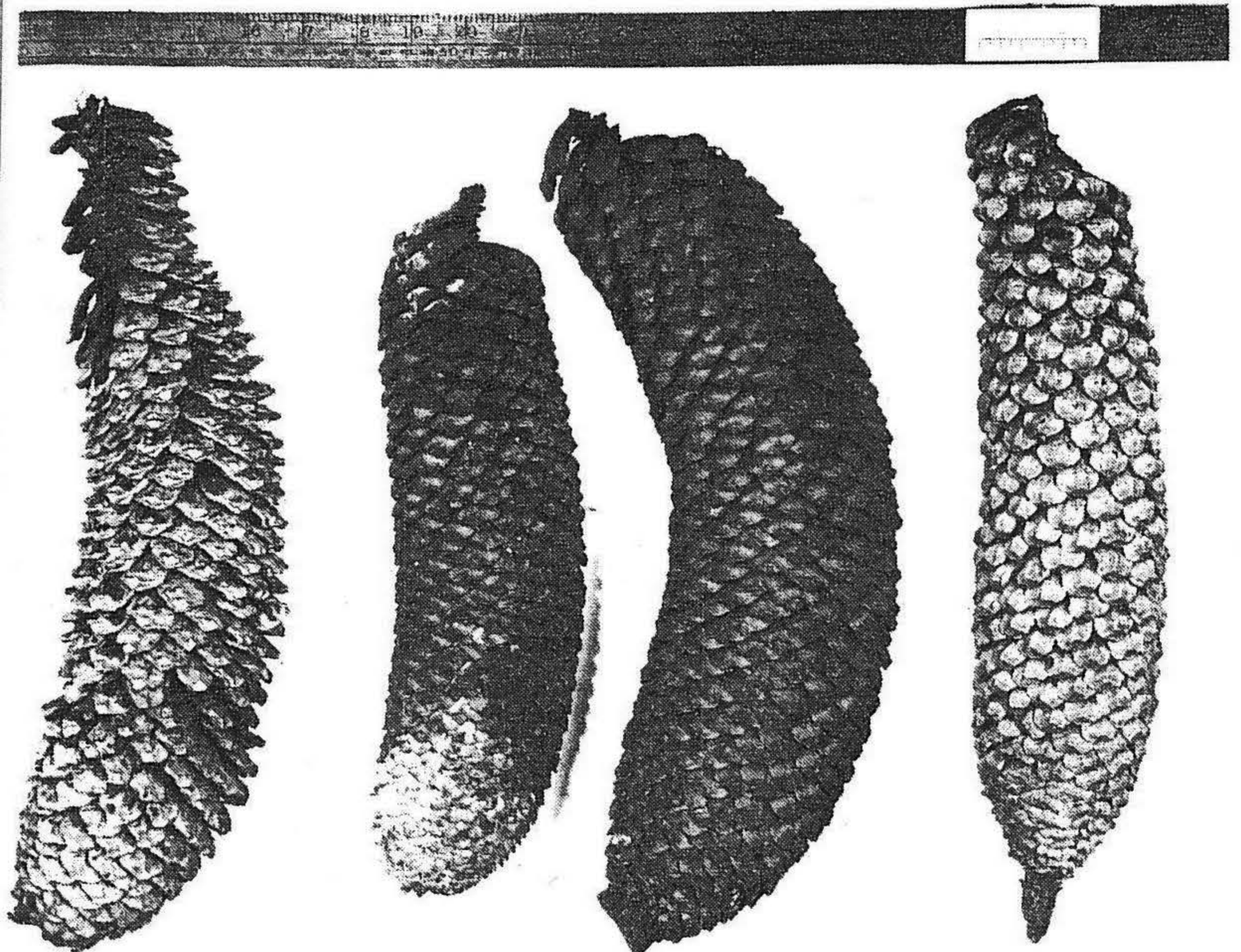


FIG. 11

E. concinnus, male cones, left, south of Belingwe; 2 in centre from 1 mile north of Lundi Bridge on main north-south road; right, from about 20 miles S-E. of West Nicholson. (Photo: H. J. Schlieben.)

