

**FLORA
OF SOUTHERN AFRICA**

VOLUME I

EDITED BY

L. E. CODD

B. DE WINTER

AND

H. B. RYCROFT

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FLORA OF SOUTHERN AFRICA

which deals with the territories of

THE REPUBLIC OF SOUTH AFRICA, BASUTOLAND,
SWAZILAND AND SOUTH WEST AFRICA

VOLUME I

Edited by

L. E. CODD and B. DE WINTER

Botanical Research Institute,

Department of Agricultural Technical Services

and

H. B. RYCROFT

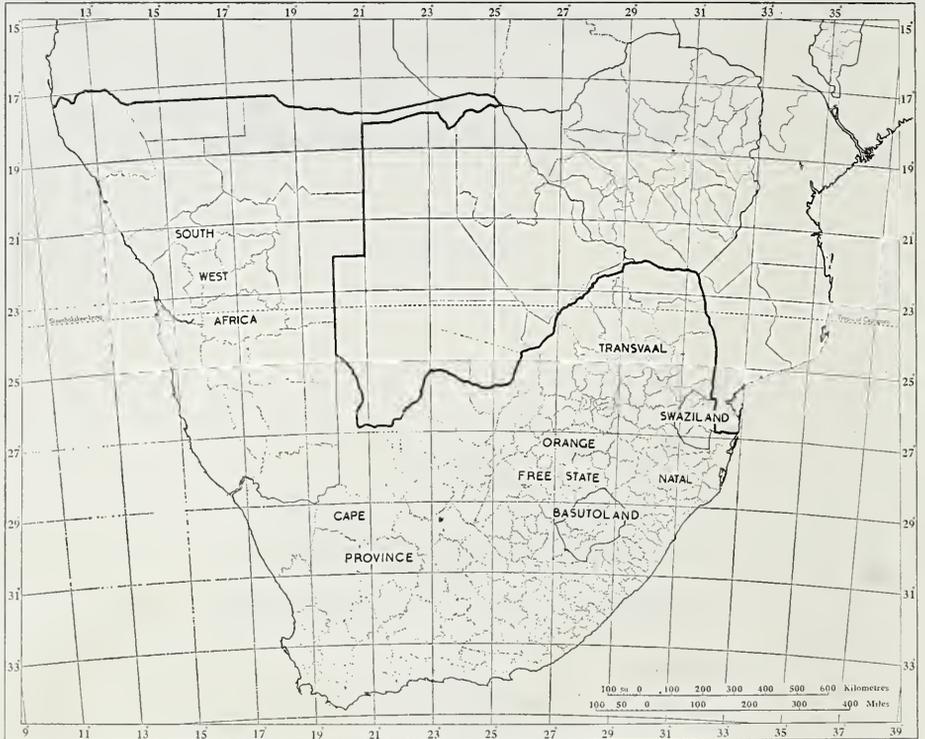
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THE TERRITORIES DEALT WITH IN THIS FLORA



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INTRODUCTION

THE second part of the Flora of Southern Africa to be published is Volume 1 of the planned series, as set out on pp. viii and ix. The first part to appear, Vol. 26 in the series, was published in 1963. No particular sequence of publication has been fixed and each volume is sent to press as it is completed, irrespective of its place in the proposed plan of the whole work.

For convenience the families are arranged on the lines of the Engler system, largely because the Flora is designed to be used in conjunction with the *Genera of South African Flowering Plants* by E. P. Phillips. The delimitation of families does not necessarily follow the latter work and modern trends may be accepted where such a procedure is considered justified. The genera are numbered in the Flora on the basis of the system published by De Dalla Torre and Harms in order to facilitate reference in Herbaria, such as those administered by the Botanical Research Institute, which have adopted this system of arranging their material.

Vol. 1 includes the Gymnosperms, the Typhaceae and the early families of water plants belonging to the Order Helobiae. The families in the Gymnosperms and Helobiae have been delimited on the lines that are now more or less generally accepted and deviate, in certain respects, from the treatment in the 2nd edition of Phillips's *Genera* (1951). A key to the families included in the Helobiae is, therefore, given on pp.

As in Vol. 26 (1963), the generally accepted abbreviations are used except in the following cases which appear frequently and are therefore considerably condensed:—

F.C.	Flora Capensis
F.T.A.	Flora of Tropical Africa
F.T.E.A.	Flora of Tropical East Africa
F.Z.	Flora Zambesiaca
I.C.B.N.	International Code of Botanical Nomenclature
Phill., Gen.	The Genera of South African Flowering Plants by E. P. Phillips, ed. 2 (1951)
Burt Davy, Fl. Transv.	Manual of the Flowering Plants and Ferns of the Transvaal and Swaziland, Vol 1 (1926) and Vol. 2 (1932).

As before, the abbreviation "l. c." is used for previously cited references, even though "op. cit." or "tom. cit." would in certain cases be more correct.

Magisterial districts are cited alphabetically in each Province and the intention is to follow the latest delimitations of districts except where they are very small when a more general term may be used, for example:—

Peninsula includes the Districts of Cape Town, Wynberg and Simonstown.

Reef includes the Districts of Roodepoort, Johannesburg, Germiston, Alberton, Kempton Park, Benoni, Brakpan and Springs.

The spelling of the names of some localities has been brought into line with the findings of the Committee on Standardisation of Place Names.

In the Index, synonyms are in *italics* and exotic species are signified by an asterisk*.

Although the name of Miss I. C. Verdoorn is not listed among the Editors of this work, it is a pleasure to acknowledge the great debt owed to her for her constant stimulus in furthering the progress of the work and for her careful scrutiny of the nomenclature and wording of the entire text. Others who have assisted the Editors in many ways are Dr. R. A. Dyer, former Chief of the Institute, Dr. D. J. B. Killick, Mrs. Obermeyer-Mauve and Mr. J. P. Jessop.

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STANGERIACEAE

by R. A. DYER

Plants dioecious with thick roots merging into simple or branched subterranean stems. *Stem* tuberous, with leaves from the apex of each stem or branch, alternating with series of small scale-like bracts. *Leaves* pinnate, 1–4 from each stem, somewhat fern-like, petiolate, deciduous; leaflets in several to many opposite or subopposite pairs, with a conspicuous midrib and dichotomously forked lateral veins. *Cones* with scales (sporophylls) arranged spirally, tightly imbricate upwards. *Male scales* with the pollen cells stipitate on the lower surface towards the base; pollen ellipsoidal. *Female scales* stalked with two ovules, one on either side and above the pedicel with the micropyle directed towards the cone axis; scale-head or bulla shield-like with incurved lateral lobes. *Seeds* with fleshy outer layer tightly adhering to the hard inner shell encasing the copious endosperm; cotyledons 2.

A monotypic family endemic in the eastern coastal region of South Africa.

In the past most workers have referred all living cycads to a single family. L. A. S. Johnson, in the Proceedings of the Linnaean Society of New South Wales 84 : 64 (1960), restricts the family Cycadaceae to the single genus *Cycas*. He creates the new family Stangeriaceae and resuscitates the family Zamiaceae for the remaining genera. Johnson's classification is supported by Kew and is followed here in the interests of a uniform nomenclature.

2

STANGERIA

Stangeria T. Moore in Hook., Journ. Bot. 5 : 228 (1853); J. Smith in Hook., *ibid* 6 : 88 (1854); Marloth, Fl. S. Afr. 1 : 97, t. 14, t. 63 (1913); Pilg. in Pflanzenr. 15 : 74 (1926); Schuster in Pflanzenr. 4, 1 : 103 (1932); Hutch. & Rattr. in F. C. 5, 2 (Suppl.) : 25 (1933); Phill., Gen. ed. 2 : 49 (1951); R. A. Dyer in Bothalia 8 : 429 (1965).

Description as for family.

A monotypic genus on the eastern border of South Africa; named in honour of Dr. William Stanger, who became Surveyor General of Natal.

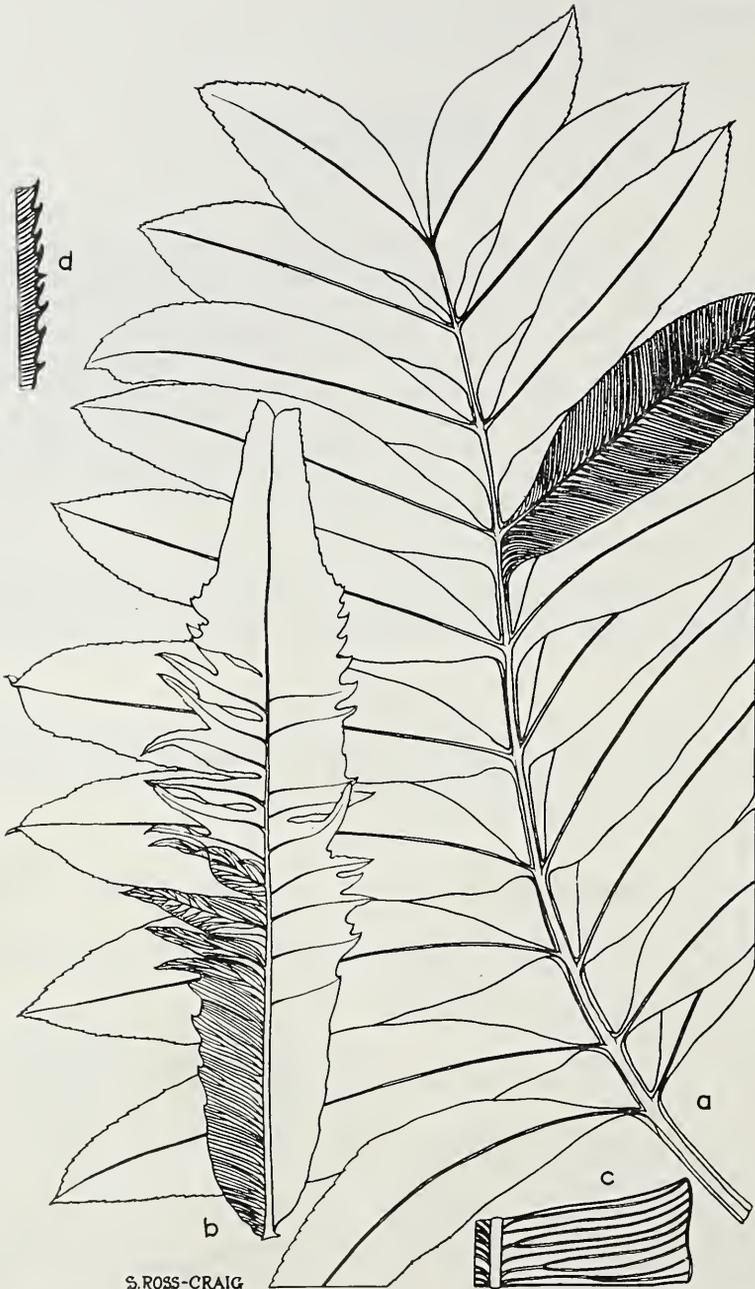
Stangeria eriopus (Kunze) Nash in Journ. New York Bot. Gard. 10 : 164, pl. 62 (1909); Hutch. & Rattr. in F. C. 5, 2 (Suppl.) : 26 (1933); R. A. Dyer in Bothalia 8 : 429 (1965). Type: eastern Cape, *Drege*.

Lomaria eriopus Kunze in Linnaea 13 : 152 (1839); 18 : 116 (1844). *L. coriacea* sensu Kunze in Linnaea 13 : 152 (1839).

Stangeria paradoxa T. Moore in Hook., Journ. Bot. 5 : 228 (1853); Hook. in Bot. Mag. t. 5121 (1859); Schuster in Pflanzenr. 4, 1 : 103; fig. 15 A–K (1932). Type: Natal, *Stanger* s.n. — var. *katzeri* (Regel) Marloth, Fl. S. Afr. 1 : 97, fig. 63 (1913); Schuster l.c. 105, fig. 15B, t. 3 (1932). — var. *schizodon* (Bull.) Marloth, l.c. pl. 14 (1913). — forma *schizodon* (Bull.) Schuster, l.c. 105, fig. 15C, t. 3 (1932). *S. schizodon* Bull., Cat. 1872 : 8 (1872). Type: Hort. *S. katzeri* Regel, Gartenfl. 23 : 163, t. 798

(1874). Type: Hort. *S. zeyheri* Stoneman, Plants and their Ways in S. Afr., fig. 214 (1915), nom. subnud.

Perennial herb with variously carrot-shaped main root or roots continuous with the main stem. *Stem* subterranean, tuberous, turnip-shaped, up to 10 cm diam., branched or unbranched, with ovate, early deciduous, woolly scales at the apex. *Leaves* pinnate, 1–4 from the apex of each stem or branch, extremely variable in size (according to ecological conditions), 25 cm–2 m tall, petiolate; petiole more or less equal to the length of the divided blade, grooved on upper side; leaflets in 5–20 pairs, opposite or subopposite, the lowermost shortly stalked, the uppermost



S. ROSS-CRAIG

FIG. 1.—*Stangeria eriopus*, a, typical leaf from open veld; b, leaflet from forest locality; c, portion of leaflet showing veins; d, margin of serrulate leaflet; much reduced except c and d (taken from F.C. 5, 2 (Suppl.) 1933.

connate and decurrent on the rhachis on the lower side, entire or serrulate to irregularly incised-lobate, elongate-lanceolate, acutely acuminate to rounded at apex, up to 40 cm long and 6 cm broad, glabrous. *Cones* solitary, silvery pubescent becoming brown tomentose, pedunculate. *Male cones* sub-cylindric, slender, tapered to the apex, 10–15 cm long and up to 3 cm diam., with numerous spirals of scales closely imbricate upwards; scales glabrescent, broadly triangular or rhomboid; bulla face curved upwards with sharp teeth on margin. *Female cones* elliptic-ovoid, up to 18 cm long, 8 cm diam.; scales stalked; bulla with slightly convex peltate face, imbricate upward, irregularly toothed on margin. *Seed* red, up to 3.5 cm long, 2.5 cm diam., angled by compression, with fleshy covering adhering firmly to the thin hard inner coat encasing the copious endosperm. Fig. 1.

In coastal grassveld and forest from Bathurst District in the eastern Cape to northern Natal (Zululand) near Kosi Bay.

CAPE.—Bathurst: *MacOwan* 2000; *Dyer* 4836. East London: *Galpin* 7366; *Dyer* 4528. Kentani: *Pegler* 262; 1247; *Flanagan* 1118; *Dyer* 4514; 4516. Port St. Johns: *Galpin* 2849.

NATAL.—Port Shepstone: *Mogg* 13906; *McClellan* 352. Umzinto: *Hilliard* 3121. Pinetown: *Strey* 3852; *Bruce* 151. Mtunzini: *Codd & Dyer* 2818. Eshowe: *Acocks* 12970. Ingwavuma: *Ward* 3717; *Vahrmeijer & Tölken* 995.

This plant was originally confused with a fern as the synonymy shows. The tall graceful leaves produced by plants within forests are very different from the relatively small hard ones characteristic of plants in open grassveld. It does not seem possible to draw a clear line of distinction between the forms, which fact makes it unsatisfactory to distinguish taxa of varietal rank. The tuberous rootstock is regarded as all underground stem by some writers but the basal portion is a tuberous root which develops rapidly in the seedling stage. The transitional area between stem and root is not readily detected. The stem portion may occasionally branch into nearly a dozen heads, each of which may produce a cone at the same time.

ZAMIACEAE

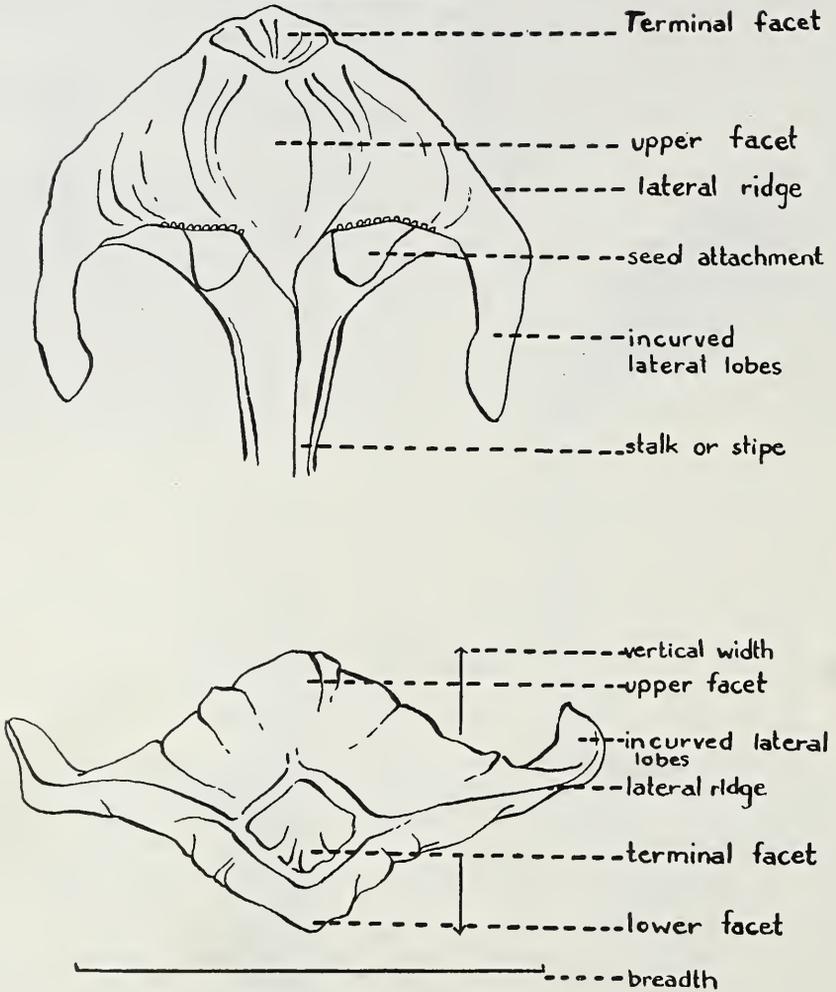
by R. A. DYER and I. C. VERDOORN

Plants dioecious, with subterranean or aerial stems. *Stem* protected by persistent leaf-bases, fibrous round the circumference and with central fibrous pith, branched or unbranched from the base, rarely above, with a few to many leaves produced from the apex of the stems and alternating with series of ovate to lanceolate woolly bracts. *Leaves* pinnate, palm-like. *Cones* with male and female scales (sporophylls) spirally arranged, 1–several produced at the apex of the stems. *Male scales* with the pollen cells produced densely or in groups on the basal part of the lower surface. *Female scales* very closely packed and persisting on the cones for several months, pedicellate with an enlarged peltate head (bulla); bulla with incurved lateral lobes and from the inner surface, one on either side above the pedicel, are produced 2 ovules with the micropyle directed towards the axis of the cone. *Seeds* with fleshy covering, oblong in outline, angled by compression, with a thin hard globose or ovoid inner shell encasing the copious endosperm; cotyledons 2.

Restored to family rank by Johnson in Proc. Linn. Soc. New S. Wales 84 (1960). See note under Stangeriaceae.

Genera 8, scattered mainly in the southern hemisphere in tropical, subtropical and temperate America, Australia and Africa; only one, *Encephalartos*, occurs in Southern Africa.

Adaxial view of
female cone scale



ALEIDA V. D. MERWE

FIG. 2—Main features of *Encephalartos* female cone scales.

5

ENCEPHALARTOS

Encephalartos *Lehm.* in *Pugill.* 6 : 3, t.1-5 (1834); De Vriese in *Tydsch. Nat. Gesch.* 4 : 411 (1838); *Miq.*, *Monogr. Cycad.* 39 (1842); *De Cycad. Loddig.* (1842); *Linnaea* 17 : 709 (1843); *A.D.C.* in *DC.*, *Prod.* 16, 2 : 530 (1868); *Ed. Gard. Chron.* 401 (1875); *Pearson* in *Trans. S. Afr. Phil. Soc.* 16 : 345 (1906); *Marloth, Fl. S. Afr.* 1 : 99 (1913); *Pearson* in *Journ. Bot. Soc. S. Afr.* 2 : 7 (1916); *Chamberlain, The Living Cycads* 45 (1919); *Pilg.* in *Pflanzenfam.* 13 : 78 (1926); *Burt* *Davy* in *Fl. Transv.* 1 : 39; 98 (1926); *Schuster* in *Pflanzenr.* 4, 1 : 105 (1932); *Hutch. & Rattr.* in *F.C.* 5, 2 (Suppl.) : 28 (1933); *M. R. Henderson* in *Journ. Bot. Soc. S. Afr.* 29 : 6 (1943); *Journ. S. Afr. Bot.* 11 : 5 (1945); *Phill.*, *Gen. ed.* 2 : 49 (1951); *Verdoorn* in *Afr. Wild Life* 5 : 153 (1951); *Trees in S. Afr.* 8 : 3 (1956); *Melville* in *Kew Bull.* 1957 : 237 (1957); *Thieret* in *Economic Bot.* 12 : 3 (1958), partly; *Verdoorn* in *Trees in S. Afr.* 14 : 50 (1962); *Whiting* in *Economic Bot.* 17 : 271 (1963), partly; *Third Conference on the Tox. Cycads, Federation Proceed.* 23 : No. 6, pt. 1 (1964), partly; *Dyer* in *Bothalia* 8 : 432 (1965).

Plants dioecious with main root or roots tuberous. *Stem* unbranched or branched from the base, rarely branched above and then largely due to injury, subterranean or aerial, occasionally up to 10 m tall, covered by alternating series of woolly bracts and persistent swollen truncated leaf bases (pulvini). *Leaves* arising from the apex of the stems, spirally arranged, persisting 2-several years, petiolate, pinnate with a straight or curved rachis; leaflets pungent-pointed, entire, toothed or lobed on one or both margins, reduced in size towards base of rachis, sometimes to prickles, with longitudinal parallel venation and no midrib; leaflets of seedlings of all species with several teeth round apex. *Cones* 1-5, sometimes more, from near or round apex of stem, glabrous to densely woolly, pedunculate; peduncle of male cones somewhat longer than those of the female cones in the same species. *Male cones* subcylindric; scales densely packed in many spiral rows, terminating in a sterile truncate apex or beak; pollen cells in dense clusters on the basal portion of lower surface. *Female cones* cylindrical to oval, broader than the male; scales tightly packed, stalked, bearing 2 collateral ovules arising from the inner surface and lying along the upper side of the stalk, with an enlarged peltate head (bullae); bulla face flat or somewhat protruding and with lateral ridges extending into the incurved lateral lobes, having in the main an upper, lower and terminal facet. *Seed* red, yellow, amber or brownish with age, fleshy, oblong, angled by compression, with apical fleshy end variable in length, with a thin hard globose or oblong-ovoid inner shell encasing the copious endosperm, having a long maturing period on the cone whether fertile or not. *Fig.* 2.

Widely distributed on the African Continent but absent from South West Africa, western Cape, O.F.S. and Basutoland; 35 species are recognised, 26 of which occur in Southern Africa. The Latin name is derived from the common name Bread Tree or Broodboom, referring to the making of bread by the Hottentots and Bantu from the starchy pith within the trunks.

Cycas revoluta Thunb. from the East, which is found occasionally in cultivation in South Africa, and *C. thourasii* R.Br., which occurs naturally along the Mozambique coast, could be mistaken for species of *Encephalartos*. They are readily distinguished by a mid-rib in the leaflets and by the branched female inflorescence which is not cone-like.

In citing literature, where there is no reason to disagree with the references given by Hutchinson and Rattray in *Fl. Cap.* 5, 2 (Suppl.) 1933, these have frequently been omitted.

Leaflets 2-4 mm broad, 8-14 cm long, linear, entire with revolute margins, dark green; crown of stem brown woolly; cones 2-5 together, densely woolly; male cone scales on stipe 1-1.5 cm long 1. *ghellinckii*
Leaflets 4 mm or more broad, margins usually thickened and sometimes recurved but not revolute:

Leaflets towards the base of the petiole deflexed in relation to the rachis, the basal leaflets reduced to a short or long series of prickles, those about the middle of the rachis spreading at right angles to the axis and recurving, 14-21 cm long, 8-13 mm broad, linear, attenuate, 13-21-veined on the under surface and glaucous (silvery or bluish) on under surface when young, stems branched from the base, up to 2 m long, rarely longer; face of male cone scales moderately greyish pubescent

..... 7. *inopinus*

- Leaflets spreading at right angles or ascending in relation to the axis of the rhachis (none deflexed), glaucous or green:
- Leaflets 4–8 mm broad, linear, entire, glaucous or somewhat silvery when young, sometimes yellowish with age, rarely reduced to more than one prickle at base, venation conspicuous on under surface; cones densely woolly or only moderately so in *E. laevifolius*, seeds light brown or brown-madder to ochre-yellow:
- Cones with dense woolly covering:
- Stems well developed above ground:
- Stem crown conspicuously and rather persistently brown woolly; trunk 35–60 cm diam., up to 3 m or more tall; cones 3–several together; median leaflets 10–17 cm long and about 7 mm broad, 7–9-nerved on under surface.3. *friderici-guilielmi*
- Stem crown not conspicuously brown-woolly, trunk rarely up to 30 cm diam. and not often up to 2 m tall:
- Median leaflets 9–13 cm long, 4–5 mm broad, 5–6-nerved on under surface; margin somewhat recurved; cones often single.2. *cydadifolius*
- Median leaflets 10–13 cm long, 6–8 mm broad, finely 10–14-nerved on under surface, flat; cones 1–4 together.4. *lanatus*
- Stems rarely up to 20 cm above ground, forming dwarf branched clumps; cones single; median leaflets 9–13 cm long, 4–6 mm broad, finely about 9-nerved on under surface.5. *humilis*
- Cones with short greyish tomentum, not conspicuously woolly; median leaflets up to about 12 cm long, 5–7 mm broad, 10–12-nerved on under surface; trunk 1–3 m tall, rarely more than 30 cm diam.6. *laevifolius*
- Leaflets 1 cm or more broad, if less than 1 cm broad then bright green not glaucous; margins entire or toothed; cones glabrous or apical part of scale face with reddish or brownish hairs:
- †Stems usually well developed above ground, if subterranean then leaves glaucous as in *E. horridus*:
- Leaves glaucous with bluish bloom when young and persisting so for several months at least, contrasting with the old leaves:
- Leaves positively glaucous when young, leaflets rarely reduced to more than one prickle at base, median leaflets usually less than 2.5 cm broad:
- Median leaflets mainly entire or occasionally with 1 or 2 teeth on lower margin:
- Leaves slightly or markedly incurved near the tip; female cone-scales with slightly rugose face.8. *eugene-maraisii*
- Leaves slightly or markedly recurved towards tip:
- Female cone-scales with irregularly warty face, the pulvinus of petiole often partly hidden by stem bracts, leaves often pilose when young, leaflets usually overlapping above middle of rhachis.9. *princeps*
- Female cone scales with smooth or slightly rugose face, pulvinus of petiole exposed and prominent, with brown collar, leaves glabrous, leaflets often not overlapping.10. *lehnmannii*
- Median leaflets, some or most, with 1–3 spine-tipped lobes on the lower margin, glabrous:
- Stems mainly above ground; median leaflets 1.5–2.5 cm broad, some or all with 1 or 2 spine-tipped lobes on lower margin, and lobes sometimes twisted out of the plane of the leaflet; female cone scales yellowish-green, rugose on face with the lateral incurved lobes 2–3 cm long.11. *trispinosus*
- Stems mainly subterranean, occasionally up to 45 cm tall, rarely taller, median leaflets rarely less than 2.5 cm broad, deeply 1- or 2-lobed on lower margin and lobes twisted out of plane of the leaflets, female cone scales blackish or reddish-brown, ridged towards terminal facet but otherwise with a fairly smooth face, with the lateral incurved lobes about 1 cm long.12. *horridus*
- Leaves light or medium green, faintly glaucous; median leaflets usually more than 2.5 cm broad, lower margin with 3 or occasionally 4 spine-tipped lobes.13. *arenarius*
- Leaves light or dark green, with or without prickles or lobes along one or both margins, not glaucous except sometimes in young stage of *E. longifolius* and *E. arenarius*:
- Lower margin of median leaflets with 2–4 triangular pungent lobes, upper margin without lobes or teeth:
- Leaves medium green, faintly glaucous, glabrous; leaflets not prominently veined on under surface.13. *arenarius*
- Leaves dark green, finely pubescent when young, rigid, leaflets prominently veined on under surface.14. *latifrons*
- Lower and upper margin of median leaflets entire or with one or more prickles or teeth:
- Leaflets reduced in size towards base of rhachis but not to more than one or exceptionally 2 prickles:

- Leaves 1-1.5 m long, suberect-spreading and recurved or arcuate in the upper half; leaflets dark green often with bluish lustre and sometimes glaucous when young, finely pubescent when young, median ones mainly oblong-lanceolate, up to 20 cm long and 4 cm broad, generally overlapping on upper half of rhachis, margins not or sparingly toothed. 15. *longifolius*
- Leaves 1-1.5 m long, nearly straight; leaflets bright green, median ones oblong-lanceolate to lanceolate up to 15 cm long and 2.5 cm broad, rarely overlapping, variably toothed on margins; incurved lateral lobes of female cone scales lacerate-winged, about 3 cm long and extending nearly to axis. 16. *altensteinii*
- Leaflets reduced to several or many prickles towards base of rhachis:
- Leaflets with a single terminal spine or point, broadest below or occasionally near middle:
- Leaflets often showing veins on lower surface but not in regular raised formation:
- Leaflets spreading and straight from the rhachis, stems often branched from base, rarely up to 7 m tall:
- Leaves curved, bow-shaped giving an umbrella-like canopy; median leaflets dark green, more or less ovate-lanceolate, up to 20 cm long and 5 cm broad. 17. *woodii*
- Leaves spreading, straight or slightly curved in the upper third:
- Median leaflets lanceolate to ovate-lanceolate, 16-23 cm long, 2.5-4.5 cm broad; face of female cone-scales with prominent blunt rugosities; incurved lateral lobes toothed or laciniate, 2-3 cm long. 18. *natalensis*
- Median leaflets mainly narrowly lanceolate, 12-17 cm long, 1.2-2.2 cm broad; face of female cone-scales without prominent excrescences; incurved lateral lobes, laciniate, about 1.8 cm long. 19. *lebomboensis*
- Leaflets spreading-recurved from rhachis, lanceolate to ovate-lanceolate, sometimes falcate, 10-20 cm long, 2-3.5 cm broad; stems rarely branched, many over 6 m tall. 20. *transvenosus*
- Leaflets with about 20 regular conspicuously raised longitudinal veins on lower surface, median leaflets linear-lanceolate, straight or somewhat falcate, 15-25 cm long, 2-3 cm broad, rarely more. 21. *paucidentatus*
- Leaflets with 3-5 almost equal pungent lobes at the end, usually 3-4 cm broad, broadest above or sometimes near middle, slightly narrowed to the base; cones salmon or shrimp-pink to scarlet. 22. *ferox*
- ††Stems dwarf, subterranean or rarely up to 20 cm exposed above ground, unbranched or sometimes branched; leaflets light or dark green, not glaucous, linear, or linear-lanceolate, with or without marginal teeth:
- Leaflets reduced to many prickles towards base of petiole, median ones averaging 15-20 cm long, usually with one or two prickles on both margins; female cone scales with the terminal facet extending almost to the basal margin of the bulla face or overlapping slightly the scale below; male cones 6.5-12 cm diam. 23. *villosus*
- Leaflets reduced to one or two prickles at the base or sometimes none:
- Leaflets, some or nearly all with one or two prickles on the margins, average length 12-14 cm, occasionally up to 30 cm, 8-15 mm broad, female cone scales with terminal facet generally slightly below central, rarely overlapping scale below, male cones 6-8 cm diam. 24. *umbeluziensis*
- Leaflets (except on juvenile plants) entire or with 1-3 small teeth on lower margin, average length 6-8 cm long, 8-11 mm broad:
- Female cone scales with terminal facet on the face indistinct and with the lower margin as low as or slightly overlapping the scale below; male cones less than 8 cm diam.; median leaflets usually toothed on lower margin (Natal). 25. *ngoyanus*
- Female cone scales with terminal facet on the face distinct, not extending to basal margin; male cones 6-11 cm diam.; median leaflets usually without prickles on lower margin (Cape). 26. *caffer*

1. *Encephalartos ghellinckii* Lem., Illustr. Hort. 14 Miscell. 80 (1867); Illustr. Hort. 15, pl.567 (1868); Hutch. & Rattr. in F.C. 5, 2 (Suppl.): 43 (1933); M.R. Henderson in Journ. S. Afr. Bot. 11 : 57 (1945); R. A. Dyer in Bothalia 8 : 437 (1965). Type: Hort. Verschaffelt, no specimen traced, but tab. in Illustr. Hort. 15, pl.567 (1868) adequate;

probably originated from Natal, see R. A. Dyer in Journ. S. Afr. Bot. 31 : 120 (1965).
Zamia ghellinckii Hort. ex Lem., l.c.
Encephalartos gracilis G. Henderson, Ill. Dict. Gard. Suppl. 341 (1900), nomen.