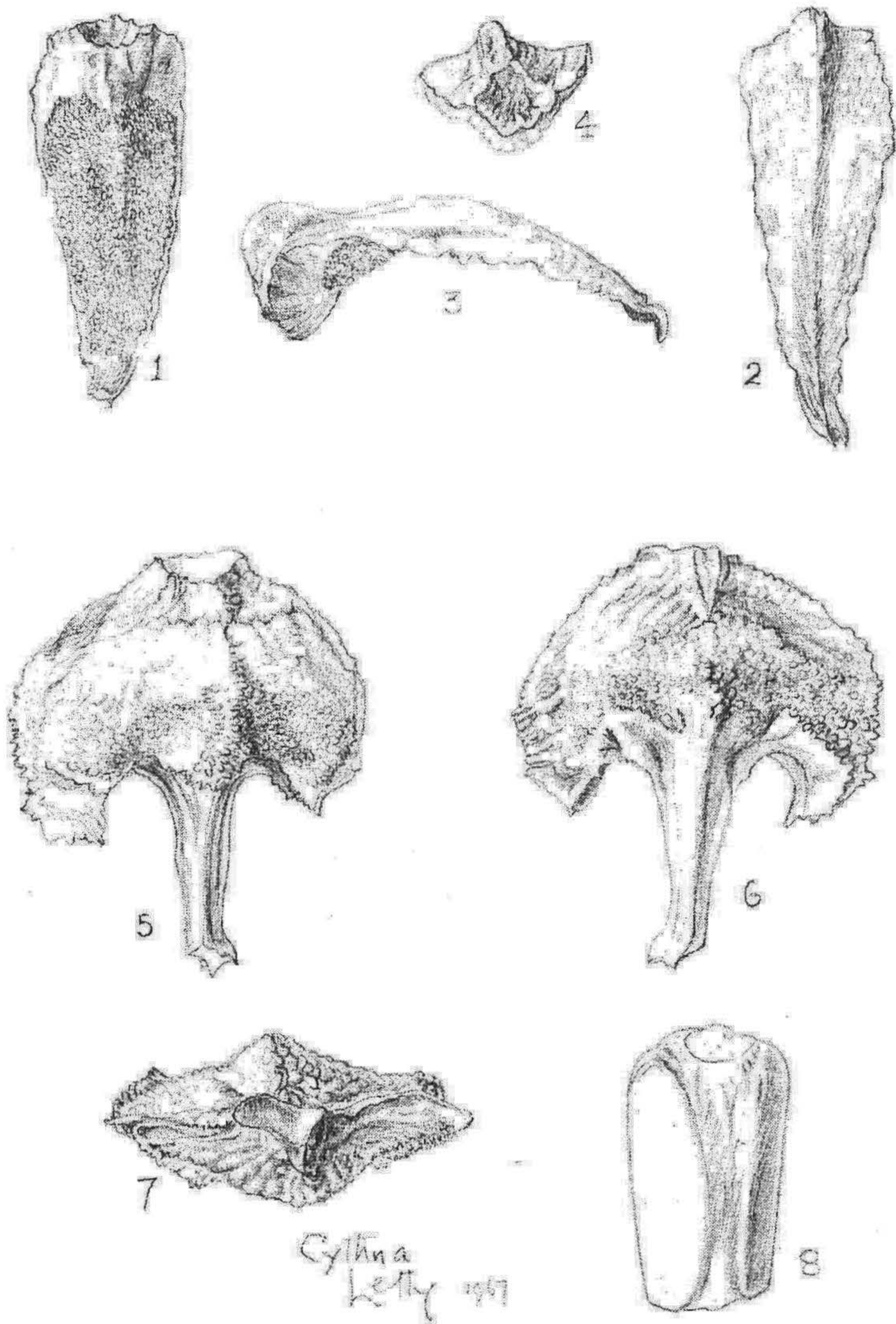


FIG. 12
E. concinnus, 1-4, male cone scale; 1, under side; 2, upper side; 3, side view; 4, front view with terminal facet; 5-7, female cone scale; 5, upper side; 6, lower side; 7, front view with terminal facet; 8, seed.

mediana breviter stipitata, leviter deflexa anguste oblongo-cuneata, 4–5 cm. longa; bulla 7–10 mm. longa, 1.7–2.25 cm. lata, .7–1.25 cm. crassa, vulticulo terminali 7–10 × 3–10 mm. *Strobilus* femineus subcylindricus, usque 45 cm. longus, 20 cm. diam., pedunculo obconico circa 8 cm. longo apicem versus 8 cm. lato; bulla megasporophyllum medianorum 5–5.5 cm. lata, plus minusve 3 cm. longa, circa 3 cm. crassa, facies adaxialis rotundata vel 1-costata, basi verrucosa; vulticulus terminalis 8–12 mm. latus, 5–8 mm. altus; semina ellipsoidea, 3.5–3.75 cm. longa, 2–2.25 cm. lata, rubra.