Plant unbranched or branched from the base; stems up to about 3 m tall, rarely up to

3.5 m and then usually leaning; 30–40 cm diam., with brown woolly crown. *Leaves* up to 1 m long, including petiole 25 cm long, at first densely greyish tomentose, glabrescent except for brown silky-tomentose pulvinus; rhachis stiff, slender, straight or spreading-upcurved and sometimes somewhat twisted, yellowish; leaflets spreading-reflexed, dense above middle of rhachis, more spaced and reduced in size towards its base, with thickened entire revolute margins and generally inconspicuous venation which may be more evident on upper surface than lower; median leaflets 8–14 cm long, 2–4 mm broad, pungent-tipped. *Cones* 2–5 together, on short stout peduncles, densely covered with matted brownish tomentum. *Male cone* cylindrical, curved, about 25 cm long, 6–7 cm diam., narrowed slightly to both ends, median scales thin, broadly obcordate, 2–2.5 cm long, 3–3.5 cm broad, on slender stalk (stipe) 1–1.5 cm long; bulla face 2 cm broad and 1 cm thick vertically, very little projecting, with acute lateral wings, upper and lower facets rounded or slightly humped, terminal facet concave, about 7 mm broad and 3 mm wide vertically. *Female cone* barrel-shaped, up to about 22 cm long and 14 cm diam.; median scales about 4 cm long, 4–2.6 cm broad and 2.5–3 cm thick vertically, with short recurved lateral lobes; bulla face woolly, only slightly projecting, nearly flat. *Seed* golden-yellow, about 2.5 cm long and as broad or broader.

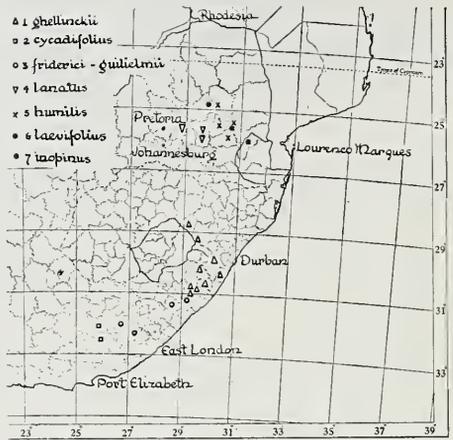
On the southern foothills of the Drakensberg in the eastern Cape and from 2,000 ft altitude in southern Natal to higher altitudes northwards along the mountain range as far as Mont-aux-Sources; occasionally in fair abundance. Map. 1.

CAPE.—Flagstaff: *McLoughlin* 513a; *Verdoorn & Christian* 712; 712a. Tabankulu: *Acocks* 12259. Mt. Ayliff: *Smith* 6833.

NATAL.—Port Shepstone: *Strey* 5878. Umzinto: *Wood* 13055. Richmond: *Hilliard* 3145. Estcourt: *Symons* 498; *Dyer* 4771. Bergville: *Hutchinson, Forbes & Verdoorn* 48; *Galpin* 9648; *Dohse* 72; *Dyer & Codd* 4784.

This species is readily distinguished from all others of the genus by its narrow leaflets with recurved margins. In leaf characters it resembles species of *Cycas* in the family Cycadaceae, which differ in having a midrib in the leaflets. The leaflets of specimens from the Drakensberg seem on the average to be slightly broader and with less recurved margins than those farther south from lower altitudes toward the coast.

2. *Encephalartos cycadifolius* (*Jacq.*) *Lehm.*, *Pugill.* 6 : 13 (1834); *Miq.*, *Monogr.*



MAP 1.—Distribution map of *Encephalartos ghellinckii*, *E. cycadifolius*, *E. friderici-guilielmi*, *E. lanatus*, *E. humilis*, *E. laevifolius* and *E. inopinus*.

Cycad. 43 (1842); *Schuster in Pflanzenz.* 4, 1 : 108 (1932), in part; *Hutch. & Rattr.* in *F.C.* 5, 2 (Suppl.) : 42 (1933), for the lesser part, excluding citations; *M.R. Henderson in Journ. S. Afr. Bot.* 11 : 50 (1945), for the lesser part, excluding most citations; *R. A. Dyer in Bothalia* 8 : 439 (1965). Type: Cape, without locality, the illustration in *Jacq.*, *Fragm.* 27, t.26 (1801), from a plant cultivated in Vienna, leg. *Scholl*; see *R. A. Dyer in Journ. S. Afr. Bot.* 31 : 116 (1965).

Zamia cycadifolia *Jacq.*, *Fragm.* 27, t.26 (1801); (it is doubtful if t.25 is from the same species).

Encephalartos eximius *Verdoorn in Bothalia* 6 : 426 (1954). Type: Cape, Bedford, *Story* 4021 (PRE, holo.).

Plants branching from the base; stems up to about 60 cm tall, rarely 90 cm and about 25 cm diam.; bracts about 3 cm long and 2.5 cm broad at base, tomentose on outer surface. *Leaves* about 60–90 cm long including petiole 10–20 cm long, woolly and with some long straight hairs when young, glabrescent except for densely greyish tomentose pulvinus; rhachis fairly stiff, suberect sometimes slightly twisted; leaflets somewhat glaucous when young, pungent-tipped, upper ones spreading from the rhachis horizontally or forming a wide V, not or only slightly overlapping, reduced gradually in size to base and apex of

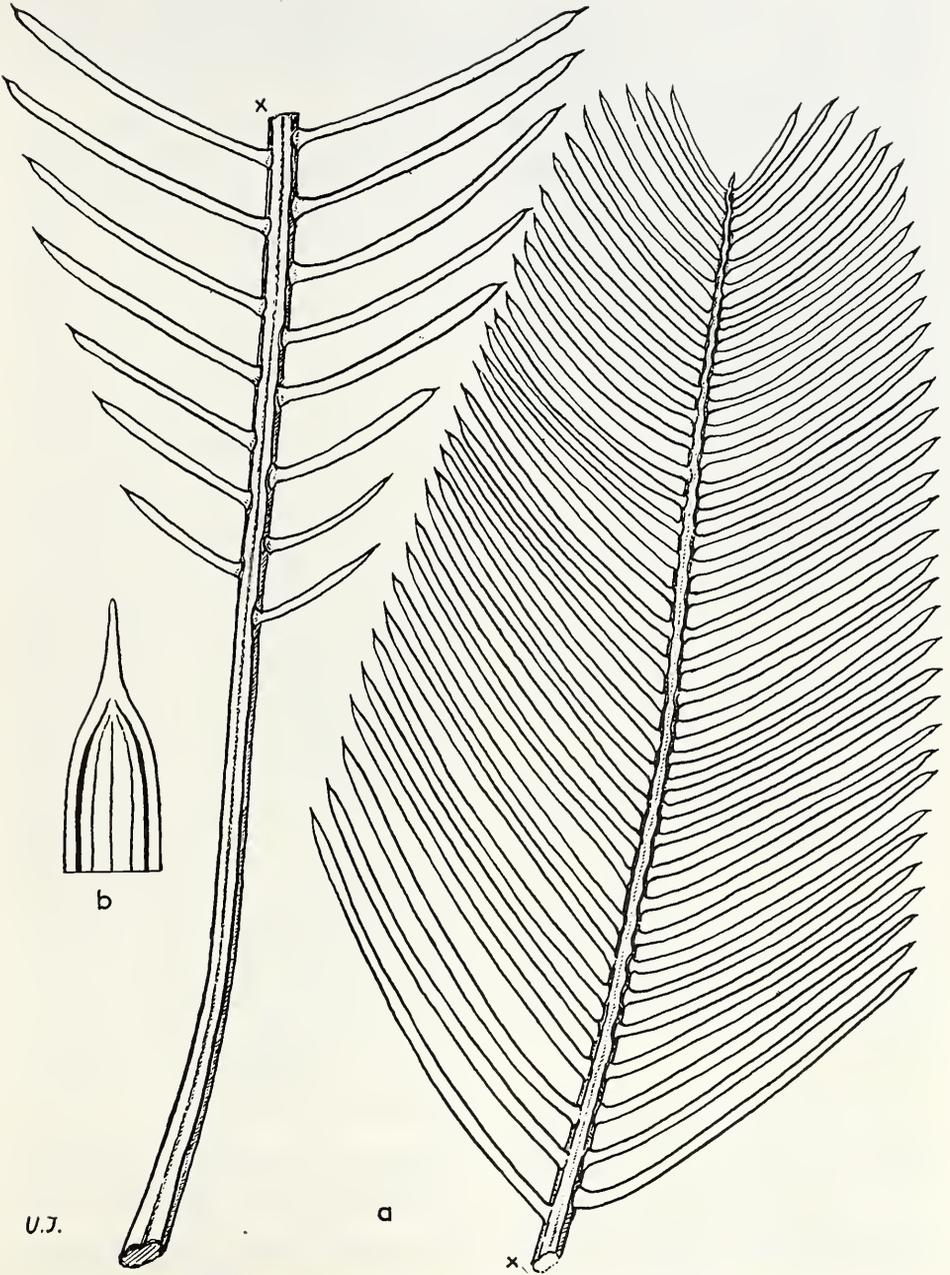


FIG. 3.—*Encephalartos cycadifolius*, a, typical leaf reduced; b, tip of leaflet, enlarged (Dyer 5333).

rhachis; median leaflets 9–13 cm long, 4–5 mm broad, entire, with thickened slightly recurved margins and with 5–6 prominent sparsely pilose nerves on under surface. *Cones* 1 or 2 from a stem on short fairly stout peduncles subtended by narrow dorsally tomentose bracts 2–7 cm long, densely tawny or off-white tomentose. *Male cones* subcylindric, 13–22 cm long, 4.5–7 cm diam., narrowing slightly to the base and rounded apex; median scales about 2 cm long, 1.8 cm broad, with lateral ridges; bulla face (with tomentum) 1–2 cm broad and 5–8 mm wide vertically, but only about 2 mm thick vertically without tomentum. *Female cones* more or less oblong in outline with rounded apex, 20–30 cm long, 16–18 cm diam.; median scales 4–4.5 cm long and 4 cm broad; bulla about 3–4 cm broad and 1.5–2 cm thick vertically, with incurved lateral lobes up to 1 cm long, yellowish, with acute lateral ridges, upper and lower facets more or less rounded; terminal facet about 2 cm broad and 1.25–1.5 cm wide vertically. *Seeds* pale orange-yellow through salmon-suffused orange to amber-brown, about 3 cm long and 1.75–2 cm broad. Fig. 3.

Restricted to a few areas on the Winterberg in the districts of Bedford and Cradock. Map 1.

CAPE.—Bedford: *Story* 4013; 4017; 4018; 4019; 4021; 4022; 4023; 4548; *Dyer* 5331; 5333. Cradock: *Acocks* (photo); *Marloth* 2151.

Specimens of *E. friderici-guilielmi* from Queenstown and Cathcart districts have been confused with this species at various times but the former is more robust and has the leaflets more densely spaced. The problems are discussed in the Journ. S.Afr. Bot. 31 : 116 (1955).

As regards the date of publication of *Zamia cycadifolia* Jacq., *Z. horrida* Jacq. and *Z. longifolia* Jacq., Mr. A. A. Bullock of Kew has supplied the following information: "The *Fragmenta* seem to have been published in fascicles and the accepted dates are as follows: The preface, p. 2, indicates publication of fascicle one, some time after March 1800 and König & Sims, Ann. Bot. 1 : 64, give 1801 for fascicles 1 & 2, pp. 1–34, tt. 1–37. Other fascicles are indicated in the text".

3. *Encephalartos friderici-guilielmi* *Lehm.*, Pugill. 6 : 8, t. 1, 2 & 3 (1834); Miq., Monogr. Cycad. 44 (1842); R. A. Dyer in Journ. S. Afr. Bot. 31 : 117 (1965); *Bothalia* 8 : 442 (1965). Type: Cape, eastern area, *Ecklon* & *Zeyher*.

E. acanthus Mast. in Gard. Chron. 11 : 810 (1878); Thistelton-Dyer in Gard. Chron. 11 : 11 (1879). Type: Hort. Bull., Cape, probably Queenstown.

E. cycadifolius sensu Auct., Schuster in Pflanzenz., 4, 1 : 108 (1932) partly; Hutch. & Rattr. in F.C. 5, 2 (Suppl.): 42 (1932) partly; M. R. Henderson in Journ. S. Afr. Bot. 11 : 50 (1945) partly, as to Queenstown and Cathcart specimens etc.

Plant unbranched or branched from the base; stems stout, up to about 4 m tall, 35–60 cm diam., eventually leaning or procumbent with age, with open densely brown woolly crown; interseriate bracts linear-lanceolate, up to 14 cm long, densely woolly on outer surface. *Leaves* 1–1.2 m long including petiole about 30 cm long, undersurface of rhachis and margins of leaflets loosely whitish woolly when young, glabrescent, with pulvinus persistently woolly; rhachis fairly stiff, straight or recurved, often spreading more than crown when stem has cones; leaflets somewhat glaucous when young, closely spaced and overlapping in the upper half of leaf and in V disposition, linear, shortly narrowed to an amber, dark brown or black pungent apex, with entire thickened margins, and with the basal ones reduced in size, but not to prickles; median leaflets 10–17 cm long and about 7 mm broad, with 7–9 prominent nerves on the lower surface. *Cones* 3–several together (up to 10 on large male stems) on short stout peduncles, and with a dense yellowish-grey to brownish woolly covering. *Male cones* cylindric, curved, 20–30 cm long, 6–7 cm diam.; median scales about 2.5–2.8 cm long and 2 cm broad with beak projecting about 5 mm beyond sporangial margin and turned slightly upwards; bulla face terminating in a narrow blunt facet under the woolly covering. *Female cones* more or less oblong in outline with rounded apex, 25–30 cm long and 15–17 cm diam.; median scales 4.5–5 cm long; the bulla about 4.5 cm broad and 2.5 cm thick vertically, with short incurved lateral lobes 6–8 mm long; bulla face pale canary-yellow under the wool, elliptic-rhomboid with more or less acute lateral ridges; upper and lower facets broadly rounded, terminal facet flattened, about 1 cm broad and 5 mm wide vertically. *Seeds* pale yellow to pale orange-yellow, 3 cm long and 2 cm diam., angled by compression. Fig. 4.

Locally frequent on mountain sides near Cathcart and Queenstown, extending eastwards to the neighbourhood of Kokstad; the more westerly records are almost certainly incorrect. Map 1.

CAPE.—Cathcart: *Acocks* 10999; *Story* 2800; *Codd* 6356; *Dyer* 5791; *Comins* 1841. Queens-

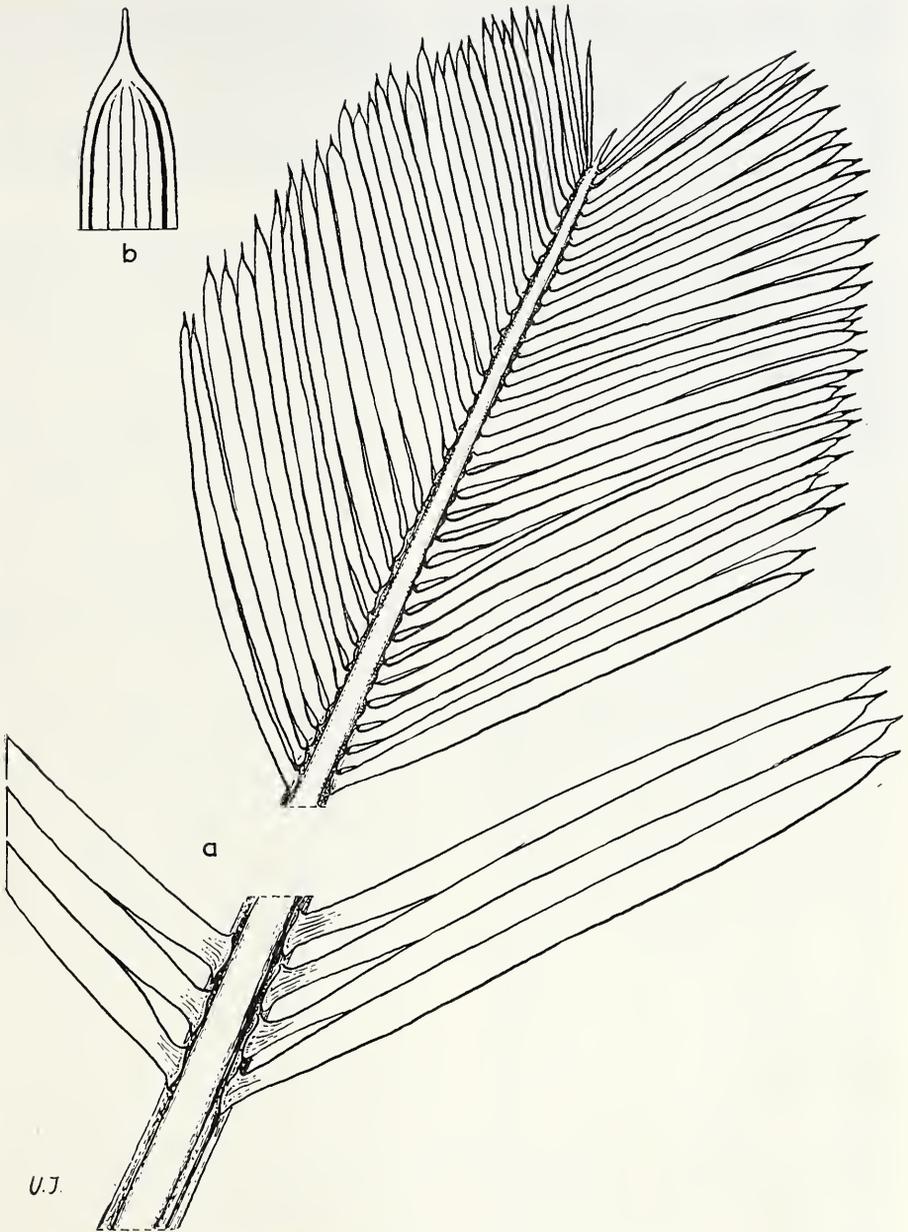


FIG. 4.—*Encephalartos friderici-guilielmi*, a, portions of typical leaf, reduced; b, tip of leaflet, enlarged (Everitt PRE 29909).

town: Galpin 1525; 18411; Dyer 5790a; Acocks 18857. Tsolo: Verdoorn & Christian 711; Dyer 4712. Tabankulu: Story 4213.

At different times this species has been confused with *E. cycadifolius* Lehm., which, however, is a smaller plant with more widely spaced leaflets. A discussion of the problem will be found in the Journ. S. Afr. Bot. 31 : 116. In Proc. Linn. Soc. New S. Wales 84 : 107 (1959), Johnson points out that the epithet *pauli-guilielmi* is a direct Latin genitive and the terminal "i" should not be doubled, which rule applies also in the present case.

4. *Encephalartos lanatus* Stapf & Burtt Davy in Fl. Transv. 1 : 40, 99, fig. 4D (1926); Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 43 (1933) partly, as to specimens from Middelburg district (excluding syn. *E. laevifolius*); M. R. Henderson in Journ. S. Afr. Bot. 11 : 52 (1945) partly, as to specimens from Middelburg district. R. A. Dyer in Bothalia 8 : 445 (1965). Type: Transvaal, Middelburg, Weeber H.6471 (K ex PRE, holo.).

Plants unbranched or sometimes branched from the base; stems up to about 1 m tall and only very rarely up to 3 m long and reclining, up to about 25 cm diam., with densely grey woolly bracts. *Leaves* 6-1 m long, including petiole 20-25 cm long, white or grey woolly when young except under surface of leaflets, glabrescent except base of petiole and pulvinus; rhachis recurved and often slightly twisted; leaflets glaucous when young, entire, pungent, set in V formation above middle of rhachis and usually overlapping, reduced in size to base and apex of rhachis; median leaflets 10-13 cm long, 6-8 mm broad, finely 10-14-nerved on under surface. *Cones* 1-4 together on short peduncles, covered by a dense light cream to greyish tomentum. *Male cones* subcylindric, 25-30 cm long, 5-6 cm diam., narrowed to both ends; median scales about 2.3 cm long and 2.5-3.2 cm broad, with lateral ridges; bulla face flattened, about 2.5 cm broad and 1.5 cm wide vertically (with tomentum). *Female cones* oblong in outline, 25-35 cm long, 12-15 cm diam., slightly narrowed to rounded apex and base; median scales 3-3.5 cm long; bulla 4.3-5 cm broad, 2.5-2.7 cm thick vertically, with incurved lateral lobes about 5 mm long, with acute lateral ridges; bulla with base glabrous, yellow or greenish-yellow, upper and lower facets woolly, rounded, terminal facet indistinct, about 1.5 cm diam. *Seeds* yellow, oblong-orbicular, 2.5-3 cm long, 2.25-2.5 cm broad with scanty pulp.

In sheltered valleys of the upper reaches of the Olifants River catchment in the Middelburg, Witbank and Bronkhorstspuit districts, sometimes common locally. Map 1.

TRANSVAAL.—Middelburg: Weeber H.6471; Pole Evans H.11427; Marloth 11748; Verdoorn 2143; 2144; 2145; 2146; 2467; Dyer & Verdoorn 4411; Codd & Verdoorn 10106. Bronkhorstspuit: Dyer photographs; Verdoorn 2259; Van Ryneveld in PRE 29803.

The key and descriptions reveal the distinguishing characters between this and the two species *E. humilis* Verdoorn and *E. laevifolius* Stapf & Burtt Davy, both of which have been confused with it. Both these latter are restricted to the catchment area of the Crocodile River while *E. lanatus* is restricted to that of the upper reaches of the Olifants River including the Wilge River and other tributaries.

5. *Encephalartos humilis* Verdoorn in Bothalia 6 : 220, pl.3, 241 (1951); R. A. Dyer in Bothalia 8 : 448 (1965). Type: Transvaal, Nelspruit, Dyer 4806 (PRE, holo.).

Plant dwarf, branching freely from the parent rootstock forming small clumps; stems subterranean or very occasionally up to about 30 cm above ground with a total length of 35 cm rarely up to 50 cm, 13-18 cm diam. with short lanate bracts. *Leaves* 30-50 cm long including petiole 5-15 cm long, loosely greyish tomentose with villous leaflets, glabrescent except for base of petiole and pulvinus; rhachis usually somewhat recurved and sometimes slightly twisted towards apex; leaflets glaucous when young, in V disposition above the middle of the rhachis and sometimes slightly overlapping, set parallel or only slightly angled to the rhachis, pungent, entire; median leaflets 9-13 cm long, 4-6 mm broad, finely about 9-nerved on the under surface. *Cones* single on a stem, densely greyish tomentose on exposed face. *Male cones* 15-20 cm long, 4-5 cm broad, narrowed slightly to base and apex with peduncle up to about 12 cm long; median scales about 1.5 cm long and 2 cm broad, 1.5-1.75 cm thick vertically, with lateral angles acute; bulla face very little projected, with terminal facet occupying almost whole area, hidden by tomentum. *Female cones* barrel-shaped, about 27 cm long, 9 cm diam., on short peduncle about 3 cm long; median scale 3.5-4 cm long, 4-5 cm broad, 2-2.5 cm thick vertically; bulla with lateral ridges extending into the lateral incurved lobes about 5-10 mm long, rugose on basal glabrous part; bulla face nearly flat, upper and lower facets

rounded, terminal facet about 1.5 cm broad and 1 cm wide vertically, sometimes extending nearly to lower margin. *Seeds* orange-yellow, angled by compression, 2.5–3 cm long, 2–2.5 cm broad.

Occasional on the mountains of the eastern Transvaal from the Carolina district to Lydenburg and Nelspruit, usually associated with grass and often wedged between rocks. Map 1.

TRANSVAAL.—Carolina: *Dyer, Verdoorn & Codd* 5776; 5777; 5778. Belfast: *Smuts* 285; *Van Biljon* in PRE 29426. Nelspruit: *Mogg* 17563; *Dyer* 4805; 4806; *Verdoorn* 2349; 2350; 2351; *Liebenberg* 335; *Reynolds* 3936. Lydenburg: *Marais* 270; *Van de Ende* in PRE 29427; *Dyer, Verdoorn & Codd* 5787.

The above species concept was included by Hutch. & Rattr. in F.C. 5, 2 (Suppl.): 43 (1933) and by Henderson in Journ. S. Afr. Bot. 11: 52 (1945) under *E. lanatus* Stapf & Burt Davy. It differs in its smaller, more consistently branched habit; it is less woolly and has straighter hairs on the leaflets; its habitat conditions are different as it occurs in mountain grassland within the catchment of the Crocodile River, as opposed to the Olifants River catchment for *E. lanatus*.

6. *Encephalartos laevifolius* Stapf & Burt Davy in Fl. Transv. 1: 40 & 99 (1926); R. A. Dyer in Bothalia 8: 451 (1965). Type: Transvaal, *Todd* s.n. (K. holo.; in NH 2043, iso.).

Plants unbranched or branched from base; stems 1–3 m tall, occasionally up to 3.5 m, 25–30 cm diam., without loose tomentum. *Leaves* up to about 1 m long, including petiole about 25 cm long, at first glaucous and densely pale brown woolly except on under surface of leaflets, glabrescent except for tomentose pulvinus; rhachis nearly straight or recurved and sometimes somewhat twisted above middle; leaflets spreading widely in lower half of leaf and in V disposition above middle, not or only slightly overlapping, pungent, entire, reduced in size to base and apex; median leaflets linear, up to 12 cm long and 5–7 mm broad, rarely up to 1 cm, 10–12-nerved on under surface. *Cones* 2–4 together on short stout peduncles subtended by linear-lanceolate, densely tomentose bracts, covered by a not very dense whitish tomentum. *Male cones* subcylindric, tapering slightly to base and apex, 30–40 cm long and about 10 cm diam., curved with age; median scales 3.5–4 cm long, 3.4–3.5 cm broad, shortly stalked, slightly cordate at base; bulla face projecting about 1 cm, sharply laterally ridged, with upper facet

more or less humped, lower facet rounded, terminal facet concave with the lower margin slightly more prominent than the upper, the short tomentum decreasing in density and length towards the almost glabrous base. *Female cones* broadly subcylindric, contracted slightly to the rounded apex and very slightly to the base, 20–30 cm long, 10–13 cm diam.; median scales about 4 cm long, 4–4.5 cm broad and 2.5 cm thick vertically, with incurved lateral lobes about 1.5 cm long; bulla face progressively less tomentose to an almost glabrous base, sharply laterally ridged, upper facet rounded but sometimes with 2 slightly prominent ridges, lower facet rounded, terminal facet 1–1.5 cm broad and 5–10 mm wide vertically, concave, with the lower margin slightly more prominent than the upper. *Seed* orange-yellow, angled by compression, 2.5–2.7 cm long, 2–2.3 cm broad, with short fleshy apex.

On the Kaapsehoop Mountain of the eastern Transvaal, in the Nelspruit district and in Swaziland; infrequent. Map 1.

TRANSVAAL.—Nelspruit: *Thorncroft* sub *Rogers* 28427; *Dyer* 4803; 4804; *Prosser* 1479; *Van Nouhuys* in PRE 10086; *Mogg* in PRE 29435; *Unkles* in PRE 2943; *Liebenberg* 3342.

SWAZILAND.—Piggs Peak, *Compton* 32343.

Although the type specimen was recorded as having been collected 'near Barberton' it is probable that it was actually from the Kaapsehoop Mt., now included in the Nelspruit district. It is a more robust species than *E. lanatus*, with which it has been confused, and the indumentum of the cones differs markedly. The distribution areas are in separate river catchments: the Crocodile for *E. laevifolius*, where *E. humilis* and *E. paucidentatus* also occur, but under different habitat conditions.

7. *Encephalartos inopinus* R. A. Dyer in Bothalia 8: 169 (1964); Bothalia 8: 453 (1965). Type: Transvaal, Lydenburg, *Dyer, Codd & Verdoorn* 5788 (PRE, holo.).

Plant freely branched from base; stems up to about 3 m long and often spreading or reclining at this stage, 17–23 cm diam. (including the persistent leaf bases); bracts lanceolate, about 4.5 cm long, tomentose. *Leaves* 8–1.2 m long including petiole 10–20 cm long; rhachis nearly straight, sometimes slightly up-curved and twisted towards apex, glabrous except for woolly back of pulvinus, flat or ridged on upper surface towards base, rounded on under surface, 8–13 mm thick; pulvinus up to 3.5 cm long, 4.5 cm broad, with dense brown wool on back readily rub-

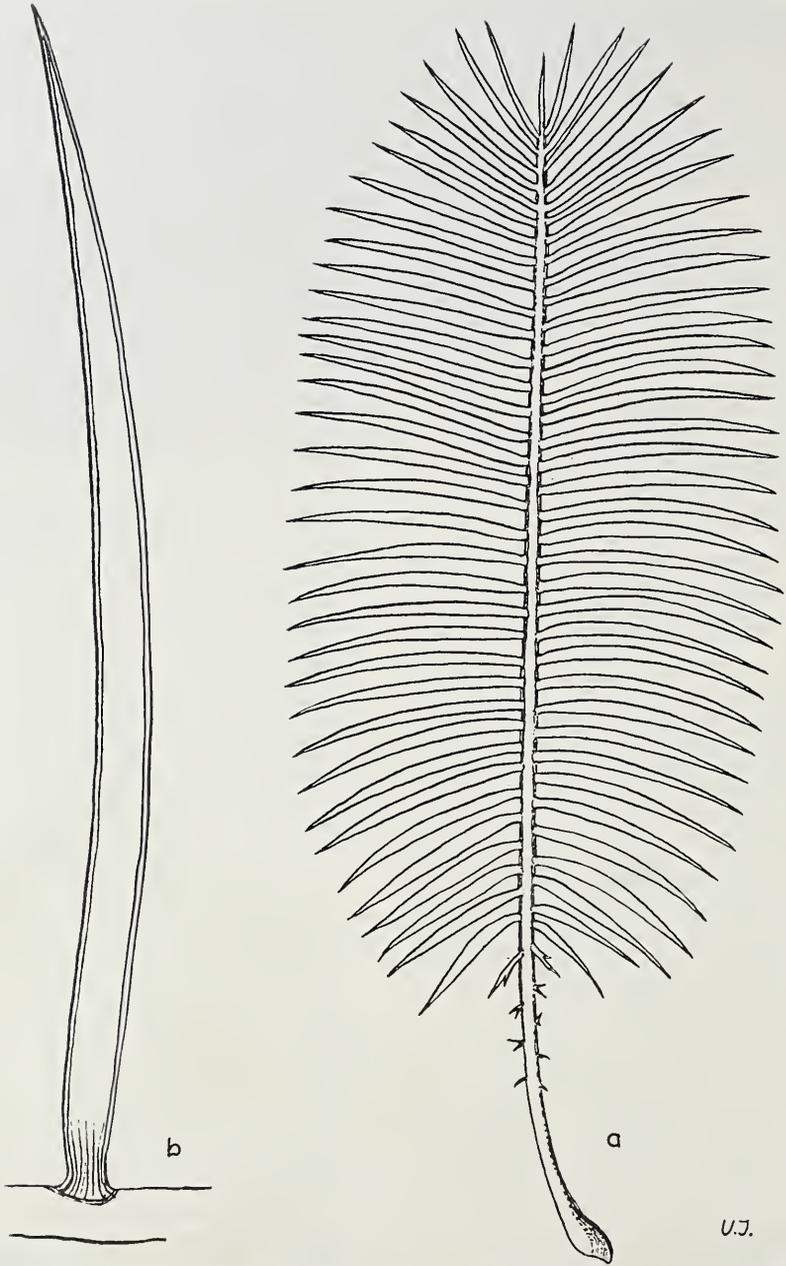


FIG. 5.—*Encephalartos inopinus*, a, leaf, reduced; b, leaflet (*Dyer, Codd & Verdoorn 5788*).

bed off, shrinking in size and wearing down considerably with age to about 1.5–2 cm long; leaflets glabrous, glaucous on under surface when young, becoming green with age, base or foot inserted parallel to axis, usually pungent, with entire margin or occasionally with 1–2 minute teeth on the lower margin near and directed towards the apex, those leaflets above middle of leaf directed slightly upwards and outwards and sometimes recurving, not overlapping, reduced in size near apex of rachis, those about the middle spreading more or less at right angles from rachis, those below directed slightly downwards and slightly falcate, 1–2 cm distant from each other and reduced in size rather abruptly to 2–6 prickles on either side of the rachis; median leaflets linear-attenuate, 14–21 cm long, 8–13 mm broad in the lowest $\frac{1}{3}$ and from there gradually tapering to the slender pungent apex, only slightly narrowed at base, not very rigid, with 13–21 veins evident but not raised on the lower surface. *Male cones* 2 or more together (immature) on peduncles about 5 cm long and 1.5 cm thick, 8–10 cm long, 4–4.5 cm diam.; scales dense (few showing some dehiscence) about 2 cm long (tips all damaged) 1.7–2 cm broad, with acute lateral margin, maximum vertical thickness 5 mm; microsporangia dense on lower basal half; beak projecting about 1 cm, with upper facet humped in middle, lower facet nearly flat, glabrous round base of beak, shortly greyish scurfy-pubescent towards apex. *Female cones* not yet recorded. Fig. 5.

On cliffs in hot valleys near the junction of the Olifants and Steelpoort Rivers in the Lydenburg district of the Transvaal. Map 1.

TRANSVAAL.—Lydenburg: between Weltevreden and Krommellenboog Asbestos Mines, *Dyer, Codd & Verdoorn* 5788; 5853; 5854; 5855; *Louis Naudé* in PRE 29805; *Van Biljon* in PRE 29753; *Els* photo; cult. Johannesburg, *Van Hoepen* in PRE 29663.

This recently described species may prove less rare than was at first suggested, once the rough terrain of its natural habitat has been explored more thoroughly. The downward direction of the lowest leaflets is more obvious in leaves of young suckers than those on old trunks.

8. *Encephalartos eugene-maraisii* *Verdoorn* in Journ. S. Afr. Bot. 11 : 1 (1945); *M. R. Henderson* l.c. 11 : 39 (1945); *R. A. Dyer* in *Bothalia* 8 : 455 (1965). Type: Transvaal, Waterberg, *Marais* in Herb. Marloth 13368 (PRE, holo.).

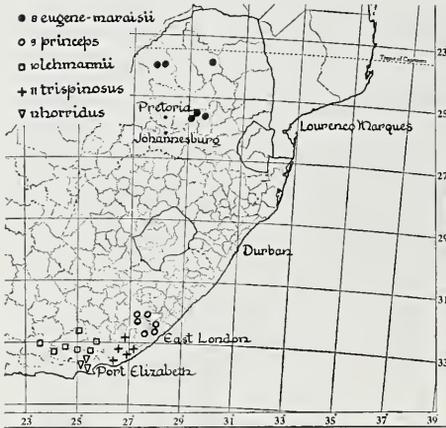
Plant unbranched or more often branched from base; stems up to 2.5–4 m tall, rarely more, reclining with age, 30–45 cm diam. with tomentose bracts. *Leaves* 7–1.3 m long including petiole 16–20 cm long; rachis nearly straight with the apical portion slightly or markedly incurved, glabrous except for densely tomentose pulvinus mainly hidden by bracts, glaucous when young; leaflets rigid, glabrous, glaucous when young, reduced in size towards apex and base of rachis; median leaflets linear-oblong, 15–20 cm long, 1.3–1.5 cm broad, cuneate at base, shortly pungent, entire or occasionally with a single tooth on lower margin. *Cones* 1–3 together on short stout peduncles, dark brown. *Male cones* subcylindric, 22–42 cm long 6–8 cm broad; median scales 2.5–3.25 cm long, 2–2.5 cm broad, with acute lateral ridges; bulla face projected into beak 7 mm long, surface slightly uneven, terminal facet about 3 mm broad and nearly 3 mm wide vertically, slightly concave. *Female cones* ovoid to oblong-ovoid in outline, 30–50 cm long, 16–20 cm broad; median scales 5–5.5 cm long, 4.5–5 cm broad, 2.5–3 cm thick vertically, with lateral ridges extending into incurved lobes about 1 cm long; bulla papillate round base, rugose in apical half and minutely pubescent, upper facet with 1–2 sagittal ridges and lower facet rounded, terminal facet concave, 1.5–2 cm broad, slightly less wide vertically. *Seeds* amber or sometimes slightly tinged with red, fleshy, angled by compression, 3.5–4 cm long, 2.3–3 cm diam.

In isolated mountainous areas of Transvaal, infrequent. Map 2.

TRANSVAAL.—Witbank: *Dyer, Codd & Verdoorn* 5858. Middelburg: *Codd & Verdoorn* 10111; *Mogg* 23933. Pietersberg: *Codd & Verdoorn* 10426. Waterberg: *Marais* in Herb. Marloth 13368; *Pole Evans* 4457; *Galpin* 13199; 13802; *Verdoorn & Dyer* 2211; *Dyer* 4290; *Dyer & Verdoorn* 4420; 4421.

The specimens in the Witbank and Middelburg districts are generally more robust and with straighter leaves than those from the Waterberg. There appears no justification for specific distinction but varietal distinction might be considered warranted by some. Its nearest relatives would appear to be *E. lehmannii* *Lehm.* and *E. princeps* *R. A. Dyer* in the eastern Cape.

9. *Encephalartos princeps* *R. A. Dyer* in Journ. S. Afr. Bot. 31 : 111 (1965); *Bothalia* 8 : 458 (1965). Type: Cape, Queenstown, *Galpin* 8090 (PRE, holo.).



MAP 2.—Distribution map of *Encephalartos eugenia-maraisii*, *E. princeps*, *E. lehmannii*, *E. trispinosus* and *E. horridus*.

E. lehmannii Auct. in part, not of Lehm.; Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 36 (1933), as to specimens from Queenstown, etc.; form "D" M. R. Henderson in Journ. S. Afr. Bot. 11 : 30 (1945).

Plant unbranched or more often branched from the base with stems up to 3 m tall or some attaining 4 m when reclining or procumbent, about 30 cm diam. *Leaves* 1–1.3 m long including petiole 15–20 cm long, glabrous, glaucous when young becoming dark green with age; rhachis straight for the most part with recurved and occasionally somewhat twisted apex, and the tomentose pulvinus mostly hidden by stem bracts; leaflets spaced in the lower half of the leaf and reduced in size towards the base, often overlapping in the upper half of the leaf and in V disposition; median leaflets up to about 15 cm long and 1.3 cm broad, pungent, entire or very occasionally toothed on lower margin. *Cones* 2 or more per crown, dull green, on short stout peduncles. *Male cones* subcylindric, narrowing to base and apex, 16–26 cm tall, 8–10 cm diam.; median scales about 3 cm long, 1.5–1.8 cm broad, 8–10 mm thick vertically; bulla face projected into a 1.2–1.5 cm long beak with sharp lateral ridges, terminal facet 5–8 mm broad and 4–6 mm wide vertically. *Female cones* more or less barrel-shaped, about 30 cm long and 20 cm diam., with rounded apex; median scales 6–7 cm long, 4.4–5 cm broad, 3–3.5 cm thick

vertically, with lateral angles extending into lateral incurved lobes 1–1.5 cm long; bulla protruding 1.5–2 cm, flattened on the face, upper and lower facets rounded or indistinctly ridged, coarsely and irregularly warty or coarsely papillate and with thin tomentum of whitish or brownish hairs, terminal facet slightly below centre, rather variable in size, 5 mm–1.5 cm broad and .5–1 cm wide vertically, rugose, concave with raised rim. *Seeds* red, angled by compression, 4–5 cm long, 2 cm diam., fleshy beak about 1.5 cm long.

Limited in distribution in the eastern Cape within the catchment area of the Kei River and its tributaries, mainly on doleritic outcrops. Map 2.

CAPE.—Queenstown: *Galpin* 8090. Cathcart: *Henderson* 1594. King William's Town: *Comins* 1661. Komga: *Flanagan* 1373; *Verdoorn* & *Christian* 708; *Dyer* 4525; *Dyer* & *Wells* 5792; 5793. Tsomo: *Sim* in K. Butterworth: *Verdoorn* & *Christian* 709; 2421; *Dyer* 4508; *Smith* & *Latimer* 261; *Dyer* & *Wells* 5794; *Smii* PRE 29907. ? Mquanduli: *Smith* 5794 (Cult.)

For a better balanced assessment of the relationship between this species concept and that of *E. lehmannii* Lehm. and *E. trispinosus* R. A. Dyer, further long-term field work is necessary. It is essential to determine more exact distribution areas, the degree of variability of characters and especially cone characters in all groups. Earlier published views were based on limited material and information.

10. *Encephalartos lehmannii* Lehm., Pugill. 6 : 14 (1834); Miq., Monogr. Cycad. 47 (1842); Schuster in Pflanz. 4, 1 : 113 (1932), in part, as to typical form; Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 34 (1933), in part, as to typical form; M. R. Henderson in Journ. S. Afr. Bot. 11 : 27 (1945), in part, as to form "A"; R. A. Dyer in *Bothalia* 8 : 460 (1965). Type: Cape, eastern area, *Ecklon* & *Zeyher*.

Zamia lehmanniana Ecklon & Zeyher in Otto & Dietr. Allg. Gartenz. 158 (1833); Bot. Zeit. 479 (1833), nomen nudum.

Encephalartos elongatus Lehm. in Tydschr. Nat. Gesch. 4 : 419, t.8A (1838). Type: Hort. Hamburg. ? *E. spinulosus* Lehm. in Tydschr. Nat. Gesch. 4, 420 (1837).

Plant unbranched or more frequently branched from the base with stems up to about 1.5 m tall, rarely up to 2 m, 25–45 cm diam. *Leaves* 1–1.5 m long including petiole up to 25 cm long, glabrous, glaucous when young, dark green with age; rhachis straight,

or sometimes slightly recurved and rarely with the apex twisted sideways, with stout tomentose pulvinus with conspicuous red-brown collar; leaflets spaced in the lower half of the leaf and reduced in size possibly to one prickle, closely set in the upper half but not much overlapping, in V disposition; median leaflets linear-lanceolate, 12–18 cm long, 1.7–1.9 cm broad, pungent, entire or rarely with 1 or 2 small teeth on lower margin. *Cones* solitary, on short stout peduncles, blackish-red because of short dense blackish hairs on the terminal half of the bulla face or sometimes greyish on the terminal facet. *Male cones* subcylindric narrowed to apex and base, 25–35 cm long, 8–10 cm diam.; median scales 2.25–2.5 cm broad, 1 cm thick vertically; bulla face projected into a beak about 1.5 cm long with acute lateral ridges, terminal facet 5–8 mm broad and about 5 mm wide vertically. *Female cones* ovoid or barrel-shaped, 30–50 cm long, 15–23 cm diam.; median scales about 6–7 cm long and 6 cm broad and 3.5 cm thick vertically with lateral ridges extending into the incurved lateral lobes 1–1.5 cm long; bulla face protruding about 2 cm, almost smooth, the upper facet with a central ridge, lower facet rounded, terminal facet 1.5–1.8 cm broad, 1–1.5 cm wide vertically, slightly concave with acute upper margin. *Seed* red, angled by compression, 4.7–5 cm long, about 2 cm diam., with fleshy beak.

Associated with karroid scrub bush in the Cape on the Klein-Winterhoekberge and Groot-Bruintjieshoogte from near Willowmore to Uitenhage and Steytlerville to Pearston, Bedford and possibly northern Albany near Kommdagga. Map 2.

CAPE.—Willowmore: *Andraea* 999; *Verdoorn & Christian* 688; 689; 689a; 689b. Steytlerville: *Story* 2491. Uitenhage: *Dyer* 4442; 4443; *Dyer & Wells* 5814. Christiansville: *Verdoorn & Christian* 690; 690a, b, & c; *Dyer* 4011; *Dyer & Wells* 5808; 5809; 5811; *Acocks* 11992. Pearston: *Jenkins* in PRE 29569; *Codd* 10472. Bedford: *Pringle* in PRE 29821.

The relationship between *E. lehmannii*, *E. horridus*, *E. trispinosus* and *E. princeps* is intimate. Individual views based on the same facts are unlikely to agree in detail. There is some discussion in the notes on *E. trispinosus*, which is always likely to be a most controversial concept.

Verdoorn & Christian 689, 689a and 689b are forms with 1 or 2 prickles of varying sizes on the lower margin of some of the median and upper leaflets. In this they indicate a relationship with *E. trispinosus* but the locality is far distant. Other records coming to hand on going to press indicate that the specimens

cited from Pearston and Bedford may qualify for varietal distinction from typical *E. lehmannii*. Female cone characters may justify this but the available material is still deplorably meagre. It has been found that the female cone scales illustrated in Bothalia l.c. fig. 50, from Groot-Bruintjieshoogte are smoother than some produced on plants from the Klein-Winterhoekberge. The latter show a similarity to those of *E. horridus*.

11. *Encephalartos trispinosus* (Hook.) R.

A. Dyer in Journ. S. Afr. Bot. 31 : 112 (1965); *Bothalia* 8 : 463 (1965). Type: Bot. Mag. t.5371 (1863) represented by specimen in K (1880).

E. horridus var. *trispinosa* Hook. in Bot. Mag. t.5371 (1863). *E. horridus* sensu Schuster partly in Pflanzn. 4, 1 : 116 (1932). *E. lehmannii* sensu Hutch. & Rattr. partly in F.C. 5, 2 (Suppl.) : 34 (1933); M. R. Henderson in Journ. S. Afr. Bot. 11 : 32, Form B1 & C (1945).

Plant branched from the base or sometimes unbranched, with stems up to about 1 m tall and 25–30 cm diam. *Leaves* usually glaucous-green when young, becoming green with age, 7.5–1.25 m long including petiole 15–22 cm long, glabrous; rhachis stiff usually recurved and often twisted towards apex, with dirty white collar round tomentose pulvinus; leaflets spaced and reduced in size towards base, occasionally overlapping in upper half; median leaflets linear-lanceolate, or oblong-lanceolate, often somewhat falcate, 10–18 cm long, 1.5–2.5 cm broad, pungent with terminal spine up to 6 mm long, usually with 1–2 pungent lobes 1–3 cm long from lower margin. *Cones* solitary, general colour blue-green or yellowish-green, shortly and stoutly pedunculate. *Male cones* subcylindric, narrowed to both ends, 25–35 cm long, 6.5–7.5 cm diam.; median scales about 2.5 cm long, 2.5–2.8 cm broad with sharp lateral angles; bulla face projected into a beak 7 mm long, terminal facet about 6 mm broad and 6 mm wide vertically. *Female cones* broadly subcylindric, rounded or narrowed to apex, 40–50 cm long and 16–18 cm diam.; median scales 7–9 cm long, 6–7 cm broad and 3.5–4 cm thick vertically, with lateral ridges extending into the incurved lateral lobes 2–3 cm long; bulla face protruding 2.5–3 cm, sparsely hairy with adpressed whitish hairs, upper facet with rugose ridges converging on the terminal facet and with irregular pointed papillae round the base, lower facet rounded, terminal facet smooth or sparsely grooved, concave, about 1 cm

broad and 1 cm wide vertically. *Seeds* reddish to yellowish-orange, 4–5 cm long and 2 cm diam., with fleshy beak (there is likely to be greater variability in cone size than recorded here based on limited material).

In the eastern Cape in karroid scrub and bush of the Bushmans, Great Fish River and intervening valleys. Map 2.

CAPE.—Alexandria: *Verdoorn & Christian* 693; 697; *Compton* 19697B. Bathurst: *Dyer & Wells* 5796; 5797; *Wells* 2904; 2905; *Acocks* 16152. Albany: *Galpin* 3083; *Verdoorn & Christian* 703; 703a; 704; *Dyer* 1184; 4842; *Dyer & Wells* 5801; *Acocks* 12769; *Smith* 5815. Victoria East: *Acocks* 15979. Peddie: *Dyer* 4547B; *Verdoorn & Christian* 705; 706.

Hooker wrote in *Botanical Magazine* 1863: "After the most careful examination of our plant (tab. 5371) I can only come to the conclusion that it is one of the many varieties of *E. horridus*; with a great tendency to have, on the inferior margin of the pinnules, two large spinescent laciniae, which, in conjunction with the terminal spines, justify the application of the term var. *trispinosa*". A herbarium specimen was preserved at Kew in 1880 but the original history of the plant was unknown. Schuster (l.c.) quoted *E. horridus* var. *trispinosa* Hook. under *E. horridus* (Jacq.) Lehm., while Hutchinson and Rattray treated the name as a synonym of *E. lehmannii*; Henderson also dealt with it under *E. lehmannii*, in which he included several forms. Henderson's material is reclassified in the present work under three groups of specific status: *E. lehmannii*, *E. trispinosus* and *E. princeps*, and a residue of supposed hybrids of indeterminate origin.

The figure in *Bot. Mag.* t.5371 can be matched very closely with specimens in the lower reaches of the Bushmans and Fish River Valleys. These specimens appear to be sufficiently distinct, numerous, widely spread and often isolated from any other species, to be given specific rank. While there is no means of confirming that the type specimen was collected within this environmental range, conversely, it would not be possible to deny the probability. There appears to be no earlier name which could, with equal confidence, be applied. The reason for caution in elevating the concept of *trispinosus* to specific rank is that a number of specimens within the same distribution area do not conform to a species pattern and give the impression that natural hybridization has taken place. *E. horridus* var. *trispinosa* Hook. first had to be viewed from this angle.

The first botanist to generalize on the relationships of specimens in the eastern Cape Province was Karl Zeyher whose notes were read in 1852 before a scientific gathering and published in the *Phytologist*. After mentioning that any person with "tact" should have no difficulty in detecting the "play of nature" he went on to say that he intended to examine all the populations once more in their natural state. The outcome is not recorded and Zeyher's warning seems to have gone unheeded.

Plants of supposed hybrid origin occur two miles up the Bushmans River and in the lower reaches of the Fish River Valley. These appear to combine the characters of *E. trispinosus* and *E. altensteinitii* both of which are present in the same areas. *E. arenarius* R. A. Dyer, the typical form of which occurs a few miles west of Bushmans River in a secluded valley, may also be involved in hybridization, and *E. latifrons* cannot be ignored. (There is a strong suspicion that *E. latifrons* has been involved in hybridization with *E. altensteinitii* at least).

The distinction between *E. trispinosus* and *E. horridus* is based largely on the structure of the female cone scales, for which view relatively few cones have been available. The distinction between *E. trispinosus* and *E. lehmannii* is based on female cone scales and leaf characters, cones again being in short supply. Nevertheless, on the evidence available it seems that neither typical *E. horridus* nor *E. lehmannii* occurs in the area of distribution of *E. trispinosus*. *E. horridus* is apparently restricted in its distribution range to the districts of Uitenhage and Port Elizabeth, while *E. lehmannii* is in Uitenhage, Willowmore and Jansenville, mainly on the lower slopes of the Klein-Winterhoekberge, with a form in the Pearson, Somerset East and Bedford districts on the Groot-Bruintjieshoogte. It is possible that it occurs also in northern Albany district near Kommadaga.

A study of these three species has led to the suggestion that both *E. horridus* and *E. lehmannii* evolved from *E. trispinosus* stock. The stem has been reduced and the lobing of the leaflets accentuated in *E. horridus*, whereas in *E. lehmannii* the stems are more robust and the leaflets are mainly entire. An occasional part-reversion within the normal populations of these two species in the direction of *E. trispinosus* indicates this possibility—a stem up to 4 ft in *E. horridus* (*Story* 2338) and specimens of *E. lehmannii* with teeth on the lower margin of some leaflets (*Verdoorn & Christian* 689, 689a, 689b). It is believed that these variations have been viewed on a rational basis in the present treatment in not giving them distinctive rank. Were cones available from all specimens it is felt that they would be sufficiently distinctive within the groups to maintain the present basic classification.

Of the herbarium material examined from known localities, the following show a strong affinity with *E. trispinosus* but leave some doubt about their complete identity:

Bathurst: Southwell, *Acocks* 16152. Peddie: *Dyer* 4547A & C. (into this category Henderson, l.c., Forms B, B2 and C also fall.)

The following appear to be of hybrid origin involving *E. altensteinitii* as the other parent:

Alexandria: Bushmans River, *Verdoorn & Christian* 693; 695; 696; 698; 699; *Archibald* 4342A; 5590; *Compton* 19697A. Bathurst: *Dyer & Wells* 5800; *Wells* 2901 (nearer *E. altensteinitii*); *Wells* 2902 (nearer *E. trispinosus*).

The following appear to be of hybrid origin involving *E. arenarius* as a parent:

Bathurst: Southwell, *Acocks* 16153; *Dyer* 4835.

The following single specimen found with *E. altensteinii* (but out of the proved range of *E. trispinosus*, and possibly since drowned in Murray Reservoir in the King William's Town district) sets a problem which cannot be followed further at this stage.

King William's Town: *Smith* 6064 (= *Verdoorn* & *Christian* 707 and *Dyer* 4847 in Hort., East London).

As we go to press a leaf, not unlike that of *Smith* 6064, but whose leaflets have no prickles, has been brought to the Botanical Research Institute, Pretoria, by Mr. J. A. Smit (PRE 29906) from about 9 miles from the Keiskamma River Mouth in the Peddie district. This is between the Bathurst and King William's Town districts. In other circumstances it might well have been identified as *E. lehmannii*, but it is suspected that the female cones, when recorded, will show a closer affinity with those of *E. trispinosus*.

12. *Encephalartos horridus* (Jacq.) *Lehm.*, *Pugill.* 6 : 14 (1834); *Schuster* in *Pflanzenr.* 4, 1 : 116 (1932), in part, excluding varieties; *Hutch. & Rattr.* in *F.C.* 5, 2 (Suppl.) : 32 (1933); *M. R. Henderson* in *Journ. S. Afr. Bot.* 11 : 20 (1945); *R. A. Dyer* in *Bothalia* 8 : 467 (1965). Type: Cape, without locality, the illustration in *Jacq. Fragm.* 27, t.28 (1801) from a plant cultivated in Vienna, leg. *Scholl.*

Zamia horrida *Jacq. Frag.* 27 : t.28 (1801), probably excluding t.27. ? *Z. gleina* *Miq.* in *Linnaea* 17 : 729 (1843). ? *Z. aurea* *Hort. ex Miq.* in *Tyd. Wet.* 1 : 297 (1848).

Plant unbranched or more usually branched from the base with stems subterranean or partly exposed, up to about 30 cm tall, exceptionally up to 1 m tall, 20–30 cm diam., the crown with a small quantity of loose wool. *Leaves* several to many in a whorl, rigid, glaucous, glabrous, .5–1 m long including petiole up to about 13 cm long; rachis much recurved in the apical third, with brown woolly pulvinus; leaflets rather widely spaced in lower half of leaf, closer in the upper half, reduced in size and entire towards base; median leaflets ovate to lanceolate in general outline, up to 10 cm long and 2.5 cm broad with pungent apex and 1–3 pungent lobes up to 4 cm prominent on lower margin and twisted out of the plane of the leaflet; nervation obscure. *Cones* solitary on short stout peduncles, with blackish or reddish-brown adpressed scurfy hairs over green surface. *Male cones* subcylindric narrowing gradually to base and apex, 20–40 cm long, 6–12 cm diam.; median scales broadly ovate, 3–4 cm long and 3–3.5 cm broad, with

acute lateral ridges; bulla face projecting 8–10 mm beyond sporangial surface, smooth or slightly corrugated, upper facet humped and sometimes with obscure ridges, terminal facet concave, smooth, about 8 mm broad and 6 mm wide vertically. *Female cones* ovate-oblong to oblong-elliptic in outline, 20–40 cm long, 15–20 cm diam., rarely smaller; median scales 4.5–6 cm long, 4–5 cm broad and 3–3.5 cm thick vertically, with lateral ridges extending into the incurved lateral lobes about 1 cm long; bulla face protruding 1.5–2 cm, rugose round base, upper facet with 1–2 or more ridges converging to the terminal facet otherwise fairly smooth, lower facet slightly protuberant, somewhat rugose, terminal facet more or less quadrangular, 1.5–2 cm broad, concave with slightly uneven surface and a narrow raised rim. *Seed* pale red or carmine, 3–3.5 cm long and about 2.5 cm diam., angled by compression, with fleshy beak.

Local in the Port Elizabeth and Uitenhage districts of the eastern Cape. Map 2.

CAPE.—Port Elizabeth: *Dyer* 5060; *Rodin* 4833. Uitenhage: *Verdoorn & Christian* 680; 681; *Dyer* 4439; *Smith* 3; *Story* 2338 (form with stem up to 4 ft long); *Dyer & Wells* 5818.

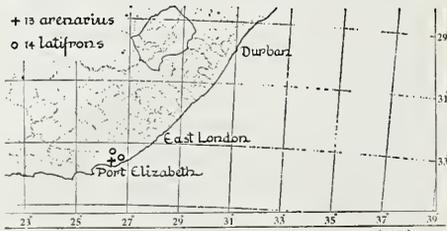
A small group of plants from infertile sourveld on quartzite hills west of Port Elizabeth are dwarf by comparison with those from the more fertile but drier karroid scrub bush in the Uitenhage district. In the latter area specimens may, on rare occasions, reach a height of 4 ft whereas the stems of others may be completely subterranean. *Jacquin* described the type as with a stem 2 ft long but it is not known how much of it was originally below ground. The Fig. 27 of the cone in *Jacquin's Fragmenta* is not good as regards detail and may have originated from *E. longifolius*. These two species have been found growing together near Uitenhage, but there was no suggestion of inter-specific hybridization at the time.

13. *Encephalartos arenarius* *R. A. Dyer* in *Journ. S. Afr. Bot.* 22 : 1 (1956); *Bothalia* 8 : 470 (1965). Type: Cape, Alexandria District, *Dyer* 5441 (PRE, holo.).

Plant unbranched or more usually branched from the base; stem up to about 1 m tall and at this length often somewhat reclinate, 20–30 cm diam. *Leaves* 1–1.5 m long including petiole 15–20 cm long; rachis spreading, recurved in upper half, glabrous except for brown tomentose pulvinus; leaflets somewhat glaucous, light green when young gradually darker green with age, overlapping

in the apical half and in V disposition, more spaced in the lower half and reduced in size occasionally to one prickle; median leaflets oblong-lanceolate, flat or slightly twisted and slightly curved upwards, 12–16 cm long, 2·5–4 cm broad with 1–1·5 cm broad attachment, closely but not prominently veined on lower surface, pungent with upper margin entire or occasionally a single tooth and lower margin usually with 3 rarely 4 flat or slightly twisted pungent lobes. *Cones* single on short stout peduncles. *Male cones* (incomplete); median scales 3–3·5 cm long, 2·25–2·5 cm broad; bulla face projected into a beak about 1 cm long. *Female cones* mainly barrel-shaped with rounded base and apex, 35–45 cm long and 20 cm diam., somewhat glaucous; median scales about 6·5–7 cm long, 5 cm broad and 4 cm thick vertically, with lateral ridges extending into incurved lateral lobes up to 2 cm long; bulla face projecting about 2 cm, upper and lower facets with or without ridges and surface slightly and irregularly undulate or minutely papillate; terminal facet 10–12 mm broad and about the same in width vertically, concave. *Seeds* coral-red, up to about 5 cm long, 2–2·5 cm broad with fleshy beak.

Local in the Alexandria District of the Cape, associated with coastal sand-dune scrub bush. Map 3.



MAP 3.—Distribution map of *E. arenarius* and *E. latifrons*.

CAPE.—Alexandria: Dyer 5439; 5441; 5443; Gledhill 5420; Verdoorn 2422; Guillarmod 4302.

Notes under *E. trispinosus* and *E. altensteinii* state that this species is possibly involved in hybridization with those species but neither occurs in the type locality of *E. arenarius* in the Caba Valley. It is nearest related to *E. latifrons*.

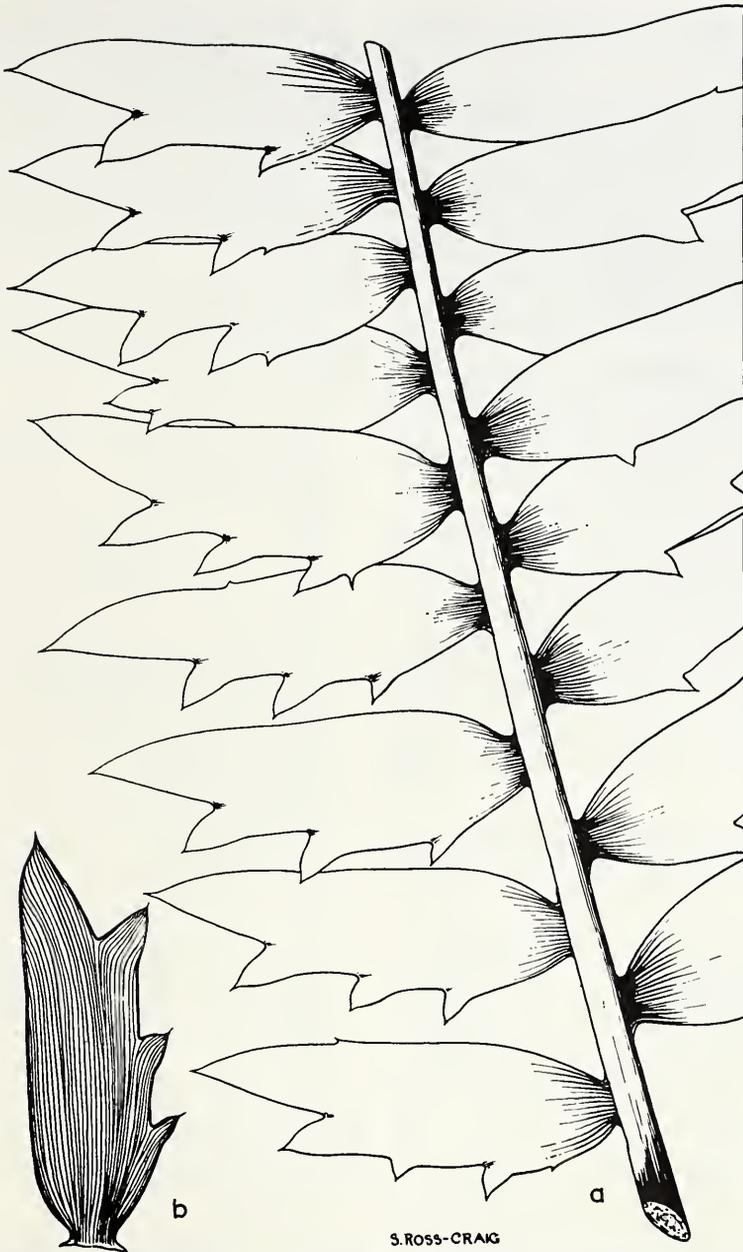
14. *Encephalartos latifrons* Lehm. in Tydschr. Nat. Gesch. 4 : 424, t.9 A & B (1837–38); Hutch. & Rattr. in F.C. 5, 2 (Suppl.): 36 (1933); M. R. Henderson in

Journ. S. Afr. Bot. 11 : 22 (1945); R. A. Dyer in Bothalia 8 : 471 (1965). Type: the illustration in Tydschr. Nat. Gesch. 4 : t.9 (1837–38).

E. horridus var. *latifrons* Miq., Monogr. Cycad. 59 (1842); Schuster in Pflanzenz. 4, 1 : 177 (1932).

Plant unbranched or more usually branched from the base with stems up to about 2·5–3 m tall, rarely taller. *Leaves* finely pubescent throughout when young, glabrescent with age, 1–1·5 m long including petiole 10–20 cm long; rhachis rigid, recurved or curled in the upper half, thickly tomentose round base and on pulvinus with whitish collar; leaflets rigid, dark green, overlapping in the upper half of leaf and in V disposition, more spreading in lower half of leaf and gradually reduced in size, but only the lowest sometimes prickle-like; median leaflets ovate-oblong, 10–15 cm long, 4–6 cm broad with attachment 1·5–2 cm broad, pungent, with upper margin entire, rarely toothed, lower margin with 2–4 deep triangular pungent lobes sometimes somewhat twisted. *Cones* 1–3 together on short stout peduncles, general colour dark green or dark blue-green. *Male cones* subcylindric narrowed to both ends, 30–50 cm long, 8–17 cm diam.; median scales 6–7 cm long, broadly obovate-oblong in the sporangial portion, 4·4–5 cm long, 3–3·5 cm broad, with acute lateral ridges; bulla face projecting into a slightly decurved beak about 2 cm long, sparsely covered with adpressed red scaly hairs, upper and lower facets variably ribbed, terminal facet slightly concave, about 1 cm broad and slightly narrower vertically. *Female cones* barrel-shaped, up to about 60 cm long and 25 cm diam.; median scales about 8·5 cm long and 5·5 cm broad, with lateral ridges extending into incurved lateral lobes about 1 cm long; bulla face protruding 2–2·5 cm, the surface with coarse pointed or blunt papillae and pale brownish scaly hairs mixed with scales, upper facet ridged or crested; lower facet rounded; terminal facet irregularly shaped, 1–1·3 cm diam., slightly narrower vertically, concave or excavate with prominent margin. *Seeds* red, angled by compression, about 5 cm long and 2–2·5 cm diam., with fleshy beak. Fig. 6.

In association with scrub bush on rocky outcrops in the Bathurst and Albany Districts of the eastern Cape; rare. Records from outside this area require verification. Map 3.



S. ROSS-CRAIG

FIG. 6.—*Encephalartos latifrons*, a, middle portion of leaf, much reduced; b, leaflet showing venation; both reduced (taken from F.C. 5, 2 (Suppl.) 1933.)

CAPE.—Bathurst: *Galpin* 8439; *Verdoorn & Christian* 702; *Dyer* 4556; 4561. Albany: *Story* 2815; 4540.

This is one of, if not the slowest growing arbore-scent species in South Africa. It seems that intervals of at least 2 or more years elapse between the production of new whorls of leaves.

A specimen in the garden on the farm Wylmington between Fish River and Shaw Park (*Dyer* 4559), strongly suggests hybridization between *E. latifrons* and *E. altensteinii*, as does another in the garden of the Albany Museum, Grahamstown. There seems no good reason for the confusion which has arisen at times between this species and *E. horridus*. The *MacOwan* specimen cited in F.C. from the Uitenhage District indicates an error in labelling.

15. *Encephalartos longifolius* (*Jacq.*) *Lehm.*, *Pugill.* 6 : 14 (1834); *Schuster* in *Pflanzenr.* 4, 1 : 111 (1932); *Hutch. & Rattr.* in F.C. 5, 2 (Suppl.): 38 (1933); *M. R. Henderson* in *Journ. S. Afr. Bot.* 11 : 40 (1945); *R. A. Dyer* in *Bothalia* 8 : 474 (1965). Type: Cape, without locality, the illustration in *Jacq.*, *Fragm.* 28, t.29 (1801) from a plant cultivated in Vienna, leg. *Scholl*.

Zamia longifolia *Jacq.*, *Fragm.* 1 : 28, t.29 (1801). *Z. lanuginosa* *Jacq.*, *Fragm.* 1 : t.30 & 31 (1801). Syntypes: Cape, *Jacquin's* illustrations. ? *Z. elegans* *Yates* in *Proc. Linn. Soc.* 2 : 18 (1849).

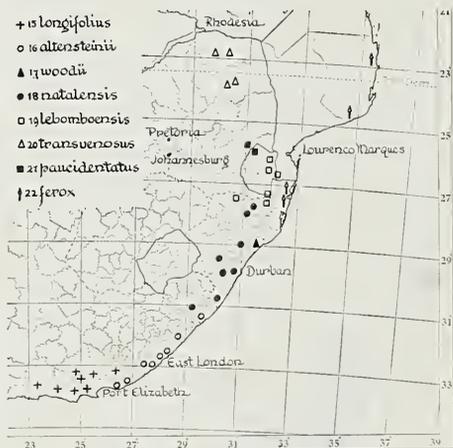
Cycas caffra *Thunb.*, in *Nor. Act. Soc. Sc. Uppsala.* 2 : 283 (1775) in part, as to part of description and part of *Thunberg's* material at Uppsala, excluding t.5.