Rhodesia.—Belingwe Distr.; few miles S. of Belingwe, *Smit* PRE30142 (PRE holo); PRE30143; *McGaw* SRGH43088; *Wild* 4131. Gwanda Distr.; about 20 miles SE. of West Nicholson on granite hill, among boulders and trees, *Leach, Bullock and Rochat* 13315 (PRE; SRGH); *Smit* PRE30144; *Munch* 469(PRE). Lundi Distr.; about 1 mile N. of Lundi Bridge, *Rushworth* 368 (SRGH; PRE); *Munch* 470(PRE). Fig. 9–12.

Plant branched from the base, rarely unbranched; main root tuberous; trunks up to about 2.5 m. long and then sometimes gradually reclining, sometimes a prostrate trunk producing buds along its length, 35–45 cm. diam., covered with alternating series of persistent leaf-bases and woolly bracts. *Leaves* mainly oblong, rounded at apex and narrowed more gradually to base, 150–200 cm. long, 20–30 cm. broad, with about 50 pairs of leaflets; petiole and rhachis subterete, woolly when young, glabrescent except for pulvinus; pinnae inserted 1–1.5 cm. apart, widely spreading, gradually reduced to prickles at base; median leaflets 10–15 cm. long, 2–2.3 cm. broad, straight or slightly curved upwards to apex, in half-open to nearly closed venetian-blind disposition, usually sharply pointed with (0)1–3(–7) fine prickles on upper or both margins, usually towards base. *Male cones* green, 1–4 in a season, narrowly ovate to sub-cylindric, up to 50 cm. long, 7.5–10 cm. diam., with peduncle 5–12 cm. long; scales numerous and closely set, those near apex slightly ascending or horizontally spreading, those below gradually decurved; median scales 4–5 cm. long, narrowly oblong-cuneate, convex on upper surface, with microsporangia to margin of lower surface; bulla 7–10 mm. long, 1.7–2.25 cm. broad, .7–1.25 cm. thick vertically, with upper facet variably humped and usually with 1 or sometimes 2 receding ridges and one extending down back of scale to near the base; lower facet receding from lower margin of terminal facet; terminal facet irregularly shaped, forming basal margin of bulla, 7–10 mm. broad, 3–10 mm. high. *Female cone* green about 45 cm. long and 20 cm. broad, sub-cylindric, narrowed slightly upwards to obtuse apex; peduncle obconic, about 8 cm. long and 8 cm. diam. at top, yellowish, subtended by linear bracts; bracts up to about 8 cm. long, woolly externally, glabrous within; median scales about 6 cm. long; stipe 3.5 cm. long, 4-angled; bulla 5–5.5 cm. broad, about 3 cm. thick vertically, projecting about 2 cm., rugose along unexposed base of upper and lower facet; lateral angles acute, extending into incurved lateral lobes about 1 cm. long; upper facet rounded, slightly wrinkled and with or without an indistinct irregularly positioned receding ridge; lower facet rounded; terminal facet irregularly shaped, 8–12 mm. broad, 5–8 mm. high vertically, slightly concave, surface glabrous but slightly granular in appearance; seeds red, angled by compression, 3.5–3.75 cm. long, 2–2.5 cm. broad, with fleshy covering.

First D. C. McGaw and then Prof. H. Wild recorded a female specimen in cultivation at Belingwe as early as 1953. The leaflets are

shorter and denser than the typical and other forms of the species but the differences are assumed to be mainly the result of the transfer from the wild state into a rockery. Reports of Cycads in the Lundi area had been current for several years but no positive record in the wild was forthcoming. In July, 1966, however, Messrs. L. C. Leach, E. J. Bullock and R. H. Rochat brought to light a colony some miles south-east of West Nicholson in the Gwanda District, where only male cones have so far been collected.

During the Easter week-end of 1967, Mr. J. A. Smit, visited the West Nicholson Cycads and from there went to Belingwe, where with the guidance of local inhabitants, traced the whereabouts of a vigorous stand of Cycads with fresh male and female cones. About the same time Mr. Drummond and party from the Salisbury herbarium, and a day or two later Mr. Munch, located Cycads including a male specimen in cone, in a ravine near Lundi.

The bulla of the male cone scales from Belingwe is thinner vertically than that of either the Lundi or West Nicholson forms, that is to say the upper facet is less humped. The male cones from Lundi may be judged as nearly intermediate between those of the other two localities, but the extent of local variation cannot be established on half a dozen cones, which is all we have seen. As regards leaf characters, Mr. Smit noted that, on the average, the Belingwe leaflets were shorter, denser and in a more closed venetian-blind position than those from West Nicholson. On the other hand both he and Mr. Munch regarded those in the latter dry area as a slightly moribund community.