Encephalartos caffer sensu *Hook.* in *Bot. Mag.* 82 : t.4903. *E. lanuginosus* (*Jacq.*) *Lehm.*, *Pugill.* 6 : 14 (1834).

Plants unbranched or branched from the base with stems up to about 3 m tall, occasionally up to even 4.5 m, 30–45 cm diam. *Leaves* 1–1.75 m long including petiole 15–35 cm long; rhachis spreading erect, recurved towards apex or arcuate, finely pubescent, glabrescent with age except for woolly pulvinus; leaflets dark green or dark green with bluish lustre, finely pubescent, glabrescent with age, rigid in texture, overlapping in the upper half of the leaf and disposed in V formation, reduced in size towards base, sometimes to one or two prickles; median leaflets mainly oblong-lanceolate up to 20 cm long and 4 cm broad, pungent or blunt, entire for the most part or with the lower margin (mainly of upper leaflets) with 1–3 short pungent or blunt teeth. *Cones* 1 or 2 on short stout peduncles, greenish-brown with reddish adpressed hairs. *Male cones* subcylindric, narrowed somewhat to the ends, 40–60 cm long and 14–20 cm

broad; median scales up to about 4 cm broad; bulla projecting into a 2 cm long beak with lateral ridges, the upper and lower facets humped towards apex, the terminal facet 8–9 mm broad and 3–5 mm wide vertically. *Female cones* ovoid, or barrel-shaped, about 60 cm long and 40 cm diam.; median scales 7.5–8.5 cm long, 5.5–6 cm broad, 4–4.5 cm thick vertically with lateral ridges extending into incurved lateral lobes about 2.5 cm long; bulla projecting 2–2.5 cm, finely rugose round the base, coarsely rugose in the apical half, upper facet with central ridge or hump, lower facet more or less rounded, terminal facet about 1.5–2 cm broad and the same vertically. *Seeds* red, about 5 cm long, 2.5 cm diam., with fleshy beak.

At intervals on exposed mountain slopes from Uniondale to Albany District, sometimes locally frequent. Map 4.



MAP 4.—Distribution map of *E. longifolius*, *E. altensteinii*, *E. woodii*, *E. natalensis*, *E. lebomboensis*, *E. transvenosus*, *E. paucidentatus* and *E. ferox*.

CAPE.—Uniondale: *Joubertina*, *Dyer & Wells* 5805; 5807. Humansdorp: *Dyer* 4447; *Story* 2457; *Dyer & Wells* 5804. Uitenhage: *Verdoorn & Christian* 676; 679; 682; 682a; 683; 684; 685; 686; 691; 691a; *Dyer* 4449; 4451. Somerset East: *Verdoorn & Christian* 692; 692a. Albany: *Dyer* 3328; 5449; *Wells* 2893.

The cones of this species are among the largest in the genus and may weigh up to about 70 lb. In some relatively young specimens, particularly in the most westerly area of distribution, the leaves

are decidedly glaucous, giving the impression that two distinct species are present, but field observations near Joubertina indicate that it is merely infraspecific variability. The nearest situated normally glaucous-leaved species to that site is *E. lehmannii* which is separated by the Langeberge. These two species occur fairly near together at the northern entrance to Paardepoot but evidence of hybridization has not been found there. *E. longifolius* has recently been found in association with *E. horridus* on a hill near Uitenhage but no hybridization between the two species was observed there either. Its nearest related species is *E. altensteinii*.

16. *Encephalartos altensteinii* *Lehm.*, Pugill. 6 : 11, t.4 & 5 (1834); Hook.f. in Bot. Mag. 117 : t.7162, 7163 (1891), excluding concept of *E. natalensis* Dyer & Verdoorn; Marloth, Fl. S. Afr. Fig. 62, 64, t.15, 16a (1913); Schuster in Pflanzenr. 4, 1 : 112 (1932); Hutch. & Rattr. in F. C. 5, 2 (Suppl.): 39 (1933), in part; M. R. Henderson in Journ. S. Afr. Bot. 11 : 41 (1945), all excluding concept of *E. natalensis*; R. A. Dyer in Bothalia 8 : 477 (1965). Type: Cape t.4 in Pugill l.c. leg. Ecklon & Zeyher.

E. marumii de Vriese in Tydschr. Nat. Gesch. 5 : 188 (1838). Type: Hort. Amsterdam.

Plants branched or unbranched with stems up to about 4 m tall, rarely up to 7 m and then usually reclining, 25–35 cm diam. with small amount of wool at apex soon disappearing. *Leaves* 1–2 m long including petiole 10–30 cm long, tomentose on emergence except on upper surface of leaflets soon glabrescent; rachis stiff and nearly straight when in exposed habitat, curved in shade, glabrous except for pulvinus; leaflets variably rigid, reduced in size to base but not to a series of prickles, inconspicuously nerved; median leaflets oblong-lanceolate to lanceolate up to about 15 cm long and 2.5 cm broad, with 1 or 2 or, less frequently, 3–5 teeth on upper and lower margin, sometimes on one margin and not the other, rarely entire, mucronate. *Cones* 2–5 together, rarely only 1, on short stout peduncles, yellowish. *Male cones* subcylindric, obtuse or narrowed to apex, up to about 50 cm long, 12 cm in diam.; median scales up to 5 cm long and 3 cm broad with acute lateral ridges; bulla projected into a decurved beak about 1.5 cm long, upper facet with central ridge, lower facet rounded, terminal facet flat or slightly concave, about 1 cm broad and 5–10 mm wide vertically with sparse mixed reddish and white scaly hairs. *Female cones* broadly subcylin-

dric, obtuse or narrowed to apex, 40–55 cm long, 20–28 cm diam.; median scales 7–8 cm long, 8–9 cm broad, 3.5–4 cm thick vertically, with lateral ridges extending into incurved lateral lacerate lobes about 3 cm long and almost reaching the cone axis; the bulla face deeply wrinkled and 2–3 cm prominent. *Seeds* scarlet, angled by compression, 3.5–4 cm long, 2–2.25 cm diam., with fleshy beak.

Coastal districts of the eastern Cape from Bushmans River to Transkei, associated with low forest but sometimes on exposed cliffs. Map 4.

CAPE.—Alexandria: *Copeman* in PRE 29556; *Verdoorn* & *Christian* 699. Bathurst: *Verdoorn* & *Christian* 700; *Dyer* 4555; 4557; 4558. King William's Town: *Smith* 5771; 6873; *Dyer* 4843; 4844; *Acocks* 11876. East London: *Galpin* 7104; *Dyer* 4428; 4846. Komga: *Flanagan* 1372. Kentani: *Pegler* 116. Elliotdale: *Story* 4123. Lusikisiki: *Crundall* in PRE 29557. This last specimen of an incomplete leaf has leaflets much smaller than average but possibly represents an outlying form.

A specimen received from the Botanical Garden of Hamburg in 1952 closely matches the type figure. The parent plant from which it was taken may possibly have been there in Lehmann's time.

Specimens within this distribution area, which have prickles on the petiole, suggest hybrid influence with *E. villosus* Lem. There is strong evidence for this supposition near East London. Such specimens could be mistaken for forms of *E. natalensis*, the concept of which has been associated with *E. altensteinii* by several writers.

There is overwhelming circumstantial evidence to suggest that natural hybridization is not uncommon between *E. altensteinii* and *E. trispinosus* when they occur together in the wild state (see notes under the latter).

A specimen in cultivation in the Bathurst District, *Dyer* 4559 and less convincingly another in the grounds of the Albany Museum, Grahamstown, *Wells* 2907, suggest hybridization between this and *E. latifrons*.

17. *Encephalartos woodii* *Sander* in Gard. Chron. 1908 : 257 (1908); Prain in Kew Bull. 1914 : 250 (1914) with habit fig., and 1916 : 181 (1916) in text; Schuster in Pflanzenr. 4, 1 : 120 (1932); Hutch. & Rattr. in F. C. 5, 2 (Suppl.): 40 (1933); M. R. Henderson in Journ. S. Afr. Bot. 11 : 47 (1945); R. A. Dyer in Bothalia 8 : 482 (1965). Type: Natal, Zululand, *Medley Wood*, photograph in Sander, l.c.

E. altensteinii var. *bispinosa* J. M. Wood in Ann. Rep. Durban Bot. Gard. 1907 : 8, with fig. Type: Wood, cult. NH.

Plant (only male known) branching from the base (sometimes branched above in cul-

tivation); stem up to 6 m tall, 50–90 cm diam. at base, narrowing to about 50–60 cm above, with densely leafy crown and woolly bracts. *Leaves* 1·8–2·5 m long including petiole 10–20 cm long; rhachis gracefully spreading-recurved or arched, densely pale brown woolly at first becoming glabrous with age except for large pulvinus about 10 cm broad; leaflets leathery, dark green, gradually reduced to prickles at the base, those from juvenile suckers variably 2–5-toothed in the lower half on one or both margins, those on old stems often with entire margins; median leaflets more or less ovate-lanceolate, up to about 20 cm long and 5 cm broad, the apex often slightly hooked and blunt. *Male cone* 1-several, bright orange-yellow, on short stout peduncles, subcylindric, 40–90 cm long, rarely up to 120 cm, 15–20 cm diam., median scales up to about 7 cm long and 3–3·5 cm broad; bulla with the beak projecting 2·5–3·5 cm beyond sporangial surface, with acute lateral ridges, the upper facet with a central ridge or hump, the lower facet rounded or slightly ridged, the terminal facet slightly concave, about 1 cm broad and about the same vertically, often with raised margin.

Recorded from one locality only near Ngoye in Zululand and possibly now extinct in the wild; recorded in the wild by Chamberlain in 1912 and lastly by a Forest Officer in 1916: see R. A. Dyer in *Bothalia* 8 : 485 (1965). Several plants are in cultivation locally and overseas. Map 4.

NATAL.—Mtunzini: *Wylie* in NH 16044; 16046; (Cult. Durban Bot. Gard.) *Medley Wood ex Forbes* in PRE 29381; *Dyer & Verdoorn* 2361; 2362; 2363.

Our knowledge of *E. woodii* is based on suckers of different ages from a single male specimen, the rootstock of which appears to have perished, leaving only its transplanted progeny in cultivation. The female form is unknown. One may speculate that the single male plant was a relic of a species now extinct or it could possibly have originated as a mutation within the concept described as *E. natalensis* Dyer & Verdoorn. This latter suggestion is contained indirectly in Medley Wood's original observation that it was possibly a variety of *E. altensteinii* Lehm., the name under which *E. natalensis* was then known. The broadening of the stem base with age into a form of buttress and the long, gracefully curving leaves with a densely woolly young rhachis are among the main distinguishing characters of the old plants in cultivation.

18. *Encephalartos natalensis* Dyer & Verdoorn in *Bothalia* 6 : 205 (1951); R. A. Dyer in *Bothalia* 8 : 486 (1965). Type: Natal, Dyer 4475 (PRE, hol.).

E. altensteinii Auct., all in part, not of Lehm.; including Gard. Chron. 6 : 392–97 fig. 80–83 (1876); ser. 3, 2 : 281 (1887); Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 39 (1933); M. R. Henderson in Journ. S. Afr. Bot. 11 : 41 (1945).

Plants branched from the base or occasionally unbranched, with stems 3–4 m tall and occasionally up to 6·5 m, 25–40 cm diam., sometimes showing small amount of wool round apex. *Leaves* 1·3–3·2 m long including petiole 10–26 cm long; rhachis erect spreading, sometimes slightly recurved and twisted towards apex, tomentose at first, glabrescent with age except for densely woolly pulvinus; leaflets mainly spreading in the lower half of leaf and gradually in narrower V disposition towards apex, reduced to several prickles towards base of rhachis, dark green; median leaflets lanceolate to ovate-lanceolate, 16–23 cm long, 2·5–4·5 cm broad, pungent, entire or with 1–5 sharp prickles on one or both margins, more often on the lower leaflets and sometimes almost lobate on young plants. *Cones* 2–3 together on stout peduncles, dark yellowish-green with thin foxy tomentum. *Male cones* up to about 45 cm long, 9–10 cm diam., median scales about 4 cm long, 2·5–3 cm broad with sporangial surface obovate-oblong; bulla extended into a beak about 1·5 cm long with acute lateral ridges, the upper and lower facets fairly smooth, terminal facet about 8 mm broad, 7 mm wide vertically and with raised lower margin. *Female cones* oblong or oblong-ovate in outline up to 50 cm long and 25 cm diam.; median scales 7–8 cm long, 5 cm broad and 4 cm thick vertically with lateral ridges extending into the incurved lateral toothed lobes 2–3 cm long; bulla face about 2 cm prominent, finely rugose round base with upper and lower facets rounded or humped and with prominent blunt rugosities, terminal facet about 2 cm broad and 1·5 cm wide vertically, slightly concave. *Seed* scarlet, 5 cm long and 2 cm diam., with fleshy beak.

On cliffs in midland areas from the eastern Cape border to northern Natal; associated with but rarely within forest; occasional. Map 4.

CAPE.—Tabankulu, *Story* 4219.

NATAL.—Port Shepstone: Oribi Gorge, *Dyer & Dohse* 5412; 5418; 5420; 5421; 5422; *Beard* 724. Pinetown: *Edwards* 2865. Camperdown: *Dyer* 4475; 4476; 4477; *Dyer & Verdoorn* 2367; 2368; 2369; 2371. Lions River: *Bayer* 57; *Dyer & Codd* 4785. Krantzkop: *Verdoorn & Christian* 714; 714a. Vryheid: *Acocks* 11689; *Dyer* 4696;

4697; *Ward* 3398. Ngotshe: *Codd* 9568; *Gerstner* 5144.

There is no difficulty in distinguishing typical *E. natalensis* from *E. altensteinii* by the pubescence and series of prickles towards the base of the leaf rhachis of the former and their absence from the latter; the leaflets of the typical forms differ also but it is not known if the characters merge in the eastern Cape-southern Natal area. Assumed hybrids between *E. altensteinii* and *E. villosus* near East London show a strong likeness to some forms of *E. natalensis* in Natal. *E. villosus* has not been recorded in the presence of *E. natalensis* in the wild.

19. *Encephalartos lebomboensis* *Verdoorn* in *Flow. Pl. Afr.* 27: Pl. 1078, 1079 (1949); R. A. Dyer in *Bothalia* 8 : 491 (1965). Syn-types: Swaziland, *Keith* in PRE 28362 a & b (male and female respectively).

Plant branched or unbranched from the base with stems up to about 4 m tall and 30 cm diam., somewhat woolly on crown, with linear-lanceolate bracts about 4 cm long, 1 cm broad and woolly on back. *Leaves* in a dense crown, 1-2 m long, rarely longer, including petiole 3-10 cm long, pubescent when young, glabrescent; rhachis almost straight except towards tip which may be recurved or twisted, brown woolly towards base when young, glabrescent except pulvinus; leaflets mainly spreading widely, crowded above middle of rhachis but not much overlapping, wider spaced towards the base of rhachis and gradually reduced to several prickles; median leaflets narrowly lanceolate or sometimes oblong-lanceolate, 12-17 cm long, 1.2-2.2 cm broad, with 1-4 prickles on both margins, more regularly on the lower margin, rarely without prickles. *Cones* 1-3 together on short stout peduncles, apricot-yellow or dull salmon-pink. *Male cones* up to about 45 cm long and 13 cm in diam., narrowed gradually to apex and base; median scales about 3.5 cm long, 4 cm broad and 1.5 cm thick vertically, with sharp lateral irregularly lacinate ridges; bulla projected into a beak 1-1.5 cm long, terminal facet about 1 cm broad and slightly narrower vertically, with acute lower margin and indistinct upper one. *Female cones* cylindrical-ovoid, up to about 45 cm long and 22 cm diam.; median scales about 6 cm long, 4.8 cm broad and 3.5 cm thick vertically, with lateral ridges extending into the incurved lateral irregularly lacinate winged-lobes about 1.8 cm long; bulla face protruding about 1 cm,

with greyish or foxy pubescence, upper and lower facets more or less rounded and rarely ridged, the terminal facet central, slightly concave, 10-20 mm broad and 5-10 mm wide vertically, tomentose. *Seeds* scarlet, 4 cm long, 1.8-2.2 cm diam., with fleshy beak.

On cliffs and in gorges of the Lebombo Mountain range in Swaziland and extending into the south-eastern Transvaal, northern Natal and Mozambique. Map 4.

NATAL.—Paulpietersburg: *Schoeman* 1; *Verdoorn* 2310; 2311; *Dyer & Codd* 5032; 5033; 5034. Ngotshe: *Ward* 3919. Ubombo: *Codd & Verdoorn* 10282. Ingwavuma: *Verdoorn & Christian* 717; 718a; 719; 721; *West* 2118; *Codd & Verdoorn* 10300; 10301; *Ward* 4106; 4107.

TRANSSVAAL.—Piet Retief: *Du Plessis* 114a; 204; *Dyer & Verdoorn* 5837.

SWAZILAND.—Stegi, *Keith* in PRE 28352a, b; *Verdoorn & Christian* 723; 724; *Dyer* 4793; 4795; *Compton* 29292.

E. lebomboensis meets *E. villosus* inland from Pongola Poort in the Transvaal (and probably elsewhere in the valley) and plants of suspected hybrid origin (*Dyer & Verdoorn* 5838) were observed in close proximity to the two species. At Pongola Poort on the Transvaal side of the Jozini Dam wall, *E. ngoyanus* occurs with *E. lebomboensis* but evidence of hybridization between these species is lacking.

The closest relationship of *E. lebomboensis* in South Africa is with *E. natalensis*. Although prickles on the rhachis, nearly to the base, are a feature of *E. lebomboensis* and *E. natalensis*, occasional specimens in the Paulpietersburg district may be almost devoid of them as in *E. altensteinii*. This observation presents a problem for further investigation. The female cone scales seem tolerably uniform and do not show the prominent wrinkled face of *E. natalensis* or *E. altensteinii*.

20. *Encephalartos transvenosus* *Stapf & Burt Davy*, in *Burt Davy*, *Fl. Transv.* 1: 40, 99, Fig. 4 B (1926); M. R. Henderson in *Journ. S. Afr. Bot.* 11 : 45 (1945); Miller in *Journ. Bot. Soc. S. Afr.* 30 : 14 (1944); R. A. Dyer in *Bothalia* 8 : 494 (1965). Type: Transvaal, Letaba, *Burt Davy* H. 3086 (PRE, holo.).

E. altensteinii sensu Hutch. & Rattr. in *F.C.* 5, 2 (Suppl.): 39 (1933), partly.

Plant generally unbranched, occasionally branched after injury to crown, maximum height about 13 m (35-40 ft, many between 15-25 ft), 40-45 cm diam., apex of stem with some brown wool. *Leaves* 1-2.5 m long with fairly short petiole, densely tomentose at first, glabrescent, except for pulvinus; rhachis mainly straight, recurving towards apex;

leaflets spreading-recurved more or less at right angles to rhachis, upper ones often somewhat overlapping, reduced in size towards apex and to several prickles at base; median leaflets lanceolate to ovate-lanceolate, sometimes slightly falcate, 10–20 cm long, 2–3.5 cm broad, smooth on upper surface, with unevenly prominent veins on lower surface, remotely 2–5-toothed on upper margin towards base of leaflet, 1–3-toothed on lower margin, with pungent apex. *Cones* 2–4 together on short stout tomentose peduncles. *Male cones* subcylindric, 30–40 cm long, 13–15 cm diam., obtusely rounded at base and apex; median scales 4–4.5 cm long, 2.5 cm broad with sharp lateral ridges; bulla face projecting 1–1.5 cm, with deciduous reddish hairs, upper and lower facets variably slightly angled, terminal facet 1.5–1.6 broad, 8–13 mm wide vertically. *Female cones* oblong-oval in outline, 50–80 cm long, 20–30 cm diam.; median scales about 8 cm long, 6–7 cm broad, 3–4 cm thick vertically; bulla face projecting about 2.5 cm with fairly acute lateral ridges extending into the incurved lateral lobes 1–2 cm long, slightly verrucose to nearly smooth on exposed portion, upper and lower facets rounded with slight ridging, terminal facet thinly fawn-tomentose, 1.5–2 cm broad, 1–1.5 cm wide vertically. *Seed* red, angled by compression, 4.5–5 cm long, 2.5 cm diam., with fleshy beak.

On mountains in the mist belt of the Soutpansberg and Letaba districts, occurring in dense formation at Modjadji's Location. Map 4.

TRANSVAAL.—Letaba: Modjadji Mt., *Burt Davy* H. 3086; *Astley Maberly* in PRE 15059; *Verdoorn & Dyer* 2220; 2221; *Compton* 180891; *Codd & De Winter* 3102; 3103; 3104; *Rogers* 22068. Soutpansberg: *Codd* 6918; *Gerstner* 5895; 6193; *Verdoorn & Dyer* 2218; *Key* 1; 2; *Compton* 18061.

The Modjadji Cycad is the grandest species of them all. The leaflets recurve from the place of insertion on the rhachis and the teeth on the upper margin of leaflets are often more conspicuous towards the base than those on the lower margin. Female cones weigh up to 75 lb. In Fl. Cap. 5, 2 (Suppl.) 1933, Hutch. & Rattr. associated this species with their broad concept of *E. altensteinii*.

21. *Encephalartos paucidentatus* Stapf & *Burt Davy* in *Burt Davy* Fl. Transv. 1 : 40, 99 fig. 4A (1926); Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 40 (1933); M. R. Henderson in *Journ. S. Afr. Bot.* 11 : 48 (1945); R. A. Dyer in *Bothalia* 8 : 498 (1965). Type:

Transvaal; (exact locality and collector uncertain) H. 5185 (PRE, holo.), see R. A. Dyer in *S. Afr. Journ. Sci.* 61 : 50 (1965).

Plant unbranched or occasionally branched from base, stems up to about 6 m tall, 40–70 cm diam. with brown wool on crown. *Leaves* 1–2 m long including petiole 20–40 cm long; rhachis usually fairly straight or slightly recurved, sometimes slightly twisted, pubescent at first, glabrescent with age except woolly pulvinus; leaflets widely spaced towards base, a few becoming smaller, lobate and prickle-like, those towards apex becoming narrower and closer together but only sometimes overlapping; median leaflets narrowly lanceolate, straight or somewhat falcate, 15–25 cm long, 2–3.2 cm broad, rarely more, with up to about 30 conspicuous raised veins on lower surface, shortly pubescent, glabrescent on upper surface and more slowly so on under surface, with or without 1–3 prickles on one or both margins usually towards base. *Cones* probably 2–3 together on short stout peduncles, golden-yellow. *Male cones* up to about 60 cm long, 15 cm broad; median scales narrowly oblong-ovate to oblong-lanceolate, 4–5 cm long, 2–2.5 cm broad, with sharp lateral ridges; bulla projected into a decurved beak up to about 1.5–2 cm long, upper and lower facets humped towards base, terminal facet slightly more than 1 cm broad and slightly narrower vertically with irregularly toothed or crenate margin. *Female cones* (complete cone not seen); median scales 5–6 cm broad and about 3.5 cm thick vertically with lateral ridges extending into incurved lateral winged lobes about 2 cm long; bulla face protruding about 3 cm, with upper and lower facets rounded and conspicuously rugose, apical facet pubescent, concave, about 1.5–2 cm broad and about the same width vertically, with crenate margin. *Seed* red, up to about 4 cm long and 2.5 cm diam., with fleshy beak.

In association with low forest and mountain bush in the eastern Transvaal and Swaziland, rare. Map 4.

TRANSVAAL.—Barberton: *Van Elden* in PRE 10085; *Dyer* 4800; *Codd* 9458; *Thorncroft* sub *Rogers* 28426 (K); *J. Thorncroft* in PRE 29815.

SWAZILAND.—*Miller* 3597; *Halker* s.n.

The question of the locality from which the type specimen was collected is discussed in the *S. Afr. Journ. Science*, 61 : 50 (1965). The stated locality north of the Soutpansberg is highly unlikely. Long

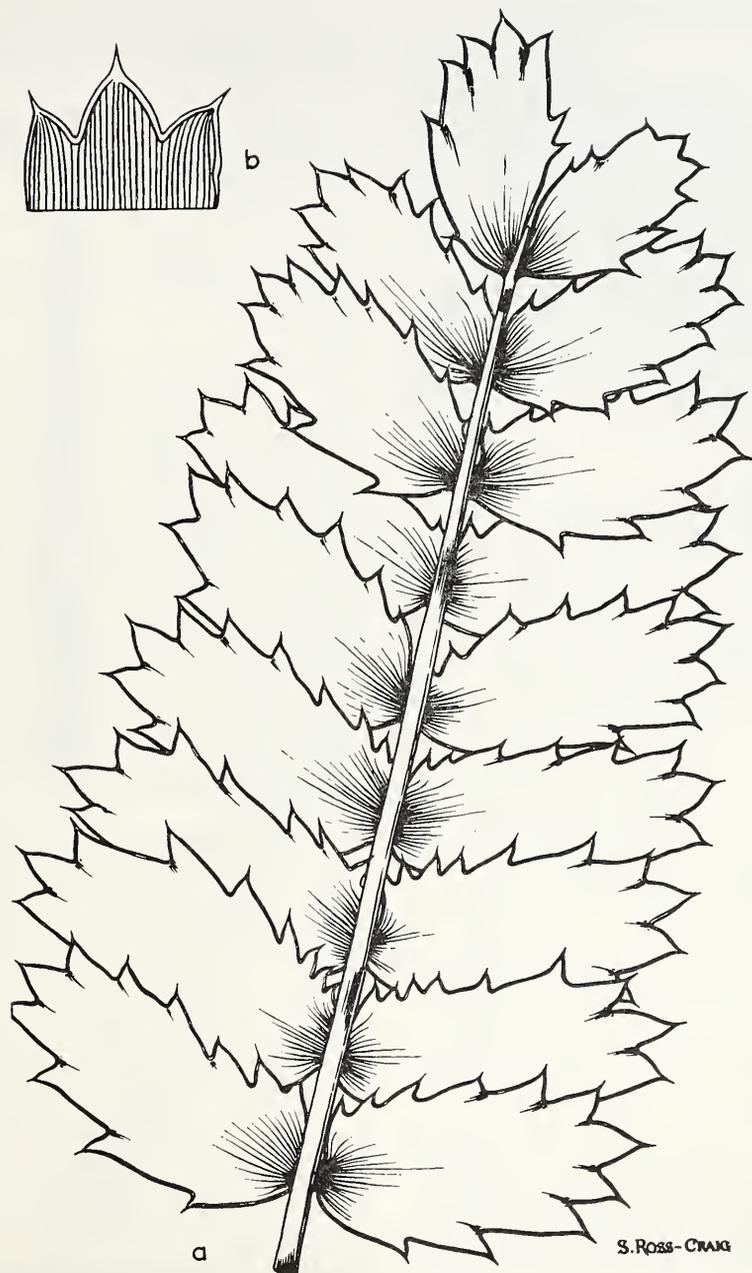


FIG. 7.—*E. ferox*, a, apical portion of leaf, reduced; b, apical portion of leaflet (taken from F. C. 5, 2 (Suppl.) 1933).

slender tapering leaflets with conspicuous veins on the lower surface are noteworthy characters of this species.

22. *Encephalartos ferox* Bertol. f. in Mem. Accad. Sci. Bologn. 3 : 264 (1851); Prain in Kew Bull. 1916 : 180 (1916); F.T.A. 6, 2 : 352 (1917); Schuster in Pflanzenr. 4, 1 : 113 (1932); Lewis in F.Z. 1 : 81, t.1, fig. B (1960); Paiva in Estud. Bot. 28 : 21 (1961); R. A. Dyer in Bothalia 8 : 499 (1965). Type: Mozambique, *Fornasini*.

E. kosiensis Hutch. in Kew Bull. 1932 : 512 (1932); Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 34 (1933); Compton in Hook. Icon. t.3220 (1933); Ogalvie in Kew Bull. 1939 : 655, Pl. 4 (1939); M. R. Henderson in Journ. S. Afr. Bot. 11 : 27 (1954); Schelpe in S. A. Journ. Sci. 47 : 16 (1950). Syntypes: Natal, Zululand, *Aitken & Gale* 63; *Lugge* NH16507. *E. sp.*, *Aitken & Gale* in Bot. Survey S. Afr. Mem. 2 : 18 (1921).

Stems unbranched or occasionally branched from base, majority less than 1 m tall and only rarely are they 2 m or more tall, about 30 cm diam. *Leaves* several to many in a whorl, 1–2 m long including petiole 20–30 cm long; rachis nearly straight, erect spreading, at first tomentose, glabrescent except for pulvinus; leaflets mainly overlapping in the upper half, more spaced in lower half, reduced in size gradually towards base of rachis into a few to several prickles; median leaflets broadest towards apex, more or less oblong-elliptic, up to about 15 cm long and 3.5 cm broad, rarely up to 5 cm broad, 2–4 small teeth on upper and lower margin and terminating in 3–5 broadly triangular pungent lobes at the apex. *Cones* 1–3 together on stout short peduncles, glabrous, shrimp-pink to red (Brazil Red, R.C.S.). *Male cones* subcylindric, narrowed to both ends, up to about 40 cm long, 7–10 cm diam.; median scales 3–4 cm long, 2.5–3 cm broad, 9–15 mm thick vertically with sharp lateral ridges; bulla face projecting into a decurved beak about 1 cm long, upper and lower facets somewhat rugose, terminal facet 6–10 mm broad, and about 6 mm wide vertically. *Female cones* ovoid to ovate-oblong in outline, 25–50 cm long, 20–40 cm diam., median scales 5–6.7 cm long; bulla 4.5–7 cm broad, 3.5–5.5 cm thick vertically, with lateral ridges extending into incurved lateral lobes almost to the main axis, upper and lower facets finely wrinkled in basal half, somewhat rugose on apical half, rounded, terminal facet slightly concave, 2–3 cm

broad and about 2 cm wide vertically. *Seeds* scarlet, 4.5–5 cm long, 1.5–2 cm diam., angled by compression, with fleshy beak. Fig. 7.

Locally common in coastal bush and grassveld from about 400 miles north of Loureco Marques to Sordwana Bay in Zululand; a solitary plant reported about 25 miles inland from Sordwana Bay. Map 4.

NATAL.—Zululand, *Aitken & Gale* 63; *Lugge* NH 16507; *Prosser* 1984.

The plant reported about 25 miles inland from Sordwana Bay seems to be outside the normal range of distribution and one can only speculate on how it reached there.

23. *Encephalartos villosus* Lem., Illustr. Hort. 14, Misc. 79 (1867); 15 : pl.557 (1868); Dyer in Bot. Mag. t.6654 (1882); Marloth, Fl. S. Afr. 1 : 96, t.15 B, t.16 B (1913); Schuster in Pflanzenr. 4, 1 : 118 (1932), in part, excl. *Zamia villosa* Gaertn.; Hutch. & Rattr. in F.C. 5, 2 (Suppl.) : 31 (1933), excl. *Z. villosa* Gaertn.; M. R. Henderson in Journ. S. Afr. Bot. 11 : 17 (1945); Verdoorn in Flow. Pl. Afr. 26 : Pl.1001, 1002 (1947); R. A. Dyer in Bothalia 8 : 502 (1965). Type: Hort. Verschaffelt, without locality, probably Natal, no preserved specimen traced but tab. in Illustr. Hort. 15, pl. 557 (1868) adequate; see R. A. Dyer in Journ. S. Afr. Bot. 31 : 119 (1965).

E. mackenii sensu G. Henderson, Ill. Dict. Gard. 1 : 508 (1885) not of Miq. Type: Natal, *McKen*, Hort. ? *E. striatus* Stapf & Burtt Davy in Burtt Davy, Fl. Transv. 1 : 40, 98 (1926). Type: without locality, *Reid* H.2987 (PRE 4, holo.).

Stem subterranean or sometimes with the crown slightly exposed, usually unbranched, up to about 30 cm long, 20 cm diam. with woolly interseriate bracts 5–7 cm long. *Leaves* 1.25–2.5 m long, suberect and gracefully curved-spreading above, white-woolly on rachis and lower surface of leaflets when young, glabrescent except for woolly pulvinus; leaflets glossy-green, spreading to recurving, not overlapping except occasionally towards apex of leaf, reduced to many prickles nearly to base of rachis; median leaflets linear to linear-lanceolate, acuminate, 15–25 cm long (rarely 30), 1.5–2.5 cm broad, usually with both upper and lower margins with 1–3 forward-directed sharp prickles, rarely entire, apex with single point or occasionally with 2 subequal lateral prickles in addition. *Cones* 1–several from a crown on stout peduncles up to about 20 cm long and 2.5–5 cm diam.,

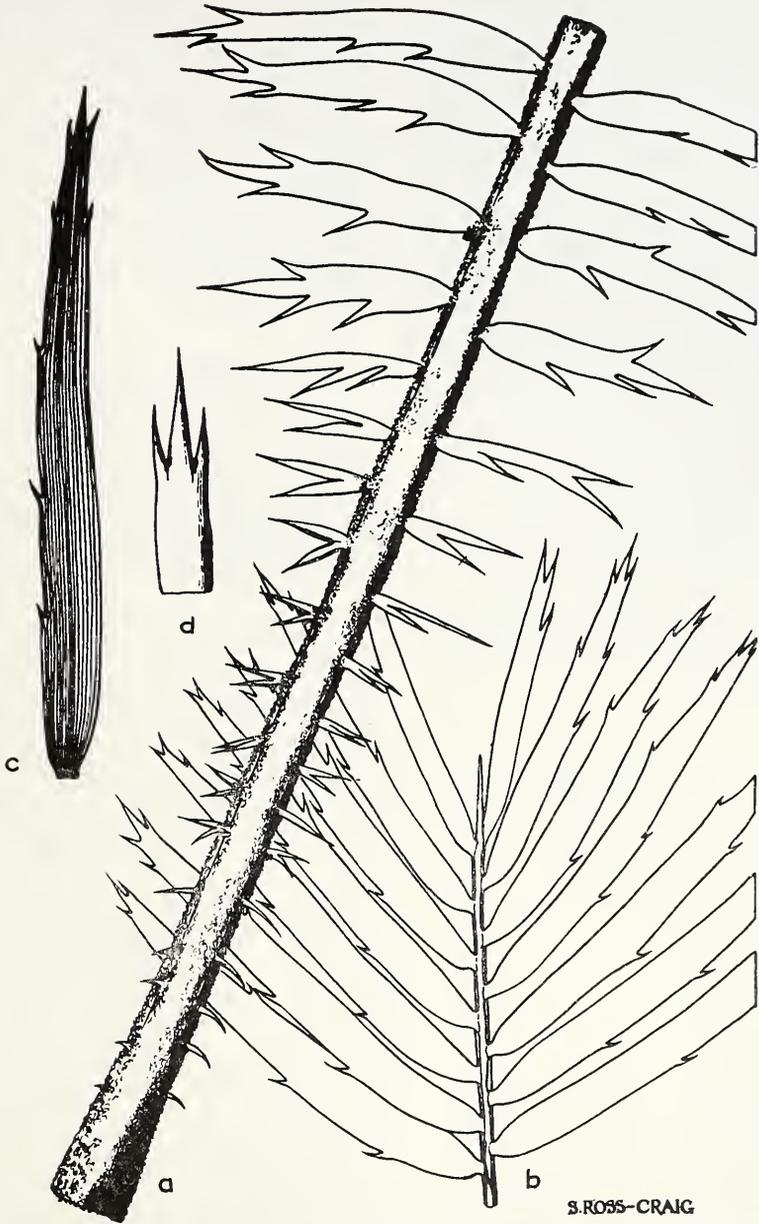
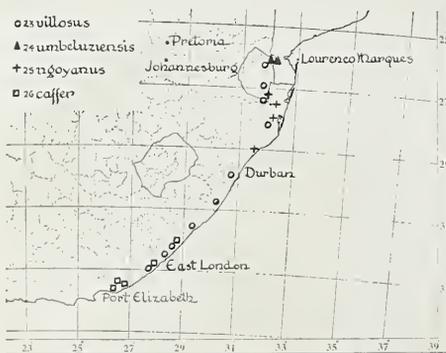


FIG. 8.—*E. villosus*, a, base of leaf, reduced; b, tip of leaf, reduced; c, median leaflet, reduced; d, tip of leaflet (taken from F.C. 5, 2 (Suppl.) 1933).

greenish-yellow to orange-yellow. *Male cones* up to about 65 cm tall, tapered to the apex and 6.5–12 cm diam. above the base (varying considerably and partly dependent on whether one or more cones arise from one stem), thinly pale brown tomentose when very young, glabrescent, unpleasant smell when dehiscing; scales set at upward angle from the axis; median scales 3–5 cm long, 3–3.5 cm broad; bulla laterally angled, with flattened face and up to 1.5 cm thick vertically, upper facet humped, terminal facet about 5 mm broad and 5 mm wide vertically extending to the lower margin of the face and there irregularly toothed or rough. *Female cones* oblong-ovoid in outline, 30–40 cm long, 12–13 cm diam.; median scales 4–4.5 cm long with quadrangular stipe about 2.6 cm long; bulla 4.5–5 cm broad, 2.5 cm thick vertically with incurved lateral lobes about 1.5 cm long and laterally angled; bulla face flattened with the upper and terminal facet almost in one plane; terminal facet with the lower margin more or less toothed and somewhat overlapping the scale below. *Seeds* scarlet, 2.5–3.3 cm long, 1.8–2 cm diam., with fleshy apex. Fig. 8.

From the eastern Cape near East London to Natal, south-eastern Transvaal and Swaziland, often locally common and usually associated with bush or low forest. Map 5.



MAP 5.—Distribution map of *E. villosus*, *E. umbeluziensis*, *E. ngoyanus* and *E. caffer*.

CAPE.—East London: *Galpin* 3340; 7102; 7767; *Dyer* 4429. Kentani: *Pegler* 342; 756; 1124; *Flanagan* 1374. Willowvale: *Acocks* 12287; *Marais* 485. Port St. Johns: *Mogg* 13052.

NATAL.—Camperdown: *Dyer* 4478; *Edwards* 2864. Zululand: *Ward* 4085; *Wells* 137.

SWAZILAND.—*Stegi, Nicholson* in PRE 27261; *Dyer* 4794.

TRANSVAAL.—*Piet Retief: Du Plessis* 114B; *Dyer & Verdoorn* 5836.

Galpin's reference on the label of one sheet of his 3340 to a stem of 5 ft must have been the result of confusion at some stage with *E. altensteinii*, with which *E. villosus* sometimes grows in low forest near East London. Specimens received at the Pretoria National Botanic Garden from that area strongly suggest that hybridization between these two species takes place on occasions in the wild. Hybridization between *E. lebomboensis* and *E. villosus* is indicated in specimens seen inland from Pongola Poort in the Piet Retief District. It seems that the farther north one travels the more robust the form of this species.

24. *Encephalartos umbeluziensis* R. A. *Dyer* in Flow. Pl. Afr. 28 : Pl. 1100 (1951); R. A. *Dyer* in Bothalia 8 : 505 (1965). Type: Mozambique, Umbeluzi, *Key* in PRE 28429 (PRE, hol.).

E. villosus sensu Lewis in F. Z. 1 : 83 (1960). *E. villosus* var. *umbeluziensis* (R. A. *Dyer*) Lewis, op. cit. 1 : 565 (1961); *Paiva* in Estud. Bot. 28 : 22 (1961). *E. sp.* aff. *E. caffer* *Lehm.* vel aff. *E. villosus* *Lem., M. R.* Henderson in Journ. S. Afr. Bot. 11 : 17 (1945).

Stem subterranean or sometimes with crown slightly exposed, usually unbranched with thick tuberous root, up to about 30 cm long and 20–25 cm diam., with densely woolly interseriate bracts. *Leaves* 1–2 m long, including petiole 10–30 cm long, suberect, woolly at first except on upper surface of leaflets, glabrescent; rhachis nearly straight, sometimes spreading-recurved in shade, 7–12 mm thick towards base; leaflets light green when young, soon becoming dark green, spaced about 1 cm apart with the bases inserted on the rhachis more or less along a straight line, twisted near the base like a half-open Venetian-blind, reduced in size towards base of rhachis but not reduced to a series of prickles; median leaflets linear, tapering to apex, 10–20 cm long, rarely upto 30 cm, 8–15 mm broad with apex pungent and usually with 1–2 prickles on upper margin and 1–3 on lower margin. *Cones* 1–3 together, pedunculate, olive-green turning to sulphur-yellow, glabrous. *Male cones* subcylindric, tapering slightly to apex, up to about 30 cm long, 6–8 cm diam. with peduncles 10–12 cm long, 2.5–3 cm thick; median scales about 5 cm long, 2–2.4 cm broad, 1–1.2 cm thick vertically, with acute lateral ridges; bulla face with the upper facet humped or ridged, the lower

facet slightly rounded, terminal facet rhomboid, 8–12 mm broad and 6–9 mm wide vertically. *Female cones* on peduncles about 15 cm long and 3.5 cm diam., up to 30 cm long, 12 cm diam.; median scales up to about 5 cm long and broad and 3 cm thick vertically, with acute lateral ridges; bulla face with upper facet with 1–2 sagittal ridges, lower facet slightly rounded and inconspicuous, terminal facet rhomboid, 1.3–2 cm broad and about the same vertically, somewhat below centre of bulla face or occasionally extending nearly to lower margin. *Seed* scarlet, about 3.5 cm long, 2 cm thick, angled by compression. Figs. 9a and 9b.

In dry forest without much undergrowth in southern Mozambique and extending into Swaziland up the Umbeluzi River Valley. Map 5.

SWAZILAND.—*Compton* 29571; 32066; 32067.

The basal leaflets are not reduced to a long series of prickles as in *E. villosus* Lem. and the cones, especially the male ones are considerably smaller on the average. Young plants of *E. umbeluziensis* and *E. ngoyanus* are not readily distinguished but so far no overlap in distribution has been observed. Mature plants of the former are considerably more robust especially in the round petioles and larger cones.

25. *Encephalartos ngoyanus* Verdoorn in Flow. Pl. Afr. 27: Pl. 1053, 1054 (1949); R. A. Dyer in Bothalia 8: 508 (1965). Syntypes: Zululand, Verdoorn & Christian 716; 716b (female and male respectively) (PRE).

E. caffer sensu Hutch. & Rattr. in F.C. 5, 2 (Suppl.): 30 (1933), partly, as to Rattray 1278. *E. sp. aff. E. caffer* Lehm., M. R. Henderson in Journ. S. Afr. Bot. 11: 16 (1945).

Stem subterranean or with crown exposed, usually unbranched, up to about 30 cm long and 20 cm diam., with woolly bracts. *Leaves* 3–7 in a whorl, 60–120 cm long including slender petiole 10–30 cm long; rachis erect or slightly recurving with silky and woolly off-white tomentum, glabrescent except for pulvinus; leaflets thinly pubescent at first, glabrescent, reduced in size abruptly near apex of leaf and gradually towards base but rarely to a prickle; median leaflets linear-lanceolate, pungent, 7–8 cm long, 9–11 mm broad, occasionally in shade up to 12 cm long and 1.5 cm broad, usually with 1–3 teeth on lower margin, rarely entire. *Cones* solitary on short stout peduncle, pale olive-green turning yellow. *Male cones* more or less cylindrical, 20–25 cm long, 4.5–6 cm diam.;

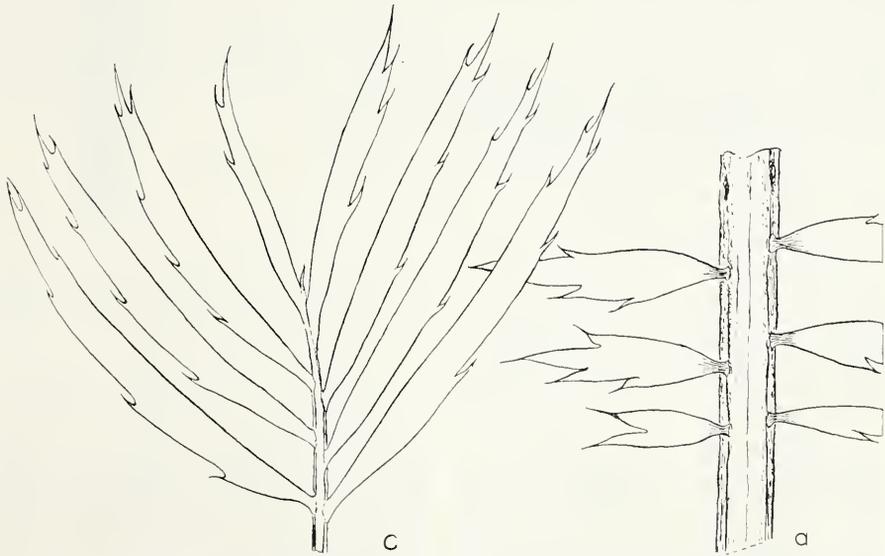


FIG 9a.—*E. umbeluziensis*, a, basal leaflets, not reduced to spines; c, tip of leaf, both $\times \frac{1}{2}$ (Dyer 4798).

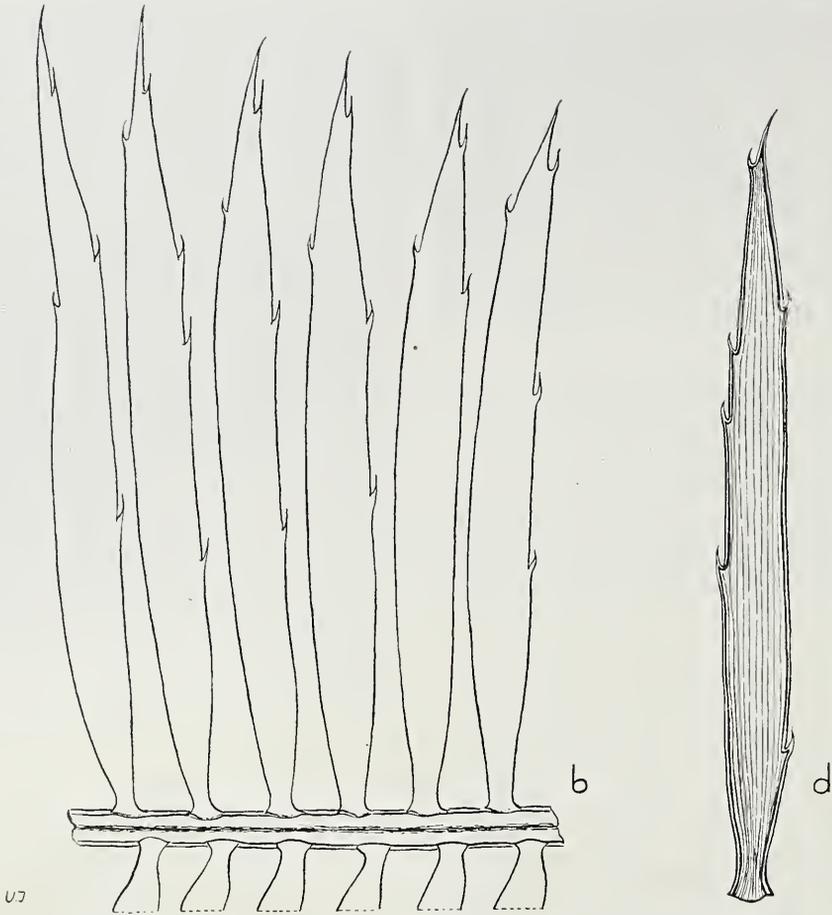


FIG. 9b.—*E. umbeluziensis*, b, median leaflets; d, single median leaflet, both $\times \frac{1}{2}$ (Dyer 4798).

median scales 2.5–2.8 cm long, 2.2–2.5 cm broad, 1.4–1.5 cm thick vertically, laterally angled; bulla face projecting in a subcylindric beak 7–8 mm long with the terminal facet only faintly indicated except for lower margin which is acute, decurved and sometimes slightly overlapping scale below. *Female cones* ovate-oblong in outline about 23 cm long, 10 cm diam.; median scales about 5 cm long, 4–5 cm broad and 3 cm thick vertically, laterally ridged and extended into incurved lobes about 5 mm long; bulla face only slightly projecting with upper facet humped, terminal facet faintly defined on upper mar-

gin, lower margin acute decurved and sometimes slightly overlapping scale below. *Seed* scarlet, 2.7–3 cm long, 2 cm diam.

In grassveld and forest margins, often near boulders, in northern Zululand and over the Transvaal and Swaziland border. Map 5.

NATAL.—Mtunzini: Ngoye, *Verdoorn & Christian* 715; 715a; 716; 716a, b, c; *Rattray* 1278; *Ward* 3469. Lower Umfolozi: Mkuzi, *Galpin* 13310. Ubombo: *Ward* 4077. Ingwavuma: *Verdoorn & Christian* 720; 720a, b, c, d; *Conyngnam* 1a, b, c.

TRANSVAAL.—Piet Retief: Pongola Poort, *Williams* in PRE 29821.

SWAZILAND.—Ubombo Mt., *Galpin* 11818.

This species seems to be distinguishable from *E. caffer* in a number of inconspicuous ways. Firstly the root-system is less tuberous, the stem less consistently subterranean, the leaflets less crowded, not twisted and the lower margin often toothed, and the female cone scales have a less pronounced terminal facet.

The break in distribution between the two species is noteworthy but not necessarily taxonomically significant.

26. *Encephalartos caffer* (Thunb.) Lehm., Pugill. 6 : 14 (1834); DC., Prod. 16, 2 : 532 (1868); Schuster in Pflanzenr. 4, 1 : 109 (1932); Hutch. & Rattr. F.C. 5, 2 (Suppl.): 29 (1933), excluding specimens cited from Natal; M. R. Henderson, in Journ. S. Afr. Bot. 11 : 13 (1945); R. A. Dyer in Bothalia 8 : 509 (1965). Syntypes: Cape, Thunb. sheets 1 & 2 of leaves and part of male and female cone material (UPS).

Cycas cafra Thunb., in Nov. Act. Soc. Sc. Uppsala. 2 : 285, (1775) partly, as to t.5 and part of Thunberg's material at Uppsala, excluding part of description.

Zamia cycadis L. f., Suppl. 443 (1781). Type: Cape, Thunberg. *Z. villosa* Gaertn. Fruct. 1, t.3 (1788). *Z. pungens* Ait. Hort. Kew ed. 1, 3 : 478 (1789) partly, as to Masson's specimen. *Z. cafra* Thunb., Prodr. 2 : 92 (1800); Fl. Cap. ed. Schult. 429 (1823) partly, as to Thunberg's material and Fig. of *Cycas cafra*.

Encephalartos brachyphyllus Lehm., Cat. Hort. Hamb. 1836, ex Lehm. & De Vriese, Tydsch. Nat. Gesch. 4 : 414, t.6 & 7 (1838) and Nov. Sp. Cycad. 6, t.1 & 2 (Scrip. 1837). Type: Hort. *E. cycadis* (L.f.) Sweet. Hort. Brit. ed. 3 : 626 (1839). *E. verschaftlii* Regel in Act. Hort. Petrop. 3 : 3 (1875). Type: Hort. *E. caffrorum* Hort. Sion ex Yates in Proc. Linn. Soc. 11 : 19 (1849); Schuster l.c. Type: Hort.

Plant with subterranean stem or with crown slightly exposed; roots tuberous; stem unbranched or occasionally branched, up to about 30 cm long, 15–25 cm diam., woolly at crown. Leaves 40–90 cm long, including the petiole of a few–several cm long; rhachis erect at first or slightly curved, densely brown woolly, glabrescent except pulvinus; leaflets numerous and crowded, sometimes twisted at various angles to the axis, glabrous, reduced at base to 1–2 prickles; median leaflets linear-lanceolate, up to about 10 cm long, 8–10 mm broad, entire, although toothed on young plants, somewhat decurrent at base. Cones solitary on stout peduncles, glabrous, usually shining, greenish-yellow. Male cones with peduncle up to about 15 cm long, cylindrical 20–30 cm long, 6–11 cm diam., median scale 2.5–3.5 cm long, 2.5 cm broad with lateral ridges;

bulla face projecting 5–6 mm beyond sporangia, upper facet smooth rounded, terminal facet 1–1.5 cm broad and wide vertically, slightly below central, concave and with the lower margin sometimes slightly toothed. Female cones on peduncle 6–7 cm long and 3.5–4 cm diam., subcylindrical, slightly narrowed to rounded apex, about 30 cm long, 15 cm broad; median scales 4.5–6 cm long, 5.5–6 cm broad, 3.5–3.7 cm thick vertically; bulla with lateral ridges extending into incurved lateral lobes about 1 cm long, basal portion pale orange-yellow or orange, closely papillate, upper facet rounded, with or without a sagittal ridge and fairly smooth surface, lower facet rounded, terminal facet 2.25–2.5 cm broad, 1.5–2 cm wide vertically, with slightly raised and sometimes toothed margin. Seeds scarlet, 3.7–3.9 cm long, 2.3–2.5 cm diam.

In sour grassveld of coastal belt from southern Steytlerville and Uitenhage Districts to the neighbourhood of Willowvale in the Transkei; infrequent. Map 5.

CAPE.—Steytlerville: cult. NGB 2601/16; Henderson 1505. Uitenhage: Van Stadens, Rattray 1098. Alexandria: Archibald 4565. Bathurst: Verdoorn & Christian 701; Dyer 4839; Smith 6558; Dyer & Wells 5795. East London: Mt. Coke, Galpin 7839; Smith 6901; Dyer 4845. Kentani: Pegler 1124; 1127; 2156; Verdoorn & Christian 710.

The species has not been rediscovered in the Steytlerville or Uitenhage districts in recent years.

For many years there was uncertainty about the correct application of the epithet *caffer* because Thunberg confused two species under the one name. The other species is now named *E. longifolius* Lehm.

G. G. Smith notes that specimens from the neighbourhood of East London have less rigid leaves than those from Bathurst and the leaflets are rolled inwards in the young stage. M. Wells noted inrolled young leaflets on a plant in Bathurst. On the other hand plants from Zululand, formerly included in *E. caffer*, are recognised as specifically distinct and are to be found under the name *E. ngoyanus*.

While these notes were in press, a record of *E. caffer* in the Humansdorp District has been confirmed. It is likely that Thunberg collected his material of both *E. caffer* and *E. longifolius* (which he confused) in this district.

Doubtful or Excluded Species

The following names have been published but the information is too incomplete for specific identification:

E. mauritianus Miq., Monogr. 48 (1842). This is cited under *E. lehmannii* in Fl. Cap. 5, 2 (Suppl.) 1933.

- E. nanus* Lehm. in Tydschr. 4 : 421 (1837). Related to *E. horridus* Lehm. but not possible to identify with certainty.
- E. plumosus* G. Henderson, Ill. Dict. Gard. 508 (1885). This could refer to a form of *E. villosus*.
- E. pungens* (Ait.) Lehm. Pugill. 6 : 13 (1834) = *Zamia pungens* Ait. Name based on a mixture of concepts.
- E. regalis* G. Henderson, Ill. Dict. Gard. Suppl. 341 (1900). This is thought to refer to a form of *E. altensteinii*.
- E. tridentatus* (Willd.) Lehm. Pugill. 6.13 (1834). = *Zamia tridentata* Willd. Sp. Pl. 4 : 846 (1806). Apparently based on a juvenile specimen of uncertain origin.
- E. van-hallii* de Vriese in Hoev. & de Vriese, Tydschr. 4 : 422 (1837-38). This is cited under *E. latifrons* in Fl. Cap. 5, 2 (Suppl.) 1933 and may well have been correctly diagnosed.
- E. vomii* Matte., Rech. App. Lib. Lign. Cycad. 70, (nomen) = *E. altensteinii* var. *vomii* G. Henderson, Ill. Dict. Gard. 508 (1885).
- The following epithets and others cited by Schuster in Pflanzenz. Cycad. (1932) which we have been unable to verify do not appear to have nomenclatural significance:
- E. almasianus* Hort. under *E. longifolius*
E. aquifolius Lodd. under *E. horridus* var. *latifrons*
E. brownii Hort. under *E. horridus* var. *latifrons*
E. crassifolius Hort. under *E. caffer*
E. ellipticus Lodd. ex Miq. under *E. caffer*
E. glaber Hort. under *E. altensteinii*
E. grandis Hort. under *E. altensteinii* var. *eriocephalus*
E. katzeri Regel ex Schuster under *E. altensteinii*
E. katzeri Hort. under *E. horridus* var. *latifrons*
E. lepeschkinei hort. under *E. horridus*
E. macrophyllus Hort. under *E. horridus*
E. niveo-lanuginosus Wendl. in Hort. under *E. villosus*
E. procer Miq. under *E. elongatus*
E. pumilus Lehm. MS. under *E. horridus* var. *nanus*
E. revolutus Hort. under *E. longifolius*
E. royeri Miq. in Herb. under *E. caffer*
E. van-den-heckeii Hort. under *E. altensteinii* var. *eriocephalus*
E. van-geertii Miq. under *E. cycadifolius* var. *friderici-guilielmi*

PODOCARPACEAE

by O. A. LEISTNER

Trees or shrubs, usually dioecious. *Leaves* linear to ovate or scale-like. *Male cones* axillary or terminal, usually consisting of numerous fertile scales each bearing 2 pollen sacs; pollen grains with air-bladders or wings. *Female cones* reduced, with 1 to several fertile scales; ovule solitary, erect or inverted, usually enclosed in a false aril (epimatium). *Cotyledons* 2.

Genera 7, found chiefly in the tropics and the southern temperate zone, in Africa, Asia, Australasia and South America. Only one genus occurs in Southern Africa.

In Phillips's Genera the genus is placed under the Taxaceae, but in agreement with Pilger (Engl. & Prantl, Pflanzenf. ed. 2, 13 : 211, 1926) and subsequent authors such as Stapf (F. C. 5, 2 Suppl. : 3, 1933) and Florin (Acta Hort. Berg. 15: 285-388, 1951) it is here put into a separate family.

In accordance with a recommendation of the International Code of Botanical Nomenclature the name *Podocarpus* is here treated as masculine. Previously it has, however, often been regarded as feminine and where such names are quoted under synonymy in the present work they are given in the original form.

13

PODOCARPUS

Podocarpus L'Hérit. ex Pers., Syn. 2 : 580 (1807), nom. cons.; Endl., Gen. Pl. 1 : 262 (1837); Pilg. in Pflanzenz. 4, 5 : 54 (1903); Stapf in F.C. 5, 2 (Suppl.) : 3 (1933); Buchholz & Gray in Journ. Arn. Arb. 29 : 54 (1948); Phill., Gen. ed. 2 : 50 (1951).

Nageia Gaertn., Fruct. 1 : 191 (1788), partly, nom. rej.

Trees or shrubs, dioecious, evergreen. *Leaves* spirally arranged, subopposite or whorled, rarely opposite, linear to narrowly ovate or scale-like. *Male cones* axillary, rarely terminal, sessile to shortly stalked, catkin-like; pollen grains usually with 2 air-bladders or wings.

Female cones axillary, on thin naked stalks or on short leafy or scaly branches, usually reduced to 1 to 2 fertile terminal scales and a few sterile lower scales which are fused with each other and with the cone axis; the fused cone axis and scales beneath the seeds either remain woody or become swollen and often fleshy at maturity (receptacle). *Ovule* solitary, adnate to the face of the fertile scale, inverted and enclosed in a false aril (epimatium) arising from the face of the scale and adnate to the single integument. *Seeds* ellipsoid to globose; testa and false aril form a coriaceous or externally fleshy and internally more or less woody shell; embryo axile.

Found mainly in montane and coastal forests in the tropics and the southern subtropics. There are about 80 species in the genus, of which four are recognised in Southern Africa.

The shape of leaves of all species varies greatly depending on the age of the specimen and the position of the leaf on the shoot. In general, leaves of juvenile specimens are longer, more slender, more pointed and often more falcate than leaves of adult trees. Juvenile features are usually lost when the tree is about 5 to 10 years old but they are sometimes retained in specimens of appreciable age. Leaves of senile plants tend to differ as follows from those of normal adult specimens: they are shorter, and often either narrower (e.g. *P. falcatus*) or wider (e.g. *P. latifolius*).

In both juvenile and adult specimens of all species dealt with, the 2 or 3 lowermost, and thus oldest, leaves on each shoot differ as follows from average leaves: they are shorter, broader, blunter, tend to be widest in the upper half and often have a brown tip. The uppermost 2 or 3 leaves, on the other hand, are generally longer, narrower and more acute than average leaves and they tend to be widest in the lower half.

This variability must be considered when consulting the key and the descriptions, which are based largely on leaves from the middle of shoots of average adult specimens.

Leaves of all species in our area are frequently infested by a fungus, *Corynelia uberata* Fr. ex Ach.

Some of the specimens cited in the following references were not seen: Pilg. in Pflanzenz. 4, 5 (1903), Burt Davy, Fl. Transv. (1926), Stapf in F.C. 5, 2 (Suppl.) (1933), Gray in Journ. Arn. Arb. 34 (1933).

- Branchlets usually less than 1.5 mm in diameter near apex, often square and distinctly ridged by leaf bases; leaves twisted at base and blade thus orientated in vertical plane, stomata present on both surfaces; seeds borne on scaly or leafy branches, which do not become swollen at maturity; Swellendam eastward into Transvaal. 1. *P. falcatus*
- Branchlets usually more than 1.5 mm in diameter near apex, terete, with shallow grooves or slight ridges; leaves not twisted at base and blade thus orientated in horizontal plane, stomata absent or sparse on upper surface; seeds borne on receptacles which become swollen and often fleshy at maturity, receptacles on naked stalks:
- Leaves usually shorter than 8 cm, roughly parallel-sided in middle portion, spreading to erect; seeds borne on succulent, often brightly coloured receptacles:
- Leaves generally wider than 5 mm, stomata absent on upper surface (very rarely a few present); Cape Peninsula and eastward into Transvaal. 2. *P. latifolius*
- Leaves generally 4–5 mm wide, many with 1 to several short rows of stomata on upper surface; western Cape only. 3. *P. elongatus*
- Leaves usually longer than 8 cm, tapering gradually from about the middle to an acuminate tip, more or less pendulous; seeds borne on receptacles which are slightly swollen but neither succulent nor brightly coloured; Natal, eastern Cape. 4. *P. henkelii*

1. *Podocarpus falcatus* (Thunb.) R.Br. ex Mirb. in Mém. Mus. Hist. Nat. Paris 13 : 75 (1825); Endl., Syn. Conif. 219 (1847); Carrière, Traité Conif. ed. 1 : 472 (1855); Henkel & Hochstetter, Syn. Nadelhölz. 400 (1865); Parl. in DC., Prodr. 16, 2 : 511 (1868); Pilg. in Pflanzenz. 4, 5 : 72 (1903), not seen: Ecklon & Zeyher s.n., Bachmann 74, Drege 6182, Bachmann 69; Burt Davy, Fl. Transv. 1 : 101 (1926), partly, excl. Brit. Bech., nr. Genesa; Chalk et al., Forest Trees & Timbers Brit. Emp. 1 : 23 (1932); l.c. 3 : 86 (1935); Marloth, Fl. S. Afr. 3, 1 : 66, t.19 (1932); Stapf in F.C. 5, 2 (Suppl.): 10 (1933), partly, excl. Wood 3005 and Brit. Bech.: Stellaland,

not seen: F.D. Herb. 1246, 1244, Bachmann 74, Sanderson 3015, Rehmann 6482; Robyns in Bull. Inst. Roy. Col. Belg. 6 : 237 (1935); Dallimore & Jackson, Handb. Conif. 67 (1948); Gray in Journ. Arn. Arb. 34 : 69 (1953), probably excl. Burt Davy 20248, not seen: Anon s.n. ex Scheidweiler Herb., Basil s.n., Anon s.n. ex Herb. A.N.S., Anon s.n., Molliana s.n., H.S. s.n., "Hort. Daudin", "Hort. Monac.", Engelmann s.n., Whitford 27; Melville in Kew Bull. 1954: 568 (1955); Lewis in F.Z. 1 : 85 (1960). Type: Ribbeck-castel, Vleermuysdrift, Thunberg 23779 (UPS, holo.!).

Taxus falcata Thunb., Prodr. 117 (1800); Fl. Cap. ed. Schultes 547 (1823).

Podocarpus meyeriana Endl., Syn. Conif. 218 (1847); Parl. in DC., Prodr. 16, 2 : 512 (1868). Type: *Drege* s.n. (?) *P. elongata* sensu Pappe, Silva Capensis 32 (1854); Carrière, Traité Conif. ed. 2 : 670 (1867), partly; Sim, For. Fl. Cape Col. 335 (1907); Marloth, Fl. S. Afr. 1 : 101 (1913), non (Ait.) L'Hérit. ex Pers. *P. falcatus* var. *latifolius* Pilg. in Pflanzenr. 4, 5 : 72 (1903). Type: Kaymansgat, *Drege* 6182 (B, holo.). — var. *pondosensis* Pilg. in Pflanzenr. 4, 5 : 73 (1903). Type: Pondoland, *Bachmann* 69 (B, holo.). *P. thunbergii* var. *falcata* (Thunb.) Sim, For. Fl. Cape Col. 332 (1907), partly, as to name and synonymy but excl. description. *P. gracilior* sensu Burt Davy, Fl. Transv. 1 : 101 (1926); Stapf in F.C. 5, 2 (Suppl.): 13 (1933). *P. gracillimus* Stapf in F.T.A. 6, 2 : 343 (1917); Burt Davy, Fl. Transv. 1 : 101 (1926); Chalk et al., Forest Trees & Timbers Brit. Emp. 1 : 23 (1932); Stapf in F.C. 5, 2 (Suppl.): 14 (1933); Gray in Journ. Arn. Arb. 34 : 73 (1953). Type: Houtboschberg, *Nelson* 423 (K, holo.).