The fact that Mr. Smit collected female as well as male cones at Belingwe, persuaded us to nominate one of his collections there as the holotype. When describing *E. tegulaneus*, Melville likened the male cone scales to tiles on a roof. The comparison is apt for *E. concinnus* too and it was the neat appearance of the male cones which suggested the specific epithet.

4. *Encephalartos chimanimaniensis* Dyer and Verdoorn, sp. nov., *E. manikensi* Gilliland affinis sed strobilo masculino laxo, bullis majoribus, vulticulis terminalibus descendentibus, foliis anguste ellipticis, basibus foliolorum distantibus differt.

Planta plerumque e basi ramosa, truncis usque 1.75 m. altis cylindricis, circa 45 cm. diam. *Folia* oblongo-elliptica, basin versus attenuata, circa 150 cm. longa, foliolis infimis spinosis reductis, petiolo lanato glabrescenti sed pulvino extus permanenter lanato; foliola mediana plus minusve ovato-lanceolata, leviter falcata, 15–20 cm. longa, 2.5–3 cm. lata, saepe pungentia, marginibus basin versus utrinque plerumque 2–4-dentatis. *Strobilus* masculus 1–3, subcylindricus usque 70 cm. longus, 8–11 cm. diam. pedunculo circa 15 cm. longo bracteato; microsporophylla laxa, mediana circa 4.5 cm. longa, 3.5 lata, 2.5 cm. crassa; vulticulo terminali 2×2 cm. *Strobilus femineus* circa 45 cm. longus, 18–20 cm. latus, pedunculo 7–8 cm. longo; bulla desiccata megasporophyllorum medianorum deflexa 5.5–6.5 cm. lata, 2.5–3 cm. crassa; facies adaxialis 2-costata, basi verruculosa; vulticulus terminalis 1.8–2.2 cm. latus, 1–2 cm. altus; semina ellipsoidea, 3.7–4 cm. longa, 2–2.5 cm. diametro.

Mozambique.—Chimanimani Mt., *Munch* 443 ; 444 ; 445 (SRGH, holotype; PRE) (= *Munch ex Christian* 770 (SRGH; PRE); (= *Dyer and Verdoorn* 5868; 5869; PRE). Fig. 13–15.



FIG. 13

E. chimanimaniensis, type male plant in Mr. Munch's garden, from which his herb No. 445 was originally derived, from eastern slope of Chimanimani mountain on Mozambique side.