Tall tree generally 10–25 m high but attaining a height of 60 m with a clean bole of more than 20 m and a girth of about 7 m. Bark greyish to purplish, more or less smooth and persistent in young trees, flaking in rectangular to roundish pieces in older specimens. Branchlets terete or square (on juvenile specimens generally square), distinctly ridged by decurrent leaf bases. Terminal buds about 1 mm in diameter; outer bud scales very narrowly triangular, 2–2.5 mm long and about 1 mm wide. Leaves spirally arranged, on branchlets of juvenile specimens often subopposite, spreading to suberect, glaucous to yellowish-green, twisted at the base and lamina thus orientated in a more or less vertical plane, narrowly linear-lanceolate to linear-elliptic, falcate to straight, acute to obtuse; adult leaves (1–) 2–4 (–4.5) cm long and (1.2–) 2–4 (–6) mm wide; juvenile leaves up to 12 cm long and 0.6 cm wide; midrib slightly raised on lower surface, very slightly raised on upper surface; stomata present on both surfaces, arranged in 14–20 ± distinct longitudinal lines on either side of midrib. Male cones solitary or in groups of 2–4, subsessile to very shortly stalked, 5–13 mm long, elongating up to 15 mm after shedding pollen, (2–) 3 (–3.5) mm in diameter, brownish; outer sterile scales at base very broadly triangular-trullate to very broadly obovate, crenulate to denticulate, 0.5–1 mm long and 1–1.5 mm wide; terminal lobe of fertile scales very broadly triangular-trullate, 0.6–0.8 mm long and 0.8–1.4 mm wide, crenulate to lacerate; pollen sacs 0.6–0.7

mm long and about 0.3–0.4 mm in diameter. Female cones solitary on scaly or leafy branches 7–27 mm long and 1.5–2.5 mm in diameter, widest at the top just below seed; only the terminal scale fertile. Seed sub-spherical to obovoid, (1.2–) 1.3–1.7 (–1.8) cm long, glaucous to greyish-green, ripening to a yellowish or light reddish-brown colour; testa consisting of outer somewhat fleshy covering up to 3 mm thick which becomes very resinous inwards, and inside this a sub-spherical, somewhat laterally compressed tubercled kernel 1–1.2 (–1.4) cm long with hard woody walls (0.8–) 1–1.7 (–2) mm thick. Fig. 10 : 1.

This, the tallest member of the genus in Southern Africa, occurs in coastal and montane forests from the Swellendam district in the Cape to the northern Transvaal and southern Mozambique. It is much less common than *P. latifolius* and apparently is only rarely dominant.

CAPE.—Albany: near Grahamstown, *Jacot Guillarmod* 4600 (RUH). Alexandria: Langebosch, *Archibald* 4499. Bathurst: Kariega River, *Britten* 2440. East London: *Marloth* 2587. Engcobo: Buswayo Forest, *Van der Merwe* in F.D. Herb. 2268. George: Wilderness, *Marloth* 12703. Humansdorp: Scott's Cave, *Wells* 2851. Kentani: near Kentani, *Marais* 739. King William's Town: near King William's Town, *Comins* 1027 (GRA). Knysna: Plettenberg Bay, *Rogers* 26861. Komga: near Komga, *Flanagan* 1179. Lusikisiki: Ntsubane Forest, *Fraser* in F.D. Herb. 2226. Mossel Bay: above Langfontein, *Muir* 2380 (J). Mount Ayliff: Fort Donald Forest Station, *Cochrane* s.n. Port Elizabeth: Van Staden's River, *Theron* 1658. Queenstown: Bongolo Nek, *Galpin* 7973. Somerset East: Boschberg, *Burchell* 3174 (K). Stocken-stroom: Katberg, *Moss* 15339 (J). Stutterheim: Kabaku Hills, *Acocks* 8998. Swellendam: Grootvadersbosch, *Marloth* 3496. Uitenhage: Kamachs, *Long* 1280.

NATAL.—Bergville: Indumeni Forest, *Killick & Marais* 2142. Estcourt: Balgowan, *Hilliard* 179 (NU). Helpmekaar: near Pomeroy, *Hilliard* 1569 (NU). Ixopo: Ingwangwane, *Houshold* in F.D. Herb. 1956. Ingwavuma: Kosi Bay, *Edwards* 2551. Ladysmith: Cundycleugh, *Hilliard* 1031A (NU). Lions River: Karkloof, *Hilliard* 2026 (NU). Polela: near Donnybrook, *Hilliard* 2464 (NU). Umfolozi: near Kwambonambi Halt, *Ballenden* in F.D. Herb. 2925. Utrecht: Donkerhoek, *Devenish* 665. Weenen: Umlumba Mountains, *West & Acocks* 2745 (NH).

SWAZILAND.—Stegi: Ubombo Mountains, *Miller* S/19.

TRANSVAAL.—Barberton: Ameide Plantation, *Scheepers* 1242; 1243. Letaba: near Ofcolaco, *Scheepers* 1241. Pietersburg: near Haenertsburg, *Codd* 9437. Pilgrims Rest: Mariepskop, *Van der Schijff* 5142. Soutpansberg: *Houshold* in Col. Herb. 5248.

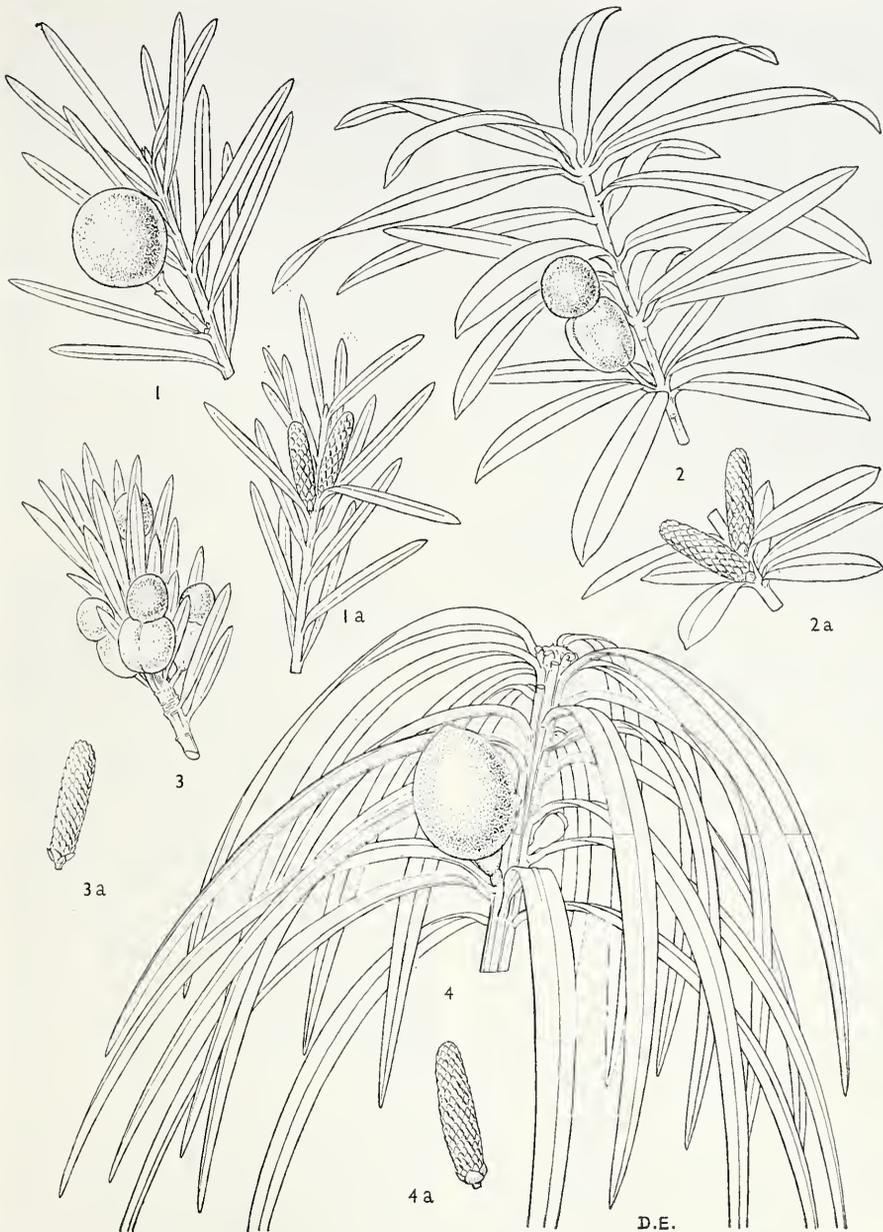


FIG. 10.—1, *Podocarpus falcatus*, portion of branch with seed (Watsham s.n.); 1a, portion of branch with male cones (*Jacot Guillarmod* s.n.). 2, *P. latifolius*, portion of branch with mature receptacle and seed (*Von Breitenbach* s.n. in *George For. Herb.* 1004); 2a, portion of branch with male cones (*Von Breitenbach* s.n. in *George For. Herb.* 1002). 3, *P. elongatus*, portion of branch with mature receptacles and seeds (*Kerfoot* s.n.); 3a, male cone (*Garside* 1044). 4, *P. henkelii*, portion of branch with seed (*Bird* s.n. in *George For. Herb.* 1001); 4a, male cone (*Von Breitenbach* s.n. in *George For. Herb.* 1005).

In some specimens from the Transvaal the leaf shape approaches that of the tropical African species *P. gracilior* Pilg., i.e. the leaves are more slender than is usual in those of *P. falcatus* and they taper gradually towards the tip from a point about the middle of the leaf, while those of *P. falcatus* normally tend to be more parallel-sided. Stapf regarded these slender-leaved specimens as true *P. gracilior*. A few Transvaal specimens, in which the leaves are markedly reduced in size, Stapf placed into a separate species, *P. gracillimus*. As regards their reproductive structures none of the Transvaal specimens were found to differ significantly from the typical *P. falcatus* and they are thus regarded as belonging to the same species. Specimens from the Ingwavuma district in northern Natal differ from the typical form in having leaves which are wider and more nearly parallel-sided, and seeds which are often larger and have thicker woody walls.

The record from British Bechuanaland in F.C. 5.2 (Suppl.): 12 (1933) refers to *Terminalia sericea* Burch. ex DC. which is commonly known as "Geelhout" (= Yellowwood).

Probably the tallest tree in South African forests; it yields valuable timber provided the wood is well seasoned. Monkeys and birds are reported to eat the fruit. Some vernacular names are: Outeniqua Yellowwood, Bastard Yellowwood, Outeniekwa-geelhout and umSonti.

2. *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb. in Mém. Mus. Hist. Nat. Paris 13 : 75 (1825), non Wall.; Pilger in Pflanzenz. 4, 5: 90, fig. 17 B (1903), partly, excl. MacOwan 1958 (1598 sphalm.) in part, Götze 986, not seen; Ecklon & Zeyher 259, Beyrich 92, 163, Bachmann 70, 71, 72, Götze 986, Bergius s.n., Schlechter 3947; Marloth, Fl. S. Afr. 1 : 101, 102, t.13, t.17 A (1913); Burt Davy, Fl. Transv. 1 : 100, fig. 5 : A-D (1926), not seen; Davy 2467, 2748, 5114, 5146, Legat 2396 b, c, d, 2397, H 2453, Rogers 2455, 21607; Chalk et al., Forest Trees & Timbers Brit. Emp. 1 : 23 (1932); 3 : 81 (1935), partly, excluding Gillett s.n. in FHO 30023; Stapf in F.C. 5, 2 (Suppl.): 5 (1933), partly, excl. MacOwan 1958 in part, Zeyher 3884, not seen : Sim s.n., Beyrich s.n., Fourcade s.n., Burt Davy 2313, Botha s.n.; Robyns in Bull. Inst. Roy. Col. Belg. 6 : 240 (1935); Dallimore & Jackson, Handb. Conif. 72 (1948); Adamson in Fl. Cape Penins. 31 (1950); Gray in Journ. Arn. Arb. 34 : 167 (1953), partly, excl. F.D. Herb. 2170, Gilbert 505, Zeyher 3880, 3885, not seen; Bowie s.n., Ecklon & Zeyher s.n., H.R.P. s.n., Eames s.n., Compton s.n., Cook s.n., Buchholz s.n.; Lewis in F.Z. 1 : 86 (1960). Type: Houtniqwas, Grootvadersbosch, aliis, *Thunberg* 23780 (UPS, holo.!).

Taxus latifolia Thunb., Prodr. 117 (1800); Fl. Cap. ed. Schultes 547 (1823).

Nageia latifolia Kuntze, Rev. Gen. 2 : 800 (1891), non Gord.

Podocarpus thunbergii Hook. in Lond. Journ. Bot. 1 : 657, t. 22 (1842); Endl., Syn. Conif. 217 (1847); Pappe, Silva Capensis 32 (1854); Carrière, Traité Conif. ed. 2 : 670 (1867); Parl. in DC., Prodr. 16, 2 : 511 (1868); Marloth, Kapland 190, 191 (1908). Type: Houtniqwas, Grootvadersbosch, aliis, *Thunberg* 23780 (UPS, holo.!). —var. *falcata* sensu Sim, For. Fl. Cape Col. (1907), partly, as to t.149 fig. 2 only. —var. *latifolia* (Thunb.) Sim, For. Fl. Cape Col. 332, t.148 (1907). *P. latifolius* var. *confertus* Pilg. in Pflanzenz. 4, 5 : 90 (1903). Syntypes: Table Mountain, Cape Town, Bergius s.n. and Schlechter 3947. —var. *lactor* Pilg. in Pflanzenz. 4, 5 : 90 (1903); Chalk et al., Forest Trees & Timbers Brit. Emp. 3 : 82 (1935); Gray in Journ. Arn. Arb. 34 : 169 (1953). Type: Vogelgat Mountains, Schlechter 9542 (K, iso.). *P. henkelii* sensu Burt Davy, Fl. Transv. 1 : 101 (1926), excl. fig. 5G; Stapf in F.C. 5, 2 (Suppl.): 9 (1933), partly as to Cooper 1298, Sim 19019, Burt Davy 2748a (2738a sphalm.), Legat 2467 (3467 sphalm.), Nelson 420; Gray in Journ. Arn. Arb. 34 : 169 (1953), partly as to Legat 2467 (*Barbarton* 2467 sphalm.) and Burt Davy 2748a.

Tree up to 33 m high with straight clean bole up to 3 m in diameter or stunted tree or shrub no more than 2 m high. Bark dark grey to khaki-coloured, smooth in young trees, later longitudinally fissured and exfoliating in long strips. Branchlets slightly angular, marked with grooves from decurrent leaf bases. Terminal buds 2–3.5 mm in diameter; outer bud scales narrowly triangular, acuminate, upper half sometimes recurved, 4–6 mm long and about 1.5 mm wide. Leaves spirally arranged to subopposite, often crowded in upper parts of shoots, spreading, dark green to glaucous and shiny above; adult leaves straight to very slightly falcate, linear-elliptic, more or less parallel-sided in middle portion, rather abruptly contracted in upper 1/4 or 1/5, apiculate to subobtusate, (2–) 3.5–6 (–10) cm long and (0.5–) 0.6–0.8 (–1.3) cm wide; juvenile leaves up to 17 cm long and up to 17 times longer than broad; midrib raised on lower surface, on upper surface slightly raised in lower 2/3; margins slightly reflexed; stomata confined to lower surface (very rarely a few present on upper surface), arranged in 20–35 ± distinct longitudinal rows on either side of midrib. Male cones solitary, rarely in groups of 2, sessile or subsessile, (0.8–) 1–2 (–3) cm long, elongating to 3 cm or more after shedding pollen, (2.5–) 3–4.5 (–6) mm in diameter, pinkish; outer sterile scales at base narrowly to very narrowly triangular, often

distinctly keeled, subentire to denticulate, 3–4 mm long and about 1.5–2 mm wide; terminal lobe of fertile scale broadly triangular to widely ovate, about 0.6 mm long and 0.6–0.7 mm wide, lacerate; pollen sacs about 1.3 mm long and 0.6–0.7 mm in diameter. *Female cones* solitary, on naked stalks (1.5–) 5–10 (–19) mm long and about 1 mm in diameter; receptacle fleshy, glaucous green, turning pink to reddish-purple when ripe, sweet-tasting and semi-transparent, 8–14 mm long and 8–14 mm wide, with 1, less commonly 2 fertile scales, 1 or sometimes 2 seeds maturing on each receptacle. *Seed* obovoid to subglobose, often slightly apiculate, glaucous to slate-coloured, sometimes turning dark violet, 7–11 mm long; shell 0.5–1.2 mm thick, consisting of 3 layers: the outermost thin and leathery, the middle one varies in thickness, is slightly woody, often contains cavities filled with resin, the inner thin and parchmentaceous. Fig. 10 : 2.

Found in the Cape Peninsula, the high forests in the southern districts of the Cape Province and in coastal and midland climax forests from the Eastern Cape to the northern Transvaal. Occurs as a tall straight tree in high temperate forests, and as a low spreading tree or shrub on exposed rocky slopes and in open coastal bush.

CAPE.—Albany: Paradise Kloof, *Jacot Guillarmod* s.n. (RUH). Bredasdorp: Potberg, *Pillans* 9454 (BOL). Cape: Houtbay, *Marloth* 1795. Caledon: Vogelgat Mountains, *Schlechter* 9542 (K). Engcobo: Mkonto Forest, *Miller* 3082. George: *Mund* s.n. Humansdorp: Assegaaibos, *Thode* A2574. Keiskammahoek: Ghulokop, *Wells* 3091A. King William's Town: near King William's Town, *Comins* 1026. Knysna: Harkerville Forest, *Keet* 524. Komga: near Komga, *Flanagan* 1728. Lusikisiki: Ntsubane Forest, *Fraser* in F.D. Herb. 2227. Maclear: Pot River Berg, *Galpin* 6831. Mqanduli: Koffiebaai, *Van der Schijff* 5446. Mount Ayliff: Gxwaleni Forest, *Cochrane* in F.D. Herb. 2173. Port Elizabeth: Loerie, *Dix* 191 (GRA). Riversdale: above Corente River, *Muir* 394. Stockenström: Katberg, *Gilliland* in J 22532. Stutterheim: Kabaku Hills, *Acocks* 8996. Swellendam: Duiwelsbos, *Zeyher* 3882. Tabankulu: Tabankulu Forest, *Hilliard* 2500 (NU). Umzimkulu: Mhlonga Forest, *Kaufmann* in F.D. Herb. 2168, 2169.

O.F.S.—Harrismith: Retief Klip, *Steytler* in NBG 56065; Swinburne, Boschklouf, *Jacobsz* 152.

NATAL.—Alfred: Ngeli Slopes, *Hilliard* 1789 (NU). Bergville: Cathedral Peak, *Killick* 1645. Durban: Berea Hill, *Thode* in STE 8044. Eshowe: *Gerstner* 3107. Estcourt: Tabamhlope, *West* 87. Ixopo: Ingwangwane, *Household* in F.D. Herb. 1957. Kranskop: Ntunjambili, *Hilliard* 1433 (NU). Ladysmith: Van Reenen, *Hilliard* 1034A (NU). Lions River: Karkloof, *Hilliard* 2024 (NU).

Mtunzini: Ngoya Forest, *Huntley* 270. Newcastle: Amajuba Hill, *Phillips* 76. Ngotshe: Tendeka, *Gerstner* 5167. Nkandla: Qudeni, *De Winter* 8284. Pinetown: Isipingo North, *Ward* 354 (NU). Polela: near Donnybrook, *Reinhold* in J 21535. Port Shepstone: The Valleys Farm, *Mogg* 13947. Port St. Johns: *Brueckner & Allsopp* 229 (NU). Richmond: Byrne, *Galpin* 11989. Underberg: Sani Pass, *Hilliard* s.n. (NU). Utrecht: Donkerhoek *Devenish* 9.

SWAZILAND.—Mbabane: Forbes Reef Bush, *Burt Davy* 2744. Piggs Peak: Devils Bridge, *Compton* 31493.

TRANSVAAL.—Barberton: Ameide Plantation, *Scheepers* 1246. Belfast: Dullstrom, *Galpin* 13363. Letaba: Grootbos Forestry Reserve, *Scheepers* 713. Lydenburg: Sabie Falls, *Legat* in Col. Herb. 2455. Pietersburg: Blauwberg, *Codd & Dyer* 9095. Pilgrims Rest: Graskop, *Rogers* 23029. Potgietersrust: Palala, *Codd* 2365. Soutpansberg: Entabeni, *Obermeyer* 1228. Wakkerstrom: Slangapiessberg, *Burt Davy* 1939. Waterberg: Geelhoutkop, *Mogg* 24500.

No justification was found for upholding var. *lactor* Pilg. as there are intermediates connecting it with the typical form. All records of *P. henkelii* from Swaziland and Transvaal have proved to be juvenile specimens or coppice shoots of *P. latifolius*. For a note on vegetative differences between the two species see under *P. henkelii*.

The commonest member of the genus in Southern Africa and one of the most abundant trees in the Knysna forests. It yields valuable timber, and both seeds and receptacles are eaten by birds and other animals. Vernacular names used for the species are True Yellowwood and Opregte Geelhout.

3. *Podocarpus elongatus* (Ait.) L'Hérit. ex Pers., Syn. 2 : 580 (1807); Mirbel in Mém. Mus. Hist. Nat. Paris 13 : 75 (1825); L.C. & A. Richard, Comm. Bot. Conif. 13, t.1 fig. 2 (1826); Endl., Syn. Conif. 218 (1847); Carrière, Traité Conif. ed. 2 : 671 (1867), partly; Parl. in DC., Prodr. 16, 2 : 511 (1868), partly; Pilger in Pflanzenr. 4, 5 : 89 (1903), not seen; *Drege* 6186, 6185, *Bachmann* 2211, 1522, 1523, *Diels* 937; Chalk et al., Forest Trees & Timbers Brit. Emp. 1 : 24 (1932); Stapf in F.C. 5, 2 (Suppl.): 7 (1933), partly, excl. *Lucas* s.n., *Salisbury* s.n. and *Vere* s.n., not seen; *Bachmann* 1522, 1523, 2211, *Diels* 937; Dallimore & Jackson, Handb. Conif. ed. 3 : 66 (1948); Gray in Journ. Arn. Arb. 34 : 164 (1953), partly, excl. *Zeyher* s.n. in part, not seen; *Pearson* 15551, "Hort. Daudin", *Marloth* 11488. Type: C.B.S., *Masson* s.n. (BM, lecto.!).

Taxus elongata Ait., Hort. Kew. ed. 1, 3 : 415 (1789); Thunberg, Prodr. 117 (1800); Fl. Cap ed. Schultes 547 (1823). *Taxus capensis* Lam.,

Encycl. 3 : 229 (1789). Type: C.B.S., *Sonnerat* s.n. in P 17135 (photo seen).

Podocarpus thunbergii var. *angustifolia* Sim, For. Fl. Cape Col. 332, t.149 fig. 3-5 (1907). Type: the plate in Sim, l.c.

Rounded tree or spreading shrub usually 3-6 m high but attaining a height of 20 m; diameter of shrubs as much as 12 m. *Bark* thin, more or less persistent, greyish-green to dark grey. *Branchlets* pale yellowish-green, terete with grooves from decurrent leaf bases. *Terminal buds* of average branchlet about 2-3 mm in diameter; outer bud scales narrowly triangular-oblong, 4-6 mm long and about 1.5 mm wide. *Leaves* spirally arranged to subopposite, often crowded in upper parts of shoots and subverticillate, spreading to suberect, glaucous to greyish-green above, narrowly oblong-elliptic, tapering in the upper 1/2 to 1/3, but more abruptly near the tip, acute to subobtuse; adult leaves (1.8-) 3-6 (-7) cm long and (3-) 4-5 (-9) mm wide; juvenile leaves up to 12 cm long and 1 cm wide; midrib distinctly raised on lower surface, on upper surface slightly raised in lower half, margins flat to slightly recurved; stomata on lower surface in 15-30 ± distinct longitudinal rows on either side of midrib, on upper surface many leaves have 1 to several short rows of stomata in shallow longitudinal grooves. *Male cones* solitary or in groups of 2-5, generally ± sessile, more rarely on thin fertile shoots up to 7 mm long bearing 3-5 sessile cones in the axils of bracts, cones (1-) 1.4-1.9 (-2.5) cm long, elongating up to 3 or 4 cm after shedding pollen, (3-) 4 (-5) mm in diameter; outer sterile scales at base trullate-ovate to broadly transversely elliptic, contracted into a short tip, margin brown, scarios, denticulate, 2-3 mm long and 1.5-2 mm wide; terminal lobe of fertile scale triangular to ovate-triangular, denticulate to lacerate, 0.5-0.6 mm long and 0.6-0.8 mm wide; pollen sacs 0.9-1.3 mm long and 0.6-0.7 mm in diameter. *Female cones* solitary, on naked stalks (2-) 4-6 (-13) mm long and about 1 mm in diameter; receptacle fleshy, glaucous green at first, turning scarlet, when ripe 9-15 mm long and 10-16 mm wide, with 1 or 2 fertile scales, 1 or 2 seeds maturing on each receptacle. *Seed* ellipsoid to ovoid, slightly apiculate, (6-) 7-10 (-12) mm long, dark glaucous green; total thickness of shell 0.3-1 mm, consisting of 3 thin layers: the outer leathery, the middle one slightly woody and the inner parchment-

aceous, mottled with dark purple, between middle and outer layers small deposits of yellow resin are common. Fig. 10 : 3.

Confined to the winter-rainfall region of the western Cape where it grows mainly on sandy soil, often along streams and rivers. It has not been recorded from the coastal belt and appears to be absent from the Cape Peninsula. In exposed positions on mountains it is often stunted and can be almost prostrate.

CAPE.—Caledon: Kogelberg Reserve, *Grobler* in STE 24247. Ceres: *Thode* A2284. Clanwilliam: Cedarberg, F.D. Herb. 1243. Malmesbury: Riebeeck Kasteel Rocks, *Taylor* 1568 (NBG). Paarl: Paarl Mountain, *Prior* s.n. (K). Piquetberg: Mouton Valley Farm, *Marloth* 11488. Robertson: near Ashton, *Marloth* 11590. Stellenbosch: Swartboskloof, *Kerfoot* 5048. Swellendam: Bontebok National Park, *Barnard* 666. Tulbagh: Witsenberg Mountains, *Marloth* 1707. Van Rhynsdorp: Van Rhyns Pass, *Mauve* 4148. Wellington: Berg River, *Marloth* 11079. Worcester: Baineskloof, *Compton* 17950 (NBG).

May be confused with *P. latifolius*, but it is a well-defined species and it is very unlikely that the two species hybridise as Gray (Journ. Arn. Arb. 34 : 165, 1953) suggests. The presence of scattered stomata on the upper surface of many leaves is a valuable diagnostic character. The grooves in which these stomata are situated are usually visible to the naked eye and the stomata themselves can be seen under 10× magnification. In the majority of specimens 20-80 per cent of the leaves have at least one short row of stomata on the upper surface. Only a few herbarium specimens were seen in which none of the leaves had any stomata on the upper surface.

The two lectotypes chosen by Gray (l.c.) cannot be accepted: firstly a species cannot be represented by more than one collection and secondly there is no indication that the author of the species saw either of the specimens chosen. Therefore the Masson specimen in BM has been chosen as the lectotype (see *Bothalia* 9 : 142 (1966)).

Seeds and receptacles are eaten by birds and other animals. The species is sometimes referred to as Breede River Yellowwood.

4. *Podocarpus henkelii* Stapf ex Dallim. & Jacks., Handb. Conif. 47 (1923), (*henckelii* sphalm.); Burt Davy, Fl. Transv. (1926), partly, as to fig. 5 G only; Chalk et al., Forest Trees & Timbers Brit. Emp. 1 : 23 (1932); l.c. 3 : 84 (1935); Stapf in F.C. 5, 2 (Suppl.): 9 (1933), partly, excl. *Cooper* 1928, *Sim* 19019, *Legat* 2467 (3467 sphalm.), *Nelson* 420, *Burt Davy* 2748a (2738a sphalm.), not seen: F. D. Herb. 1248, 1249, *Henkel* in F.D. Herb. 2331 a & b; Gray in Journ. Arn. Arb. 34 : 169 (1953), partly, excl. *Legat* 2467 (*Barbarton* 2467 sphalm.), *Burt Davy* 2748a, not seen: *Setchell* s.n., *Ad. No.* 1282, "N.Y. Bot.

Gard. Type: Mount Ayliff: Bulembu Forest, Fort Donald Forest Station, *Cochrane* in PRE 29648 (lecto.!).

Podocarpus thunbergii var. *falcata* Sim, Tree Planting in Natal 236, 285, fig. 94 (1905), nom. subnud.; sensu Sim, For. Fl. Cape Col. 332, fig. opp. p.55, t.149 fig. 1 (1907), partly, as to description and figures but excl. synonymy. *P. falcatus* sensu Sim, Fl. Trees & Shrubs for Use in S. Afr. 185 (1919); Sim, Native Timbers of S. Afr. 102, fig. 1 (1921), non (Thunb.) R. Br. ex Mirb.

Straight tree up to 35 m high and attaining a girth of up to 6 m. Bark dark grey to khaki-coloured, in older specimens longitudinally fissured, usually defoliating in long narrow strips, occasionally defoliating in large sheets. Branchlets pale green with grooves from decurrent leaf bases. Terminal buds 3–5 mm in diameter; outer bud scales narrowly triangular tapering to a \pm linear tip 0.5–1 mm long, 7–10 mm long and 1.4–1.9 mm wide at the base, upper half often rolled into a spiral. Leaves spirally arranged to subopposite, often crowded in upper parts of shoots and subverticillate, \pm pendulous, dark green and glossy above, straight to slightly falcate, very narrowly lanceolate-elliptic with widest point generally just below the middle, almost parallel-sided from there downward to about the lower third, then narrowing gradually into a short petiole, tapering very gradually from about the middle upwards to an acuminate tip; adult leaves (5–) 9–12 (–17) cm long and (5–) 6.5–8 (–10) mm wide; juvenile leaves up to 22 cm long and up to 26 times as long as broad; midrib raised on lower surface, on upper surface slightly raised, at least in lower 2/3; margins slightly reflexed; stomata confined to lower surface, arranged in 25–35 \pm distinct longitudinal rows on either side of midrib. Male cones solitary or in groups of 2–5, sessile or on very short stalks, (1.2–) 1.5–1.8 (–2) cm long, elongating to 4 cm and more after shedding pollen, (4–) 4.5–5 (–6) mm in diameter; outer sterile scales at base truncate-ovate to narrowly so, often with a \pm terete tip 0.25–0.75 mm long, strongly but bluntly keeled, subtire to finely lacerate, about 4–5 mm long and 2–3 mm wide; terminal lobe of fertile scale widely ovate to ovate-triangular, lacerate to irregularly dentate, 0.7–1 mm long and 0.9–1.1

mm wide, pollen sacs 1.3–1.5 mm long and 0.6–0.7 mm in diameter. Female cones solitary on short naked stalks, receptacle clavate, glaucous, never fleshy, often not clearly demarcated from the stalk, length of receptacle and stalk together 4–12 mm, width of mature receptacle at top 3–6 mm, receptacle consists of two bracts of which only the terminal one is fertile. Seed ovoid-ellipsoid, narrowing towards the base, (1.2–) 1.7–2.2 (–2.5) cm long and (1.1–) 1.4–1.8 (–2.1) cm wide, olive-green; shell hard, leathery, gritty but never woody, 1.4–4 mm thick, with cavities up to 1 mm wide containing a pale yellow to white resinous deposit. Fig. 10:4.

Occurs in montane and less commonly in coastal forests in Natal and the adjoining regions of the Eastern Cape.

CAPE.—Engcobo: Engcobo Main Forest, *Ryan* 4469 (FHO). Flagstaff: near Flagstaff, *Hilliard* s.n. (NU). Mount Ayliff: near Mount Ayliff, *Story* 4248. Mount Frere: near Mount Frere, *Martin* 108 (RUH). Tabankulu: Tonti Forest, *Whibley* in F.D. Herb. 2167. Umzimkulu: Mhlonga Forest, *Kaufmann* in F.D. Herb. 2170, 2171.

NATAL.—Alfred: Impetyne Forest, *Hilliard* 1249 (NU). Bergville: Indumeni Forest, *Killick & Marais* 2144. Ixopo: Ingwangwane, *Houshold* in F.D. Herb. 1948. Pietermaritzburg: near Curry's Post, *Acocks* 11578. Polela: near Donnybrook, *Hilliard* 2463 (NU). Port Shepstone: Glenmore, *Van der Schijff* 6646 (PRU).

As pointed out before, all records of *P. henkelii* from Swaziland and Transvaal have proved to be juvenile plants or coppice shoots of *P. latifolius*. Sterile specimens of the two species can usually best be distinguished as follows: in *P. henkelii* the widest point of the leaf is usually about in the middle and from here the leaf narrows gradually and evenly to an acuminate tip; in *P. latifolius* leaves are generally more or less parallel-sided in the middle portion and taper fairly abruptly in the upper 1/4 or 1/5. Leaves of juvenile plants may be widest in the middle but they too taper more or less abruptly near the tip.

Tinley 734 and 745 (both in NU) were collected in the Ngome forest in the Ngotshe district of Natal, more than 100 miles from the nearest known locality of the species. Their leaves show the characteristic tapering but they are wider and shorter than normal. Fertile material is needed for a definite identification.

A valuable timber tree often grown for ornamental purposes. It is commonly referred to as Henkel's Yellowwood.

PINACEAE

by J. P. JESSOP

Trees or rarely shrubs, monoecious, evergreen or rarely deciduous, with monopodial growth; the wood containing resin. *Leaves* linear, spirally arranged. *Male strobiles* small, usually lateral, with numerous spirally arranged scales each bearing two pollen sacs on the abaxial surface; pollen grains usually with a pair of wings; bracts absent. *Female strobiles* usually subterminal, usually woody; scales arising in the axils of numerous spirally arranged bracts and attached to them only at the base, bearing two inverted ovules on the adaxial surface. *Seeds* usually winged; testa woody or leathery; aril absent. *Cotyledons* several to numerous.

Nine genera recognised, containing about 200 species, almost all occurring in the northern hemisphere. Many species, mostly belonging to the genus *Pinus*, are cultivated in South Africa, two of which are naturalised and hence dealt with here. For a list of cultivated species see p.51.

22

PINUS

Pinus L., Syst. Veg. 1000 (1753); Pilg. in Nat. Pflanzenfam. ed. 2, 13 : 165 (1926); Adamson in Fl. Cape Penins. 31 (1950); Loock, The Pines of Mexico and British Honduras (1950); Pilg. & Melchior in Syllabus Pflanzenfam. 1 : 331 (1954); Dallimore & Jackson, Handbook of Coniferae 442 (1961). Type species: *P. sylvestris* L.