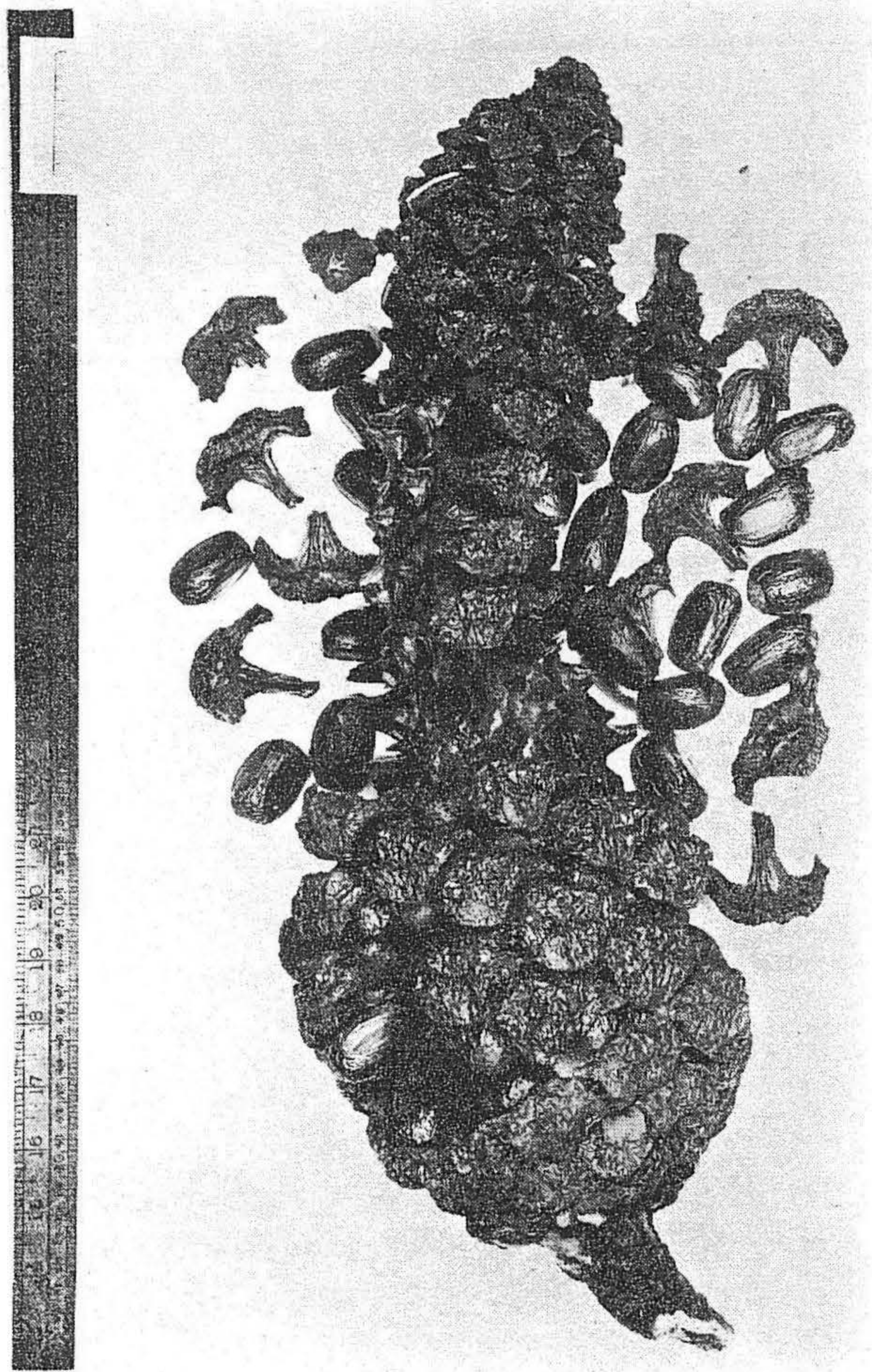


FIG. 14
E. chimanimaniensis, female cone from plant in cultivation in Mr. Munch's garden
from type locality on Chimanimani Mt. (Photo: Mr. H. J. Schlieben.)

Stems, stout, branching from base, rarely unbranched, up to about 1.75 m. tall and 45 cm. diam., covered by alternate series of leaf-bases and bracts; bracts narrowly ovate, acuminate, woolly on outer surface. *Leaves* oblong-elliptic, about 1.5 m. long, narrowed gradually to base; rhachis nearly straight to arching in the upper half, woolly when young, glabrescent with age; pulvinus about 4–5 cm. broad, woolly on outer surface; leaflets green, glossy, reduced to prickles towards base of rhachis, inserted 2–3.5 cm. apart, twisted and disposed in open venetian-blind position; median leaflets more or less ovate-lanceolate, slightly falcate, 15–20 cm. long, 2.5–3 cm. broad, often with 2–4 small teeth towards base of upper and lower margins, apex sometimes hooked. *Cones* male and female dissimilar. *Male cones* up to about 3 produced together, tallest up to about 70 cm. long, 8–11 cm. broad, subcylindric, narrowed gradually to apex and base, with peduncle about 15 cm. long, bracteate; bracts, dorsally woolly; scales lax exposing rhachis; median scales about 4.5 cm. long, 3.5 cm. broad towards apex, obtuse or slightly cordate at base, slightly decurved from insertion then arching upwards, concave on upper surface; sporangia absent from 2–3 mm. margin; bulla with vertical thickness or facial length about 2.5 cm., somewhat resembling a tortoise head; upper facet strongly humped with 2 receding ridges; lower facet 2 cm. deep to the sporangial surface; terminal facet together with lower facet appearing beak-like in sideview, 2 × 2 cm. *Female cones* about 45 cm. long, 18–20 cm. broad; peduncle 7–8 cm. long; median scales (dry) with stipe about 6 cm. long; bulla 5.5–6.5 cm. broad, 2.5–3 cm. thick vertically, deeply wrinkled in drying; lateral ridges extending into incurved lobes 1–1.5 cm. long; upper facet about 1.5 cm. high with two prominent, spaced, receding ridges, verruculose round base; lower facet together with terminal facet appearing beak-like in side-view; terminal facet 1.8–2.2 cm. broad and 1–2 cm. high vertically; seeds red, apparently not especially fleshy, 3.7–4 cm. long, 2–2.5 cm. diam.