Evergreen trees or shrubs often with apparently whorled branches. *Branches* of two kinds; the main branches bearing only scale-like leaves lacking chlorophyll, and deciduous short shoots bearing (1-) 2-5 (-8) green leaves in a common sheath. *Green leaves* needle-like, usually with 2 or more resin canals. *Male strobiles* clustered at the base of the young twigs; the pollen with bladder-like wings. *Female strobiles* terminal or lateral, ripening in their second or third year; the scales becoming woody with the free ends expanded.

About 80, or more, species widespread in, and almost all restricted to, the northern hemisphere including northern Africa. Two species are regarded as being naturalised in South Africa and are successfully competing with the indigenous vegetation, viz: *P. patula* in the eastern Transvaal and *P. pinaster* in the southern and south-western Cape Province. These two are fully described below. Many other species are cultivated in South Africa (see p.51).

Leaves arranged in bundles of 3, occasionally 4 or 5, pendulous.....1. *P. patula*
Leaves arranged in bundles of 2, patent.....2. *P. pinaster*

1. *Pinus patula* *Schlechtd. & Cham.* in Linnaea 6 : 354 (1831); Kotze, in S. Afr. Journ. Sci. 23 : 453, plates III-V (1926); Loock, The Pines of Mexico and British Honduras (1950); Poynton, Notes on Exotic Forest Trees in South Africa ed. 2 : 87 (1960); Dallimore & Jackson, Handbook of Coniferae 525 (1961).

Pyramidal trees up to about 40 m high. *Bark* broken into longitudinal, irregular shapes on the lower parts, but thin, papery and reddish-brown higher. *Young shoots* with many nodes, glabrous, glaucous-green at first becoming brownish in the second year. *Winter buds* cylindrical, long pointed, 12-25

mm long, covered with lance-shaped, long-pointed, fringed scales. *Leaves* light green, usually in bundles of 3 but sometimes 4 or 5, pendulous, 15-22 cm long; basal sheath persistent on the branches, about 25 mm long. *Female strobiles* lateral, sessile, in clusters of 2-5, 7-10 cm long, ovoid-conic, slightly curved, oblique at the base, pale brown, persistent on the branches; scales smooth with a minute prickle. *Seeds* triangular, grey mottled with black, 5 mm long; wing 12-20 mm long.

Indigenous to east-central Mexico, this species was introduced into South Africa in 1908. It now covers the largest area of any coniferous species in plantations, particularly in the eastern Transvaal,

where it is invading the vegetation on mountain slopes, especially in the Sabie district. It is also grown in the Natal Midlands and the eastern Cape.

O.F.S.—Harrismith: Harrismith Plantation, Robertson in PRF 7848, †

TRANSVAAL.—Ermelo: Jessievale Plantation, without collector in PRF 5621.

This species is known as the Patula Pine. One of its more characteristic features is the pendulous nature of the leaves.

2. *Pinus pinaster* Ait., Hort. Kew. 3 : 367 (1789); Adamson in Fl. Cape Penins. 32 (1950); Poynton, Notes on Exotic Forest Trees in South Africa ed. 2 : 94 (1960); Dallimore & Jackson, Handbook of Coniferae 528 (1961).

Pyramidal tree up to 40 m high. Bark deeply fissured, reddish-brown. Young shoots glabrous, pale brown, becoming prominently ridged and roughened by the bases of scale leaves. Winter buds stout, 20–25 mm or more

long, spindle-shaped, with whitish-brown, fringed, reflexed scales. Leaves dark green, in bundles of 2, rigid, 5–20 cm long. Female strobiles subterminal, sessile, in clusters of 1–many, 7–20 cm long, ovoid-conic, light reddish-brown; scales keeled, with a prominent, prickly umbo. Seeds 7–8 mm long with a wing 25–35 mm long.

Indigenous to Mediterranean Europe, from Portugal to Greece, and Africa as far south as Algeria. It was probably introduced to the Cape in the eighteenth century, and is now grown on a large scale in the southern and south-western Cape. It has become established in many parts of the southern and south-western mountains and is considered to constitute a serious threat to the indigenous flora.

CAPE.—Cape Town: Table Mountain, Marloth s.n. (PRE). Knysna: Concordia Plantation, Robertson in PRF 3001. Wynberg: Tokai, Neethling in PRF 6915.

This species is commonly known as the Cluster Pine.

CUPRESSACEAE

by J. A. MARSH*

Monoecious or occasionally dioecious, evergreen trees or shrubs; wood containing resin. Leaves usually of two types, in juvenile form often needle-like, spirally or subspirally arranged and spreading, in adult form usually small, squamiform, whorled or decussate and more or less appressed. Male strobiles small, mostly terminal and solitary; scales few to many, decussate or in whorls of three, bearing at the base on the abaxial surface 2–6 pollen sacs; pollen grains not winged. Female strobiles developing into typical cones, with enlarged leathery or woody valvate or imbricate and finally gaping scales, rarely fleshy and berry-like (*Juniperus*, *Arceuthos*); scales few to many, all or most fertile, bearing erect ovules at the base on the adaxial surface. Seeds free, rarely united in a stone, mostly winged; testa crustaceous to woody. Cotyledons 2, rarely 3–6.

Phillips in his Genera of South African Flowering Plants ed. 2 (1951) placed *Widdringtonia* under Pinaceae in the broad sense, but it has been decided to follow Pilger in Pflanzenfam. ed. 2, 13 : 361 (1926) and subsequent authors, such as Stapf in Flora Capensis 5, 2 (Suppl.) : 15 (1933), who take a more restricted view of the family limits and include this genus in the family Cupressaceae.

Genera about 16, found in both hemispheres; 1 genus occurs in the area of the Flora. For cultivated species see p.52

† The abbreviation PRF has been accepted for the Forestry Department Herbarium, Pretoria, and should replace "F.D. Herb." used elsewhere in this publication.

* Submitted in partial fulfilment of the requirements for the degree of M.Sc. at the University of Pretoria.

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WIDDINGTONIA

Widdingtonia Endl., Gen. Pl. Suppl. 2 : 25 (1842); Syn. Conif. 31 (1847); Schlecht. in Linnaea 23 : 339 (1864-5); Parlatore in DC., Prodr. 16, 2 : 442 (1868); Mast. in Journ. Linn. Soc. Bot. 37 : 207 (1905); Stapf in F.C. 5, 2 (Suppl.) : 15 (1933); Phill., Gen. ed. 2 : 51 (1951); Lewis in F.Z. 1, 1 : 86 (1960); Chapman in Kirkia 1 : 139 (1961).

Pachylepis Brongn. in Ann. Sc. Nat. ser. 1, 30 : 190 (1833), non Lessing (1832); Endl., Gen. Pl. 259 (1837). *Parolinia* Endl., Gen. Pl. Suppl. 1 : 1372 (1841), non Webb (1840). *Callitris* sect. *Pachylepis* (Brongn.) Benth. in Benth. & Hook. f., Gen. Pl. 3, 1 : 424 (1880). *Callitris* sensu Eichler in Pflanzenfam. ed. 1, 2 : 94 (1889), partly; sensu Dur. & Schinz, Consp. Fl. Afr. 5 : 951 (1894); Engl., Pflanzenw. Afr. 2 : 88 (1908).

Monoecious, evergreen trees or shrubs; wood fragrant, easily worked, containing oil and resin. *Leaves* of two types, in juvenile form needle-like and subspirally arranged, in adult form scale-like and appressed, decussate or alternate but not in whorls of 3 or 4. *Male cones* small, c. 4 mm long, terminal, mostly on short lateral branchlets; scales 5-7 pairs (usually 6), decussate, coriaceous, peltate, with normally 4 pollen sacs at the base of each scale. *Female cones* small, axillary, on elongated shoots, single or clustered; scales normally 4 of equal size and arranged in one whorl, rarely 5 or 6 scales, corky-coriaceous, apiculate, divaricate at time of pollination, then closing; ovules several at the base of each scale; mature cones woody, 1.3-2.5 cm in diameter, opening at the apex, with 4 very thick, woody valves often each with a prominent dorsal cusp; exterior of valves smooth to warty. *Seeds* ovoid or trigonous, winged; testa crustaceous. *Cotyledons after germination* 2, rarely 3, green, needle-like.

Named after Captain Widdington, R.N., F.R.S. (né Samuel Edward Cook) who travelled in Spain from 1829-32 and published a book on European Pines (1843).

A small genus occurring mainly along the southern and eastern mountain ranges of Southern Africa and extending as far north as Malawi (Nyasaland).

It is closely related to the North African genus *Tetraclinis* and the Australian *Callitris*; for differences between them, see Chapman in Kirkia 1 : 138 (1961). The genus *Cupressus* is superficially similar to *Widdingtonia* but differs from the latter in the fruit which consists of 6-8 peltate scales, each with a central boss or triangular process on the outer surface.

Three species are recognised, all of which occur in Southern Africa.

Valves of female cone smooth to wrinkled, not tubercled along margin, if warty then irregularly so; adult leaves on ultimate branchlets narrowly oblong, subtriangular in transverse section

1. *W. cupressoides*

Valves of female cone rough, with regular tubercles along margin; adult leaves on ultimate branchlets ovate, semi-circular in transverse section:

Seeds ovoid, triquetrous, obscurely winged; scar of attachment 4.5 × 6 mm; Clanwilliam district

2. *W. cedarbergensis*

Seeds somewhat flattened, conspicuously winged; scar of attachment 1.5 × 2.5 mm; Willowmore district.....

3. *W. schwarzii*

1. *Widdingtonia cupressoides* (L.) Endl., Cat. Hort. Vindob. 1 : 209 (1842); Syn. Conif. 33 (1847); Gordon, Pinet. ed. 1 : 333 (1858); ed. 2 : 417 (1875); Parlatore in DC., Prodr. 16, 22 : 443 (1868); Mast. in J. Linn. Soc. Bot. 37 : 270 (1905); Pilg. in Pflanzenfam. 13 : 383 (1926); Stapf in F.C. 5, 2 (Suppl.) : 18 (1933); Adamson & Salter, Fl. Cape Penins. 33 (1950); Chapman in Kirkia 1 : 138 (1961). Type: No specimen in Linn. Herb.; the original description is adequate.

Tuja cupressoides L., Mant. Pl. 125 (1767); Thunb., Prodr. 2 : 110 (1800); Fl. Cap. ed. Schult. 500 (1823); Ait.f., Hort. Kew. ed. 2, 5 : 322 (1813); Harv., Gen. S. Afr. Pl. ed. 1 : 311 (1838). *T. quadrangularis* Vent. ex Duhamel, Trait. des Arbr. 3 : 16 (1806). Type: "Ile de France au Reduit", Commerson in Herb. de Jussieu 17177 (P, holo.).

Cupressus capensis Breon in Cat. Pl. Cult. Jard. Bot. et Nat. Bourb. (1825). Type: "Ile de Bourbon", Breon s.n. (P, holo.).

Pachylepis cupressoides (L.) Brongn. in Ann. Sc. Nat. ser. 1, 30 : 190 (1833); Krauss, Fl. Kap. u.

Natal 1 : 152 (1846). *P. commersonii* Brongn. in Ann. Sc. Nat. ser. 1, 30 : 190 (1833). Type: "Ile de France au Reduit", *Commerson* s.n. in Herb. de Jussieu 17177 (P, holotype), isotype in Herb. Commerson (P!).

Callitris cupressoides Schrad. ex Drege, Zwei Doc. 115, 126 (1843), nom. nud. *C. cupressoides* (L.) Dur. & Schinz, Consp. Fl. Afr. 5 : 950 (1894); Marloth, Kapland 116, 198, 199 (1908). *C. natalensis* Endl. ex Fourcade in Rep. Natal For. 121 (1889), nom. nud. *C. commersonii* (Brongn.) Dur. & Schinz, Consp. Fl. Afr. 5 : 950 (1894). *C. whytei* (Rendle) Engl. in Pflzw. Afr. 2 : 89 (1908). *C. mahoni* (Mast.) Engl. in Pflzw. Afr. 2 : 88 (1908).

Widdringtonia commersonii (Brongn.) Endl., Syn. Conif. 34 (1847); Parlature in DC., Prodr. 16, 2 : 443 (1868); *W. natalensis* Endl., Syn. Conif. 34 (1847); Gordon, Pinet. 334 (1858); Parlature in DC., Prodr. 16, 2 : 443 (1868); Dur. & Schinz, Consp. Fl. Afr. 5 : 951 (1894). Type: according to Endlicher, it is reputed to be a *Krauss* or *Gueinzius* specimen from Port Natal. *W. caffra* Berg in Bonplandia 8 : 190 (1860). Type: no specimen cited. *W. whytei* Rendle in Trans. Linn. Soc. Bot. 4 : 60 (1894); Mast. in Journ. Linn. Soc. Bot. 37 : 270 (1905); Stapf in F.T.A. 6, 2 : 334 (1917); Pilg. in Pflanzenfam. ed. 2, 13 : 383 (1926); Stapf in F.C. 5, 2 (Suppl.) : 17 (1933); Lewis in F.Z. 1, 1 : 86 (1960); Chapman in Kirkia 1 : 138 (1961); White, For. Fl. N. Rhod. 8 (1962); Chapman, Veg. Mlanje Mts., Nyas. (1962). Type: Mt. Mlanje, *Whyte* s.n. (BM, holotype). *W. mahoni* Mast. in Journ. Linn. Soc. Bot. 37 : 271 (1905); Stapf in F.T.A. 6, 2 : 334 (1917). Type: Melsetter, *Mahon* (K!). *W. dracomontana* Stapf in Kew Bull. 206 (1918); Chalk et al., Some E. Afr. Conif. & Legum. 15 (1932); Stapf in F.C. 5, 2 (Suppl.) : 21 (1933); Chapman in Kirkia 1 : 138 (1961). Type: Drakensberg Mts., *Sanderson* 2011 (K, holotype); S!). *W. stipitata* Stapf in Hook., Ic. Plant. 32 : 3126 (1930); F.C. 5, 2 (Suppl.) : 16 (1933); Chapman in Kirkia 1 : 140 (1961). Type: Cult. Piet Retief, *Kotze* 7048 (F.D. Herb.!).

Shrub or small tree up to 9 m high or, in the tropics, attaining a height of about 50 m, with stem diameter up to 2 m, crown pyramidal when young, spreading with age; bark on young trees reddish grey, thin, fibrous, flaking off annually. *Leaves* of two types; juvenile leaves on seedlings and young trees needle-like, spreading, 1–2 cm long and up to 2 mm broad; adult leaves scale-like, appressed, narrowly oblong, often not strictly decussate, subtriangular in transverse section, adnate at the base, free and adnate portions often equally long. *Male cones* mostly on short lateral branchlets; scales usually 6 pairs, decussate, coriaceous, peltate, broadly ovate with 4 pollen sacs at the base of each scale. *Mature female cones* consisting of usually 4 woody valves; valves smooth to wrinkled, not tubercled along margin, if warty

then irregularly so. Seeds ovoid, conspicuously winged, somewhat flattened, outline including wings oblong–obovate, wing retuse at apex; seed scar about 1.5 × 2.5 mm. *Cotyledonary leaves* (after germination) 20–25 mm long and about 2 mm broad. Fig. 11 : 2.

Found on mountain ranges of the south-eastern and eastern Cape, Natal, Transvaal, extending into Southern Rhodesia, Portuguese East Africa and Malawi.

CAPE.—Caledon: Hermanus, *Smuts* 1222. George: Outeniqua Mts., *Krauss* 1140 (FI). Grahamstown: Howiesonspoor, *Zeyher* 3885 (P); Gubernorskop, *Rogers* 27668 (Z). Humansdorp: Goukama, *Burchell* 5588 (K). Mt. Ayliff: Tonti, *Kriel* 3004 (F.D. Herb.). Peninsula: Table Mt., *Burchell* 771 (K). Port Elizabeth: Otterford Reserve, *Rodin* 1123 (K). Stellenbosch: Jonkershoek, *Galpin* 12789. Stockenström: Katberg, *Muller* s.n. Umtata: Baziya, *Sin* 1473.

NATAL.—Bergville: Cathedral Peak, *Killick* 1745. Escourt: Cathkin Peak, *Meebold* 13144 (M); Giants Castle, *Sanderson* 2011 (K).

TRANSVAAL.—Pietersburg: Blaauwberg, *Schweickerdt* 1821 (K); Wolkberg, *Nanni* s.n. Pilgrims Rest: Mariëpskop, *Van der Schijff* 4477. Waterberg: Groothoek, *Codd* 3976. Soutpansberg: Hanglip, *Rodin* 4050.

The *Commerson* specimens, reputedly from Mauritius, on which *W. commersonii* was based, were examined and found to be indistinguishable from *W. cupressoides*. Mr. R. E. Vaughan of the Sugar Industry Research Station, Mauritius, states (personal communication) that no reference to these specimens is to be found in *Commerson's* manuscript notes and no species of *Widdringtonia* is indigenous to the island. Therefore the *Commerson* specimens were either obtained from a cultivated plant (which is unlikely), or were collected at the Cape and were accidentally incorporated into the *Commerson* collection when it was shipped to France after *Commerson's* death.

W. stipitata is a form of *W. cupressoides* with longer pedicels. As this characteristic is not constant, this species is placed in synonymy.

Although an impression is gained that geographical races can be recognised in *W. cupressoides* (sens. lat.), a range of variation is found in characters such as leaf shape, seed and cone morphology. Thus no reliable distinguishing character could be found to separate the three "species" *W. cupressoides*, *W. dracomontana* and *W. whytei*.

2. *Widdringtonia cedarbergensis* Marsh in Bothalia 9 : 125 (1966). Type: Clanwilliam, Cedarberg Mts., near Middelberg West Peak, *Lückhoff* in PRE 29824 (PRE, holotype).

Callitris arborea Schrad. ex Drege, Zwei Doc. 73 (1843), nom. nud.; Dallimore in Kew Bull. 1913 : 222 (1913); Stapf in F.C. 5, 2 (Suppl.) : 24 (1933), in synon. *C. ecklonii* Schrad. ex Pappe, Fl. Cap. Med. Prodr. ed. 1 : 25 (1850), nom. subnud.

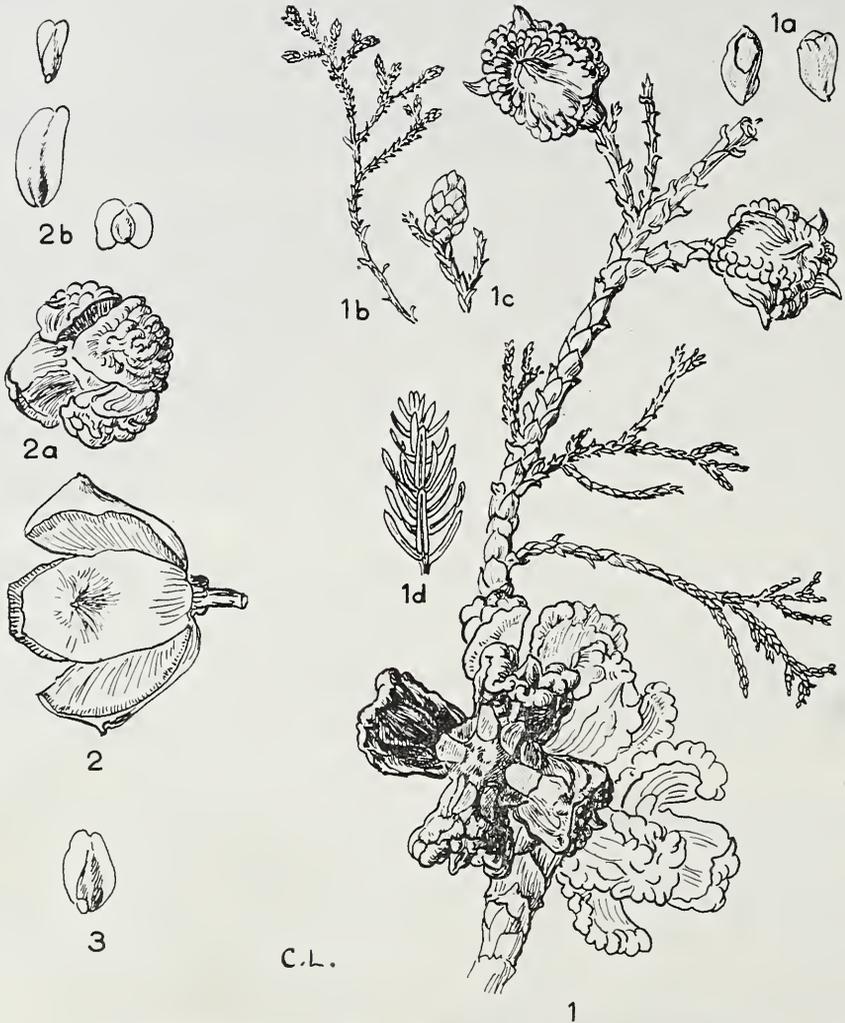


FIG. 11.—1, *Widdringtonia cedarbergensis*, branch with immature and old strobiles (Walsh in PRE 29915); 1a, anterior and posterior view of seed; 1b, twig with male cones; 1c, male cone, $\times 4$; 1d, juvenile shoot (Gov. Forester in PRE 29914). 2, *W. cupressoides*, female strobile, smooth form (Banks sub PRF 12818); 2a, female strobile, rough form (Forester, in PRE 29916); 2b, seeds showing different forms. 3, *W. schwarzii*, seed (Gov. Forester in PRE 29917).

C. juniperoides sensu Dur. & Schinz, Consp. Fl. Afr. 5 : 951 (1894); sensu Engl., Pflanzenw. Afr. 2 : 89 (1908); sensu Marloth, Kapland 167 (1908).

Widdringtonia wallichii Endl., Syn. Conif. 34 (1847), nom. nud.; Stapf in F.C. 5, 2 (Suppl.): 23 (1933), in synon. *W. juniperoides* sensu Endl., Syn. Conif. 32 (1847); sensu Stapf in F.C. 5, 2 (Suppl.): 23 (1933); sensu C. S. Hubb. in S. Afr. J. Sc. 33 : 572 (1937); sensu C. A. Smith in Journ. S. Afr. For. Add. 25 (1955); sensu Chapman in Kirkia 1 : 138 (1961). *W. wallichiana* Gordon, Pinet., suppl. 107 (1875), nom. nud.

Tree normally 5–7 m high, occasionally attaining a height of about 20 m with stem diameter up to 2 m; crown pyramidal when young, spreading with age; bark on young trees reddish grey, thin, fibrous, flaking off annually. *Leaves* of two types; juvenile leaves on seedlings and young trees needle-like, spreading, 1–2 cm long and up to 2 mm broad; adult leaves scale-like, appressed, ovate, 2–4 mm long, usually strictly decussate, semi-circular in transverse section, adnate at the base, free portion often much shorter than adnate portion. *Male cones* 2 mm long, mostly on short lateral branchlets; scales usually 6 pairs, decussate, coriaceous, peltate, broadly ovate, acuminate, with 4 pollen sacs at the base of each scale. *Mature female cones* subglobose, about 2.5 cm in diameter, usually consisting of 4 (rarely 5 or 6) woody valves; valves rough, with regular tubercles along the margin. *Seeds* ovoid, obscurely winged, trigonous; seed scar about 4.5×6 mm. *Cotyledonary leaves* (after germination) about 35 mm long and about 5 mm broad. Fig. 11 : 1.

Found on the Cedarberg Mts. near Clanwilliam in the Cape Province; occurs singly or scattered over some 30 miles on rocky outcrops at an altitude of between 3,000 and 5,000 feet.

CAPE.—Clanwilliam: Cedarberg Mts., *Coetzee* s.n.; *Ecklon* & *Zeyher* 74.3 (W); *Forester* s.n.

For reasons why it was found necessary to rename and describe this species, see note under *W. juniperoides* (L.) Endl., nom. dubium (p. 48), and *Bothalia* 9 : 124 (1966).

3. *Widdringtonia schwarzii* (Marloth)

Mastr. in Journ. Linn. Soc. Bot. 37 : 269 (1905); Marloth, Fl. S. Afr. 1 : t.17D (1913); Stapf in F.C. 5, 2 (Suppl.): 22 (1933); Ward in Journ. S. Afr. For. Ass. 31 (1958); Chapman in Kirkia 1 : 143 (1961); Lückhoff in Bosbou S. Afr. 3 : 1 (1963). Type: Willowmore, Marloth 3614 (PRE, holo.!; GRA; NBG).

Callitris schwarzii Marloth in Bot. Jahrb. 36 : 206 (1905); Kapland 134 (1908).

Tree normally 17–26 m high, occasionally attaining a height of about 40 m with stem diameter up to 5 m; crown pyramidal, usually not spreading with age; bark on young trees reddish grey, thin, fibrous, flaking off annually. *Leaves* of two types; juvenile leaves on seedlings and young trees needle-like, spreading, 1–2 cm long and up to 2 mm broad; adult leaves scale-like, appressed, ovate, usually strictly decussate, semi-circular in transverse section, adnate at the base, free portion often much shorter than adnate portion. *Male cones* mostly on short lateral branchlets, scales usually 6 pairs, decussate, coriaceous, peltate, oblong, acuminate, with 4 pollen sacs at the base of each scale. *Mature female cones* consisting of usually 4 woody valves, valves rough with regular tubercles along the margin. *Seeds* ovoid, conspicuously winged, somewhat flattened, outline including wings oblong-obovate, wing retuse at apex; seed scar about 1.5×2.5 mm; *Cotyledonary leaves* (after germination) 20–25 mm long and about 2 mm broad. Fig. 11 : 3.

Found in rocky ravines of the Baviaanskloof and Kouga Mts., Willowmore district, Cape Province.

CAPE.—Willowmore: *Civil Commissioner* s.n. (K); Baviaanskloof Mts., *Forest Officer* in F.D. Herb. 7157 (F.D. Herb.); Kouga Mts., *Burton* 4019 (F.D. Herb.); *Gov. Forester* 2; 4 (UPR); *Sim* 2920 (BOL).

Doubtful and Excluded Species

Cupressus juniperoides L., Sp. Pl. ed. 2 : 1422 (1763), was based on young seedlings grown from seed said to have come from "Cap. b. Spei." From the description it is impossible to identify the species or even the genus. There is no record that any subsequent author saw a specimen and no specimen is present in the Linnaean Herbarium. Judging from specimens seen in the British Museum and Geneva, the name was applied by botanists before 1800 to the S.W. Cape plant described by Linnaeus as *Thuja cupressoides* in 1767. At the time when Linnaeus described *Cupressus juniperoides*, the Cedarberg Mts. were unexplored botanically. In view of the above evidence, it is considered advisable to reject the name as a nomen dubium.

Cupressus africana Mill., Gard. Dict. ed. 8 (1768), nom. dubium, is presumably *W. cupressoides* from the Cape Peninsula.

Juniperus capensis Lam., Encycl. Meth. 2 : 626 (1786), nom. dubium. The type, which was examined in the Herbarium of the Museum

National d'Histoire Naturelle, Paris, consists of sterile, juvenile branches, which could not be identified with any degree of certainty. *Schubertia capensis* Spreng., Syst. Veg. 3 : 890 (1826), nom. illegit., based on *Cupressus juniperoides* L. (q.v.).

Pachylepis juniperoides (L.) Brongn. in Ann. Sc. Nat. 30 : 190 (1833), nom. dubium, based on *Cupressus juniperoides* L. (q.v.).

Widdringtonia juniperoides (L.) Endl., Syn. Conif. 32 (1847), nom. dubium, based on *Cupressus juniperoides* L. (q.v.).

Parolinia juniperoides (L.) Endl. ex Gordon, Pinet. ed. 2 : 418 (1875), nom. dubium, based on *Cupressus juniperoides* L. (q.v.).

Callitris juniperoides (L.) Dur. & Schinz, Consp. Fl. Afr. 5 : 951 (1894), nom. dubium, is also based on *Cupressus juniperoides* L. (q.v.).

Widdringtonia equisetiformis Mast. in J. Linn. Soc. Bot. 37 : 271 (1905) was based on a cultivated specimen from Tokai in the Cape. It was later placed as a synonym of the Australian species *Callitris robusta* R. Br. by Masters himself in J. Linn. Soc. Bot. 37 : 332 (1905).

Nomina Nuda

The following nomina nuda or subnuda cannot be assigned with certainty to any recognised species. *Callitris stricta* Schlecht. ex Hook. in Lond. J. Bot. 4 : 141 (1845).

Widdringtonia ericoides Knight in Syn. Conif. Pl. 13 (1850).

Callitris capensis Schrad. ex Gordon, Pinet. 333 (1858).

Widdringtonia glauca Carr., Trait. Conif. ed. 2 : 61 (1867).

WELWITSCHIACEAE

by I. C. VERDOORN

Plant dioecious, stem woody, unbranched (closed system of growth), broadly obconic or turbinate, concave on top, outer covering corky; taproot elongated, branching near the apex. *Leaves* produced from the subcircular groove around the rim of the crater-like apex of the plant, parallel-veined, persistent, growing from the base. *Inflorescences* arising from floriferous cushions above, sometimes also below, the insertion of the leaf. *Flowers* unisexual (the male pseudo-bisexual but functionally unisexual), borne singly in the axils of scales forming small cones. *Male flower*: perianth segments 4, in 2 whorls; stamens 6 with filaments connate at the base; anthers 3-celled dehiscent by 3 slits at the summit; ovule single, abortive, with the integument produced into a style-like, tubular structure and expanded at the apex into a stigma-like, papillose disc. *Female flower*: perianth segments 2, navicular, united along the margins to enclose the ovule, flattened, with wings developing along the keels; ovule with the single integument produced into a style-like tubular structure which eventually is exerted, widened and lobed at the apex. *Seeds* winged, with 2 cotyledons, endospermous.

Family with 1 genus and 1 species, found in Africa.

The single genus in this family was at first placed in the Gnetaceae, the family under which it appears in Phillips's Genera of South African Flowering Plants, ed. 2 (1951). Because of the striking morphological and physiological differences between *Welwitschia* and related genera, as well as the unique form of the plant, it has been decided to follow Markgraf who, in Engler & Prantl's Pflanzenfamilien ed. 2, 13 : 407 (1926), gives each of the genera, formerly in Gnetaceae, the status of family. This concept is today generally accepted, for example by Pearson in the Flora Capensis, Vol. 5, 2 (Suppl.) : 1 (1933) and Lawrence, Taxonomy of Vascular Plants (1960).

Among the unique characteristics found in *Welwitschia* are the following:— a closed system of growth; a single pair of leaves which persist for the life-time of the plant; male flowers with a rudimentary ovule, the integument of which is produced into a style-like structure which expands at the apex into a stigma-like disc; and winged seeds.

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WELWITSCHIA

Welwitschia Hook. f. in Gard. Chron., 71 (1862); in Trans. Linn. Soc. 24 : 6, tt.1-14 (1863); Marloth, Fl. S. Afr. 1 : 107 (1913); Pearson in F.C. 5, 2 (Suppl.) : 1 (1933); Phill., Gen. ed. 2 : 52 (1951); nom. cons. Type species: *Welwitschia bainesii* (Hook. f.) Carr.

Tumboa Welw. in Gard. Chron., 75 (1861); in Journ. Linn. Soc. Bot. 5 : 185 (1861). Type species: *Tumboa strobilifera* Welw. ex Hook.f.

Description as for family.

Only one species is known, limited in distribution to desert or desert margin along the west coast of Africa from the Kuiseb river, which runs into Walvis Bay, South West Africa, northwards to and slightly beyond, Cape Negro in Angola.

The genus was first described in 1861 as *Tumboa* by Welwitsch, who had discovered these strange plants near Cape Negro in Angola. The name *Tumboa* was derived from what Dr. Welwitsch had been told was the native name for these plants. A year later, with Welwitsch's consent, J. D. Hooker changed the generic name to *Welwitschia*. According to present day rules of nomenclature this required official conservation and in the I.C.B.N. (1935), on page 89, *Welwitschia* Hook.f. appeared in the list of conserved names.

Welwitschia bainesii (Hook.f.) Carr. Conif. ed. 2 : 783 (1867); Pearson in F.C. 5, 2 (Suppl.) : 1 (1933); Whellan in Kirkia 5, 1 : 33 (1965). Type: Damaraland, *Baines* s.n. (K, photo, PRE).

Tumboa bainesii Hook. f. in Gard. Chron. 1007 (1861); Naud. in Rev. Hort. 186 (1862) as *Tumboa*; Rendle in Cat. Afr. Pl. Welw. 2 : 257 (1899). Type as above. *T. strobilifera* Welw. ex Hook.f. in Gard. Chron. 71 (1862). Type: Angola, Cabo Negro, *Welwitsch* s.n. (K, photo, PRE).