To us, whose experience of Cycads is mainly with the species of Southern Africa, the appearance of the male cones of *E. chimanimaniensis* was at once arresting. The cones were large and lax and the shape of the bulla gave a first impression of a tortoise head, the accuracy of which comparison may be judged by an examination of Fig. 13. The upper surface of the scales over the fertile portion is markedly concave, more so than in any of the other species dealt with here.

The dry female cone scales are comparatively large but are wrinkled and appear to be considerably shrunken, Fig. 14. In other words the fresh scales would appear to have been unusually fleshy. On the other hand the seeds which are also comparatively large, are less wrinkled than the bulla of the scales and do not appear to have had an exceptionally copious fleshy covering.

A specimen with a male cone, collected in August, 1965, on the southern portion of the Chimanimani Mountain in Rhodesia at about 3,900 ft. altitude by A. Siemers, CH 25 (SRGH), shows a strong likeness to the above concept of *E. chimanimaniensis*. Only 2 plants and an old male cone were seen. We consider that the plants represent an outlier-form of *E. chimanimaniensis* and that complete information might support the view that subspecific rank is justified.

5. *Encephalartos munchii* Dyer and Verdoorn, sp. nov., *E. manikensi* Gilliland affinis sed microsporophyllis laxis, bulla minore, lobo longo medio adaxillari megasporophyllorum differt.

Planta e basi ramosa, truncis usque 1 m. altis cylindricis plus minusve 30 cm. diam. *Folia* lineari-oblonga prope basin attenuata, circa 1 m. longa, stricta, foliolis infimis spinosis reductis, basibus petiolorum lanatis glabrescentibus sed pulvinis extus permanente lanatis; foliola mediana plus minusve glauca, lineari oblonga, circa 15 cm. longa, 2 cm. lata, pungentia basin versus aequaliter attenuata, marginibus utrinque 2-7-dentatis. *Strobilus masculus* subcylindricus usque 70 cm. longus, 10 cm. latus, pedunculo circa 18 cm. longo bracteato vel ebracteato plano; microsporophylla laxa, mediana leviter deflexa, 3-3.5 cm. longa, 2.5-2.7 cm. lata; bulla glabra plus minusve 1.5 cm. crassa; vulticulus terminalis circa 12 × 8 mm. *Strobilus femineus* subcylindricus, circa 50 cm. longus, 20 cm. diam., pedunculo circa 10 cm. longo, basi bracteato; bractee angustae usque 15 cm. longae; megasporophylla mediana circa 6 cm. longa; bulla 5 cm. lata, 4 cm. crassa; lobi 2 laterales incurvi, triangulares, circa 1 cm. longi, lobo intermedio adaxiali lato aequilongo margine papilloso; vulticulus terminalis 1.5 × 1.5 cm., margine paulo prominenti.

Mozambique.—Zembe Mt. south of Vila Pery, *Munch* 452 (SRGH, holo., PRE) (= *Dyer and Verdoorn* 5859; 5860; 5861, PRE). Fig. 16-19.

Stems stout, branching from base, up to about 1 m. tall and about 30 cm. diam., covered by alternate series of leaf-bases and bracts; bracts narrowly ovate, acuminate, whitish-woolly on outer surface. *Leaves* about 1 m. long or somewhat longer, linear to narrowly oblong in general outline, slightly narrowed to apex and more gradually so to base; rhachis more or less straight and suberect, gradually spreading to reflexed with age; petiole-like base 15-20 cm. long, rather slender, variably prickly, woolly towards base, glabrescent; pulvinus swollen with thick off-white, woolly covering on outer surface, glabrous on inner surface; leaflets dull glaucous-green, comparatively thin in texture, turning yellow-brown with age, inserted about 1 cm. apart, crowded and overlapping, especially in upper half directed towards apex of rhachis in V formation, reduced to prickles at the base; median leaflets linear-oblong, more or less equal-sided towards base, about 15 cm. long, 2 cm. broad, variably spinous on both margins, mainly in lower half with few to several prickles over 5 mm. long, with pungent apex as a continuation of upper margin, lower margin curved upwards to apex. *Cones*: male and female cones jade-green, dissimilar in shape. *Male cones* up to 6 produced together, tallest up to about 65 cm. long and about 9 cm. broad, subcylindric narrowed gradually to apex and base; peduncle bracteate or ebracteate, up to 20 cm. long, smooth; upper scales spreading slightly upwards or horizontally, those below becoming gradually slightly deflexed, spaced and exposing axis; median scales oblong-cuneate 3.5-4 cm. long, with sporangia almost to lateral margins of lower surface; bulla glabrous, 2.5-3 cm. broad, 1.5-1.7 cm. thick vertically, upper facet with a median hump and with or without a less distinct secondary ridge; lower facet about 5-7 mm. in length and in same plane as sporangial surface; terminal facet about 12 mm. broad, 8 mm. vertically, concave. *Female cone* up to about 50 cm. long, 20 cm. diam. towards base, subcylindric or barrel-shaped, narrowed towards apex, with peduncle about 10 cm. long, subtended by slender woolly bracts about 15 cm. long; median scales



FIG. 16

E. munchii, from type locality near Vila Pery, Mozambique, cult., in Mr. Munch's garden, showing crown with long scale-leaves and closely set overlapping leaflets directed towards apex of leaf.



FIG. 17

E. munchii, male cone, holotype, dry.
(Photo: J. Reyburn.)

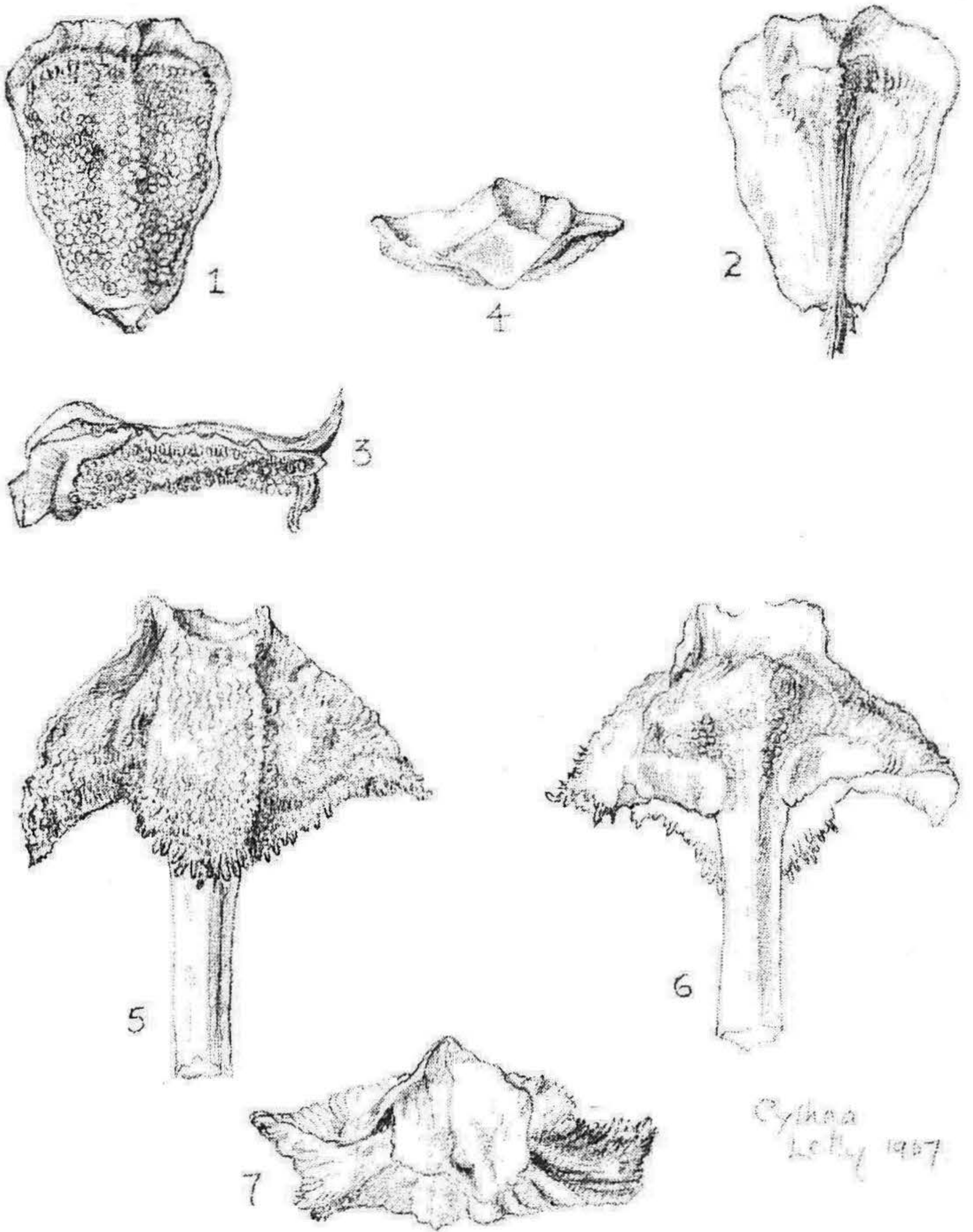


FIG. 18

E. munchii, male cone from
type plant in Mr. Munch's
garden, fresh cone.
(Photo: H. J. Schlieben.)



FIG. 19
E. munchii, female cone from plant from type locality, in Mr. Munch's garden.
(Photo: J. Reyburn.)



C. Lohr 1957

FIG. 20
E. munchii, 1-4, male cone scale; 1, under side; 2, upper side; 3, side view; 4, front view with terminal facet; 5-7, female cone scale; 5, upper side; 6, under side; 7, front view with terminal facet.

about 6 cm. long; bulla 5 cm. broad, 4 cm. thick vertically, (dry) bulla 4 cm. broad, 3 cm. thick vertically, with lateral ridges extending into incurved lobes about 1 cm. long and a broad adaxial medial lobe (extension of upper facet) of about equal length to these lateral lobes with papillae along their extremities; upper facet rugose with a central or 2 lateral ridges and passing into the broad adaxial lobe; lower facet 1 cm. deep to sporangial surface, rounded or slightly ridged, terminal facet about 1.5×1.5 cm. with slightly prominent margin; seed scarlet, 4–4.5 cm. long, 2.5–2.75 cm. diam.

The application of the epithet *munchii* for this concept is in recognition of the part played by Mr. R. C. Munch, who has persevered over the years in trying to encourage and assist botanists in unravelling the taxonomic problems connected with *E. manikensis* and its close allies. When the late H. Basil Christian first took an interest in it he intimated that he would use the name *munchii* for the form most distinct from typical *E. manikensis*. The present authors have borne this desire in mind in making their choice here. Unfortunately in the past the name was written on sheets now referred to at least 3 distinct concepts and must be used henceforth in its restricted sense and cancelled from the herbarium sheets to which it is not applicable. Mr. Munch found only a limited, fairly uniform colony on Zembe Mt., some miles south of Vila Pery in Mozambique.

The dark green, glaucous overlapping leaflets of *E. munchii*, arranged in an upward V position relative to the rhachis, are unusual. The leaflets are less rigid than those of its allies and some turn yellowish-brown after maturity. In addition to these features there are the elongated lax male cones and the development of the upper facet of the female bulla into an adaxial central lobe by which to recognize it.

Having recorded the presence of these new concepts, there are still some undecided problems of classification in this complex. There are for instance some plants from near Bandula and Caruso in Mozambique, here "lumped" with *E. manikensis*, which the late H. B. Christian regarded as distinct. Localities which should certainly bring their reward if thoroughly surveyed are: Mt. Chinyazange, the top of Mt. Nhaungue and the hill of Chigamba which lie north and south of Bandula. In any case further observations would fill in some of the gaps in the present treatment.

Another colony of plants of indeterminate status is represented by Professor Wild's specimen No. 6759, from the Chipinga district of Rhodesia. It appears to be related to *E. chimanimaniensis* but the cone-scales are smaller and shaped differently. Even among the groups of *E. chimanimaniensis*, Mr. Munch has noted some specimens with leaflets darker green and in a less open venetian-blind position than usual, which may deserve distinctive rank. We are not in a position to express a considered opinion.

Obviously there is scope for a continued study of the *E. manikensis* complex.

In the final paragraph of his introduction Melville (1957) refers to fire as an important factor leading to the extermination of *Encephalartos*. This comment cannot be interpreted literally since fire has been a factor of the natural environment from time immemorial. Nor should the statement be taken too seriously that leopards prey upon baboons,

help to preserve the balance of nature in favour of *Encephalartos*, and that by man's reduction of the leopard population, *Encephalartos* is in so much the greater danger.

In an article on South African Cycads, Dyer (1965) makes reference to the protection from fire afforded to the stem by the alternating series of persistent leaf-bases and scales. The importance of the woolly scale-leaves or stem bracts was passed without special comment. It has since been realized that without them the apex of the stem would become relatively exposed during the period of cone development and their maturity. During the lapse of time between the production of successive series of leaves, it is the scale-leaves which successfully protect the stem-apex from damage.

In modern times by far the greatest menace to the wild populations of *Encephalartos* is man. From all over the world has arisen an insatiable demand for sizable Cycads to place in cultivation. The demand is for those hardy specimens which have successfully withstood the ravages of fire, baboons and all other hazards. The cultivator usually consoles himself as having protectionist motivation. He fails to appreciate the fact that the thinning out of natural populations reduces proportionately the number of cones and consequently the chances of fertilization of the female cones that are produced in the wild.

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