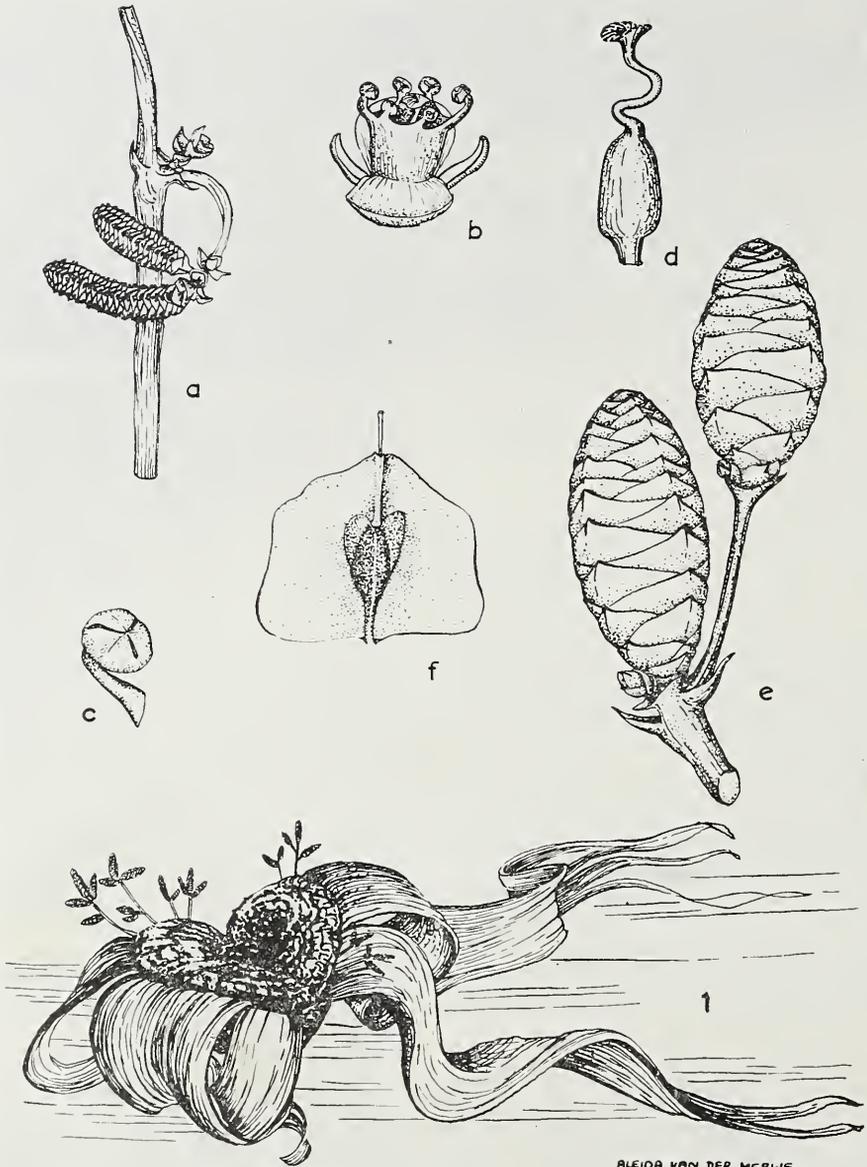
Welwitschia mirabilis Hook.f. in Gard. Chron. 71 (1862); in Trans. Linn. Soc. Bot. 24 : 7, tt.1-14 (1863); in Bot. Mag. tt.5368, 5369 (1863); McNab in Trans. Linn. Soc. Bot. 28 : 507, t.40 (1873); Sykes in Trans. Linn. Soc. Bot. ser. 2, 7 : 327 (1910); Pearson & Prain in F.T.A. 6, 2 : 333 (1917). Type: Angola, Cabo Negro, *Welwitsch* s.n. (K, photo, PRE).

Plant body unbranched, woody, obconic or turbinate, about 60 cm long, rarely up to 2 m long, usually with only the crater-like apical portion above ground, diam. at apex 0.3-1.2 m, outer covering on exposed part corky, corrugated; taproot elongated, 0.3-1 m long, sometimes up to 3 m long, usually branching only towards the apex. *Leaves* 2, rarely 3, produced from a groove encircling the rim of the crater-like apical portion, oblong, broadly acuminate to a sub-acute apex, 2-3 m long, at base as broad as about half the circumference of the plant apex, parallel-veined, with unusual lateral vascular communication, persistent, growing from the base, with age tearing into strips. *Inflorescence* a complex cyme, several to many arising annually from pits in cushions along the leaf bases, 15-30 cm long, bearing several to many cones; male cones deep salmon coloured when mature with many imbricate scales, stamens eventually exerted, subquadrate,

1-4 cm long, 5-7 mm broad; female cone glaucous green becoming yellowish and banded with salmon red at maturity, scales tightly imbricating, style-like structure eventually exerted, subquadrate, 2-8 cm long, 1.5-3 cm broad. *Flowers* unisexual and dioecious, borne singly in the axil of the scales; male: segments 4, 2 outer navicular, about 4 mm long, 2 inner broadly obovate, 4 mm long, 5 mm broad near apex, filaments united into a tube 3 mm long, free for about 1.5 mm, anthers terminal, oblate, 3-celled, dehiscing by 3 terminal slits; ovule with the integument produced into a style-like tube with a stigma-like disc at the apex; female: segments 2, naviculate and fused along their margins to enclose the ovule, eventually winged along the keels, persistent, ovule with the integument produced into a style-like, slender tube, fimbriate at the mouth. *Seed* dicotyledonous, endospermous, enclosed in the persistent membranous winged perianth segments. *Chromosomes*: $2n = 42$ (Chromosoma 14 : 522-533, 1963). Fig. 12.

Found mainly in the desert or semidesert areas along the west coast of South West Africa and Angola, which is known as the northern section of the Namib Desert. These areas stretch from the Gobabeb Research Station on the Kuiseb River in the south to just north of Cape Negro in Angola, that is a few miles south of Mossamedes. Favours dry watercourses in the desert localities but also found on rocky ledges in the Swakop gorges. Inhabits coarse gravelly soils (not deep sand as generally believed). In localities farther inland such as near the Petrified Forest nearly one hundred miles from the coast, associated with *Colophospermum mopane* in, usually, loamy soils.

S.W.A.—Swakopmund: *Dinter* 6792; 35 miles east of Swakopmund, *Hardy & de Winter* 1428 a and b, 2016 a and b; Heikamkab, lower Swakop valley, *Marloth* 1191; upper portion of ravines



ALEIDA VAN DER MERWE.

FIG. 12.—1, *Welwitschia bainesii*, male plant; a, portion of male inflorescence with two male cones; b, male flower with one of the inner segments pulled down to show the filaments united into a tube, $\times 5$; c, anther, $\times 10$; d, integument enclosing the ovule and produced into a style-like tube, $\times 7$ (Hardy & De Winter 2016a); e, portion of female inflorescence with two cones; f, female flower, nearly mature, showing the two segments winged along the keels and the very slender style-like tube of the integument exerted at the apex, $\times 1\frac{1}{2}$ (Hardy & De Winter 2016b).

leading into main valley, *Galpin & Pearson* 7440; 7470; 7476; Walvis Bay, *Cleverly* 1725; *Kock* s.n.; east of Goanikontes, *Rodin* 2606. Omaruru: Brandberg, *Srey* 2212a; 2212b; 2212c. Outjo: *Giess* 3228; 3857; 3867. Kaokoveld: Otjikongo, *Merxmüller* 7447.

The largest known specimens of *Welwitschia* are found in the desert areas such as the Welwitschia Flats near Swakopmund. Nearer the escarpment, where the rainfall increases, the average size of the plants decreases but they are usually much more abundant here than in the true desert.

CULTIVATED GYMNOSPERMS

by R. J. POYNTON

Most Gymnosperms of economic value in other parts of the world have been introduced into South Africa. Many have grown very fast and now form the basis of the softwood saw-timber industry in this country; others are widely planted for shelter and ornament. Representative examples are given below. All voucher specimens cited are housed in the Herbarium of the Forest Research Institute, Pretoria (PRF).

GINKGOACEAE

GINKGO L.

Ginkgo biloba L., Maidenhair Tree, is widely, though sparingly cultivated for ornament. TRANSVAAL.—Pretoria: Zoological Gardens, *Poynton* in PRF 13680.

ARAUCARIACEAE

AGATHIS Salisb.

Agathis brownii (Lem.) L. H. Bailey [*A. robusta* (C. Moore) F. Muell.] has been grown on a very small scale for timber in Zululand and is of potential economic importance. It is also sometimes encountered as an ornamental tree. NATAL.—Mtunzini: Port Durnford, *Van Rensburg* in PRF 10999.

Agathis microstachya J. F. Bailey & C. T. White has been planted experimentally for timber in Zululand and may be grown for this purpose on a larger scale in the future. NATAL.—Lower Umfolozi: Kwambonambi, *Haigh* in PRF 13033.

Agathis palmerstonii F. Muell. has been planted for timber on an experimental scale in Zululand and may be grown more extensively in the future. NATAL.—Lower Umfolozi: Kwambonambi, *Haigh* in PRF 13032; *Sherry* in PRF 13362.

ARAUCARIA Juss.

Araucaria angustifolia (Bertol.) Kuntze (*A. brasiliana* A. Rich.), Parana Pine, has been sparingly

planted for timber and ornament in warm, humid parts of the summer rainfall area. CAPE.—Mquanduli: Wilo, without collector, in PRF 11201.

Araucaria bidwillii Hook., Bunya-Bunya, is grown as an ornamental tree in warm areas. CAPE.—Engcobo, without collector, in PRF 3742.

Araucaria columnaris (Forst.) Hook. (*A. cookii* R. Br.), Captain Cook's Pine, is commonly grown for ornament, especially along the Natal coast. CAPE.—Uitenhage: Magennis Park, without collector, in PRF 4212, 4237—8.

Araucaria cunninghamii D. Don, Moreton Bay Pine, has been grown experimentally for timber in warm, humid parts of the summer rainfall area and is of potential economic importance in Zululand. TRANSVAAL.—Pretoria: *Kotzé* in PRF 4029.

Araucaria heterophylla (Salisb.) Franco [*A. excelsa* (Lamb.) R. Br.], Norfolk Island Pine. Sparingly grown as an ornamental tree in all warm areas. CAPE.—George: *Simmonds* in PRF 4005.

PINACEAE

PINUS L.

Pinus ayacahuite *Ehrenberg*, Mexican White Pine, together with var. *brachyptera* *Shaw*, is of potential value as a timber tree in the colder parts of the summer rainfall area. O.F.S.—Harrismith: *Kotzé* in PRF 5106.

Pinus canariensis C. Sm., Canary Pine, is grown extensively in the Cape Province for the production of poles and is also planted for shelter, shade and ornament. TRANSVAAL.—Pretoria: *Loock* in PRF 9992.

Pinus caribaea Morelet, Caribbean Pine, is grown for timber in Zululand and may be planted on a much larger scale in the future. NATAL.—Mtunzini: Port Durnford, *Lückhoff* in PRF 10267.

Pinus elliottii Engelm., Slash Pine, is grown on a very large scale in moist parts of the constant and summer rainfall areas for timber. In Zululand it is spreading naturally to some extent. TRANSVAAL.—Pilgrim's Rest: Tweefontein, without collector, in PRF 12015.

Pinus khasya Royle (*P. insularis* Endl.) has been planted experimentally for timber and is of potential economic importance in warm, humid parts of the summer rainfall area. TRANSVAAL.—Louis Trichardt: Hanglip, *Robertson* in PRF 7850.

Pinus montezumae Lamb. has been planted for timber on a small scale in cool, moist parts of the summer rainfall area. TRANSVAAL.—Belfast: *Robertson* in PRF 7871.

Pinus palustris Mill., Long-leaf Pine, has been planted fairly extensively for timber in moist parts of the constant and summer rainfall areas. TRANSVAAL.—Nelspruit: Coetzeestroom, *Lückhoff* in PRF 13588.

Pinus patula and *P. pinaster* (see pp. 42-43).

Pinus pinea L., Stone Pine, is a common ornamental tree in the western Cape Province, where it propagates itself to a certain extent. CAPE.—Cape Town: *Walsh* in PRF 13681.

Pinus pseudostrobus Lindl. has been grown for timber on a small scale under cool, moist conditions in the summer rainfall area and is likely to be more extensively planted in the future. TRANSVAAL.—Louis Trichardt: Hanglip, *Robertson* in PRF 7825.

Pinus radiata D. Don (*P. insignis* Dougl.), Monterey Pine, is planted for timber and shelter in the Cape Province. CAPE.—Bredasdorp: Napier, *Scheublé* in PRF 12527.

Pinus roxburghii Sarg. (*P. longifolia* Roxb. ex Lamb.), Chir Pine, has been grown extensively for timber in the summer rainfall area and is still planted for shelter and ornament, especially in dry localities. TRANSVAAL.—Pretoria, *Keet* in PRF 8304.

Pinus taeda L., Loblolly Pine, is grown fairly extensively for timber in cool, moist parts of the constant and summer rainfall areas. TRANSVAAL.—Ermelo: Jessievale, without collector, in PRF 5476.

CEDRUS Link

Cedrus deodara (Roxb. ex Lamb.) G. Don, the Deodar, is grown on a small scale for timber in cool, moist parts of the summer rainfall area and is widely planted for shelter and ornament. TRANSVAAL.—Pretoria: Bryntirin, *Legat* in PRF 4987.

PICEA A. Dietr.

Picea smithiana (Wall.) Boiss., West Himalayan Spruce, has been planted experimentally for timber

in cool, moist parts of the summer rainfall area and is sometimes grown for ornament. NATAL.—Lions River: Karkloof, *Poynton* in PRF 12838.

ABIES Mill.

Abies religiosa Schlecht. & Cham., Sacred Fir, has been planted experimentally for timber in cool, moist parts of the summer rainfall area. CAPE.—Victoria East: Hogsback, without collector, in PRF 9744.

TAXODIACEAE

CRYPTOMERIA D. Don

Cryptomeria japonica (L.f.) D. Don, Japanese Cedar, is grown on a limited scale for timber in cool, moist parts of the summer rainfall area and is sometimes encountered as an ornamental tree. TRANSVAAL.—Louis Trichardt: Hanglip, *Holtz-kampf* in PRF 5449.

TAXODIUM Rich.

Taxodium distichum (L.) Rich., Swamp Cypress, is widely, though sparingly cultivated for ornament. CAPE.—Cape Town: Botanic Gardens, *Legat* in PRF 4033.

CUPRESSACEAE

CALLITRIS Vent.

Callitris arenosa A. Cunn. ex Mirb. (*A. columellaris* F. Meull.) is of potential value as a timber tree, especially in Zululand. TRANSVAAL.—Louis Trichardt: Hanglip, *Poynton* in PRF 11965.

Callitris calcarata (A. Cunn.) R. Br. [*C. endlicheri* (Parl.) F. M. Bailey], Black Callitris, is sparingly cultivated for shelter and ornament. TRANSVAAL.—Letaba: Woodbush, *Kotzé* in PRF 2508.

Callitris glauca (R. Br. ex Mirb.) R. T. Bak. & H. G. Sm. [*C. hugelii* (Carr.) Franco], White Callitris, has been grown on a very small scale for timber in moist, warm parts of the summer rainfall area and is sparingly cultivated for shelter. TRANSVAAL.—Lichtenburg: *Poynton* in PRF 12002.

Callitris rhomboidea R. Br. ex A. & L. C. Rich. [*C. cupressiformis* G. Don; *C. tasmanica* (Benth.) R. T. Bak. & H. G. Sm.] has been planted experimentally for timber in warm areas and is occasionally grown for ornament. NATAL.—Mtunzini: Port Durnford, *Haigh* in PRF 13021.

THUJA L.

Thuja orientalis L., Chinese Arbor-vitae, is widely, but sparingly grown for ornament and as a hedge plant. TRANSVAAL.—Letaba: Grenshoek, *Bridgeford* in PRF 10709.

CUPRESSUS L.

Cupressus funebris Endl., Weeping Cypress, is occasionally planted for ornament. TRANSVAAL.—Pretoria: *Poynton* in PRF 12695.

Cupressus glabra Sudw. has been much planted for shelter and as a hedge plant. It hybridises freely with *C. arizonica* Greene and is frequently mistaken for it. TRANSVAAL.—Belfast: *Poynton* in PRF 11397-8.

Cupressus lusitanica Mill. (*C. lindleyi* Klotzsch), Mexican Cypress, has been planted on a small scale for timber in cool, moist parts of the summer rainfall area and may be grown more extensively in the future. TRANSVAAL.—Ermelo: *Jessievale*, *Poynton* in PRF 11407-09.

Cupressus macrocarpa Hartweg, Monterey Cypress, is grown for shelter and ornament, more

especially in the western Cape. CAPE.—Wynberg: Tokai, *Poynton* in PRF 12698.

Cupressus sempervirens L., Mediterranean Cypress, is widely cultivated for ornament—more especially the fastigate form, var. *stricta* Ait., the Churchyard Cypress. CAPE.—Wynberg: Tokai, *Poynton* in PRF 12591.

Cupressus torulosa D. Don, Himalayan Cypress, has been planted experimentally for timber in moist parts of the summer rainfall area. CAPE.—Wynberg: Claremont, *Legat* in PRF 4239.

JUNIPERUS L.

Juniperus virginiana L., Pencil Cedar, has been planted experimentally for timber under a very wide range of conditions and is occasionally encountered as an ornamental shrub or tree. CAPE.—Robertson: *Everest* in PRF 1090-2.

TYPHACEAE

by J. G. ANDERSON

Monoecious perennial herbs with creeping rhizomes. *Stems* erect, simple, terminated by dense cylindrical flower-spikes. *Leaves* mostly radical, distichous, elongate-linear. *Inflorescence* a dense spike of closely packed flowers with the male flowers zoned in the upper portion contiguous to or shortly separated from the female flowers in the lower portion. *Flowers* minute. *Male flowers* usually subtended by variously shaped scales or bracteoles; perianth absent or of 3-6 small scales; stamens 2-5; filaments free or variously connate; anthers linear, basifixed. *Female flowers* ebracteolate or with slender clavate or spatulate bracteoles, abortive clavate female flowers (carpodia) often produced; perianth of several fine, persistent, filiform or clavate hairs; ovary superior, often stalked, fusiform, unilocular with a solitary pendulous ovule; style elongated, slender; stigma linear or lanceolate. *Fruits* minute, ellipsoid or subcylindrical. *Seed* with a striate testa and mealy endosperm; embryo narrow, nearly as long as the seed.

According to Hutchinson, *Fam. Flow. Pl. 2* : 637 (1959), the Typhaceae is a monogeneric family, and this view is accepted here.

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TYPHA

Typha L., *Sp. Pl.* 971 (1753); *Gen. Pl. ed. 5* : 418 (1754); *Rohrb. in Verh. Bot. Verein. Brandenb.* 11 : 67 (1869); *Benth. & Hook. f., Gen. Pl.* 3 : 954 (1883); *Kronf. in Verh. Zool-Bot. Ges. Wien* 39 : 89 (1889); *Engl. in Pflanzenfam.* 2, 1 : 183 (1889); *N.E. Br. in F.C.* 7 : 31 (1897); *Graebn. in Pflanzenz.* 4 : 8 (1900); *N.E. Br. in F.T.A.* 8 : 134 (1902); *Phill., Gen. ed. 2* : 52 (1951); *Hutch., Fam. Flow. Pl. 2* : 637 (1959). Type species: *T. angustifolia* L.

Description as for the family.

Aquatic or marsh plants, widely distributed throughout the world, and comprising approximately 25 species, some of which are probably only forms of widespread variable species. The genus is represented by only one subspecies in South Africa.

The name *Typha* is derived from the Greek word *tuphos*, a marsh.

Typha latifolia L. subsp. *capensis* Rohrb. in Verh. Bot. Verein. Brandenb. 11 : 96 (1869); Graebn. in Pflanzenz. 4, 8 : 10 (1900), nom. superfl. Type: Cape, Uitenhage, Zwartkopsriver, *Ecklon & Zeyher* 913 (SAM, lecto.!).

T. latifolia L. forma *capensis* Rohrb. ex Kronf. in Verh. Zool-Bot. Ges. Wien 39 : 180 (1889), in syn. *T. capensis* (Rohrb.) N. E. Br. in F.C. 7 : 32 (1897). *T. australis* sensu N. E. Br. in F.C. 7 : 32 (1897) excl. syn., non Schum. & Thonn. *T. angustifolia* L. *β australis* Rohrb. in Verh. Bot. Verein. Brandenb. 11 : 83 (1869), partly as to S. Afr. specimens. *T. angustifolia* L. subsp. *australis* Graebn. in Pflanzenz. 4 : 13 (1900), partly as to S. Afr. specimens.

Perennial, robust, up to 2 m or more tall, glabrous. Stems erect, simple. Leaves distichous but spirally twisted at the base and sheathing forming a pseudo-stem, linear, tapering to an obtuse apex, convex on the back and flat or slightly concave below on the inner surface, thinner and flat towards the apex, 40–150 cm long and 4–20 mm broad, margins smooth, often undulated in the upper half, green or glaucous. Inflorescence a dense cylindrical brown or yellow-brown spike terminating the stem; upper male portion 15–30 cm long; lower female portion shorter, contiguous with the male or up to 4 cm distant. Male flowers usually with a few variously shaped, linear, lanceolate, cuneate or forked, brownish-white, slender bracteoles; stamens with slender filaments bearing 2 or 3 anthers; anthers 4–5 mm long, linear, often distinctly twisted, 2-celled, pollen simple or rarely compound. Female flowers usually ebracteolate occasionally with a few slender, colourless or brownish, lanceolate, clavate or linear, acute or acuminate bracteoles, abortive female flowers (carpodia) often produced; perianth of several, slender, colourless, simple hairs; ovary superior, usually stalked, often brown-mottled, narrow, unilocular with a solitary pendulous ovule; style slender; stigma lanceolate or linear, brown. Fruits minute, ellipsoid or subcylindrical, about 1 mm long and 0.5 mm wide at the middle. Fig. 13.

Widely distributed in Southern Africa and also recorded from Angola, Rhodesia and Mozambique. It occurs along stream-banks and in marshy places.

CAPE.—Barkly West: Newlands, *Wilman* s.n. Bathurst: Fish River, at mouth of Kap River, *Dyer* 3388. Humansdorp: *Fourcade* 1778. Komga: *Flanagan* 979. Middelburg: Grootfontein, *Theron* 1676. Peninsula: Diep River, *Marloth* 7290; 7291; Observatory, *Marloth* 7289; Cape Flats, *Andreea* 243. Port Elizabeth: mouth of Swartkops River,

Theron 1648. Queenstown: Borigola, *Galpin* 8416. Riversdale: Oakdale, *Muir* 3060. Uitenhage: Near Prentice Kraal, *Bolus* 1469. Worcester: Veld Reserve, *Van Breda* 60.

NATAL.—Durban: *Nelson* 11745. Hlabisa: Hluhluwe Game Reserve, *Ward* 2104. Inanda: near Umhlanga Rocks Hotel, *Watmough* 489. Umlazi: Isipingo Beach, *Ward* 619.

O.F.S.—Kroonstad: *Pont* 691. Thaba Nchu: Maroka School, *Potts* 1929.

BASUTOLAND.—Leribe: *Dieterlen* 18. Maseru: *Guillarmod* 2906.

SWAZILAND.—Hlatikulu: Kubuta, *Compton* 28123.

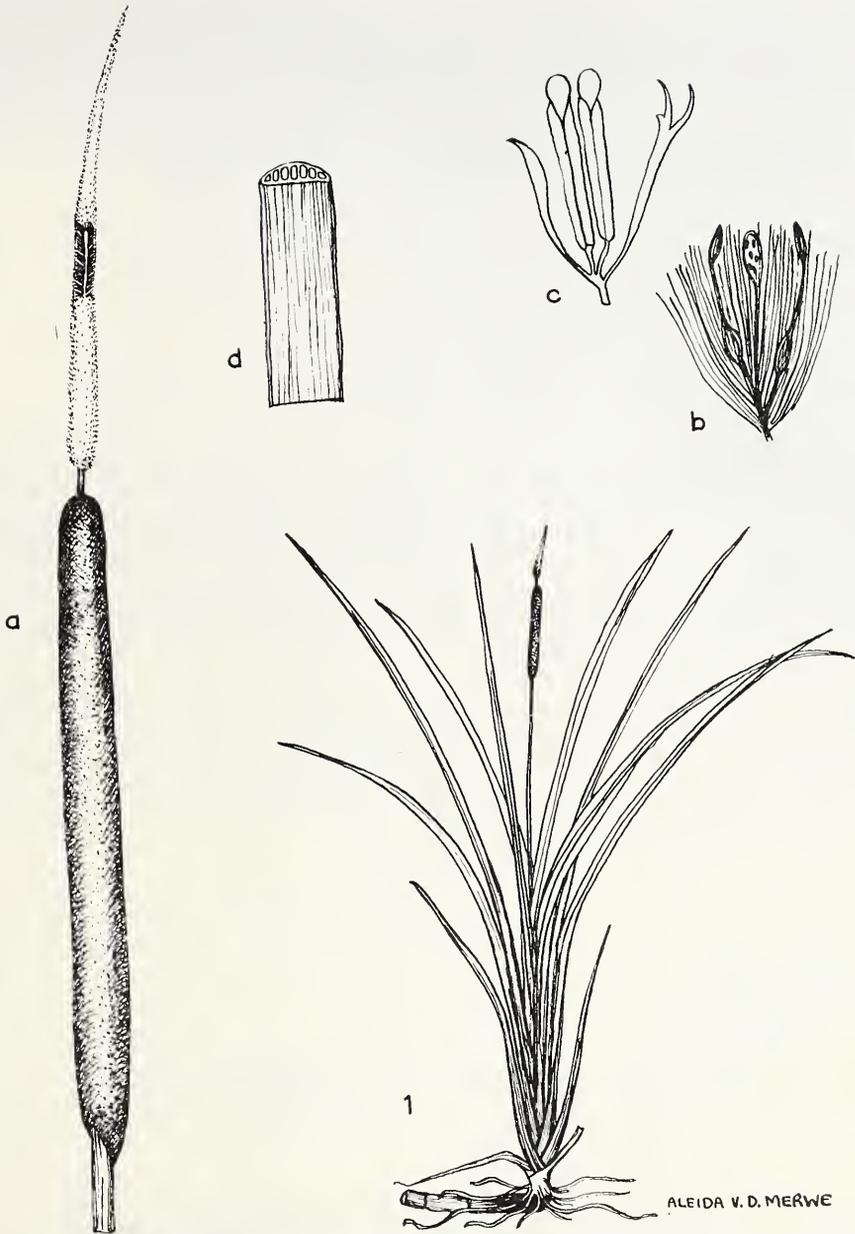
TRANSVAAL.—Nelspruit: *Codd* 8192. Pretoria: *Leenderitz* 687. Waterberg: Naboomspruit, *Mosdene, Galpin* M.373.

S.W.A.—Grootfontein: Gautscha Pan, *Story* 5302.

Rohrbach in Verh. Bot. Verein. Brandenb. 11 : 96 (1869) states that he regards the South African specimens, with which he was dealing, as constituting a subspecies of *T. latifolia* L. He, however, refers to the group as "*T. capensis*", that is, in binomial form. According to Art. 24 of the International Rules of Botanical Nomenclature, 1961, this must today be rendered as *T. latifolia* L. subsp. *capensis* Rohrb. Certain authors have inferred from Rohrbach's publication that he established *T. capensis* as a species. This led to N. E. Brown unintentionally but validly effecting a change of status for this name when in the Flora Capensis he gave it specific rank for which the correct citation is *T. capensis* (Rohrb.) N. E. Br. From the above it follows too that the combination *T. latifolia* L. subsp. *capensis* (Rohrb.) Graebn. in Pflanzenreich, Typhaceae: 10 (1900) is superfluous. *T. latifolia* L. forma *capensis* Rohrb. is published by Kronfeld in Verh. Zool-Bot. Ges. Wien 39 : 180 (1889) only as a synonym of *T. latifolia* L. subsp. *capensis*.

After examining all available South African herbarium material of *Typha*, as well as fresh material, it was concluded that only one taxonomic unit occurs in South Africa. N. E. Brown in Flora Capensis 7 : 31 (1897) included two species, *T. australis* and *T. capensis*, separated on the presence or absence of bracts in the female flowers and by the form of the stigmas. This combination of characters is not consistent. Linear stigmas with a few bracts present were found in only five specimens i.e. *Van Breda* 60, *Muir* 3060, *Theron* 1648, *Dyer* 3388 and *Nelson* 11745. In all the other specimens the flowers are ebracteolate or only contained weakly developed bracts. Even in plants of the same colony ebracteolate flowers or flowers with many or few weakly developed bracts were found. It is therefore impossible to separate the South African plants into different taxonomic groups. The same conclusion was reached by Wildenauer (MS. for Flora of S.W. Africa) when studying the South West African material.

Apart from *T. australis* from Guinea several other species of *Typha* have been recorded in Africa. Their types have not been studied as they fall outside the scope of this Flora. It is evident



ALEIDA V. D. MERWE

FIG. 13.—1, *Typha latifolia* subsp. *capensis* (habit; a, inflorescence with male flowers in upper portion and female flowers in lower portion, $\times \frac{1}{2}$ (Theron 1676); b, female flower showing perianth, gynaecium and carpodium, $\times 7$; c, male flower showing bracteoles and stamens, $\times 10$; d, portion of leaf showing shape in transverse section. (1 and d from living plants at the National Botanic Garden, Pretoria; a—c, Theron 1676).

that far too many species are being upheld in most works. Examination of the dates of the existing names indicates that the name here will not be threatened if kept as a subspecies even if further changes occur.

I have examined modern specimens of both *T. angustifolia* and *T. latifolia* collected in Sweden, and have ascertained that our plant undoubtedly

is correctly placed under *T. latifolia*. It differs from typical *T. latifolia* in having simple, or very rarely compound, pollen. The bracteoles of the male flowers are brownish-white and are linear, lanceolate, cuneate or forked. In *T. latifolia* the pollen is compound with the bracteoles of the male flowers linear and acute.

In South Africa the plant is commonly known as Bulrush, Catstail or Pappkuil.

ORDER: HELOBIAE

by A. A. OBERMEYER

The order Helobiae, also referred to as Fluviales or Najadales by some authors, consists of a number of diverse monocotyledonous families which are usually found in or near water. They are annuals or perennials; many are rhizomatous with the upper parts deciduous. The leaves are sheathing at the base and mostly ligulate. An interesting feature is the presence in all members of the minute "squamae intravaginales", also called axillary scales, which are thought to be secretory organs giving off mucilage. The flowers are interpreted by some as primitive, by others as much reduced. They are usually ebracteate. The seed is exendospermous, the embryo developing a large hypocotyl.

Engler, Wettstein, Rendle and many others, included in the Potamogetonaceae, in addition to *Potamogeton* and the closely related *Groenlandia*, the genera here separated into the families Zosteraceae, Ruppiaceae and Zannichelliaceae as constituted by Dandy, Hutchinson and others. The differences in the floral structures appear to warrant this. Singh, in his recent studies, prefers to retain *Ruppia* and *Zannichellia* in the Potamogetonaceae.

The generous assistance freely given by Mr. J. E. Dandy, Keeper of Botany, British Museum (Natural History), is gratefully acknowledged.

Key to Families

Flowers ebracteate:

Submerged aquatics (wholly or partly):

Carpels free, 1-6 ovulate:

Ovule solitary:

Ovule pendulous:

Flowers inside a fertile leaf-sheath on a flattened unilateral spadix, alternately arranged in 2 rows; completely submerged grass-like marine perennials ZOSTERACEAE, p.57

Flowers not arranged as above:

Flowers bisexual, in spikes exerted above the water-surface during anthesis:

Flower spikes few to many flowered, flowers arranged all around the axis, actinomorphic, the 4 concave petals each with an opposite sessile extrorse stamen; drupes sessile POTAMOGETONACEAE, p.60

- Flower spike consisting of 2 naked flowers facing opposite directions and inserted at unequal heights; the 4-8 carpels becoming stipitate in fruit (the inflorescence then appearing umbellate); peduncle fairly short or very long and spirally coiled. RUPPIACEAE, p. 70
- Flowers unisexual, submerged, axillary, cymose or solitary, carpels 1-9, free, sessile or stipitate in fruit; male with 2 united, apiculate anthers (rarely 1-3) which are 6, 4, 2 or 1 locular, filament lengthening rapidly during anthesis. ZANNICHELLIACEAE, p. 73
- Ovule basal, erect, anatropous; completely submerged herbs with toothed leaves; flowers axillary, sessile, small, unisexual, often dioecious, reduced to 1 stamen and a 1-ovuled carpel, naked or with a small spathe. NAJADACEAE, p. 81
- Ovules 2-6 per carpel; spikes bifid (rarely 1-8) covered in bud by a calyptri-form deciduous spathe; flowers subtended by 1-3 petaloid perianth-segments, normally bisexual; rhizome tuberous. APONOGETONACEAE, p. 85
- Carpels united, unilocular, with 3-6 parietal placentas, inferior, multiovulate; flowers subtended by a bifid spathe (or 2 free bracts in the marine genus *Halophila*). HYDROCHARITACEAE, p. 100
- Marsh plants with distichous basal leaves and ebracteate spikes; carpels 6 (often 3 alternate sterile) connate, parting from a central axis in fruit, uniovulate. JUNCAGINACEAE, p. 92
- Flowers bracteate, with 3 sepals and 3 petals; carpels free or united, 3-many; marsh plants with compound umbels. ALISMATACEAE, p. 96

ZOSTERACEAE

by A. A. OBERMEYER

Marine perennials, completely submerged, with creeping or tuberous rhizomes, with simple roots at the nodes. *Stems*, if present, floriferous, annual. *Leaves* distichous, convolute, the long sheath ending in a short biauriculate ligule. *Inflorescence* of 1 to several unilateral spikes each enveloped in a folded spathe which is continued above as a deciduous or semi-persistent lamina; flowers situated in a double row on the flattened axis ("spadix"), subtended by tongue-shaped scales (retinacula) folded inwards (these sometimes absent), monoecious or dioecious. *Male flower* a solitary, sessile, unilocular, dorsifixed anther, pollen filamentous, pollination hydrophyllous. *Female flower* protogynous, consisting of a unilocular ovary with a short style and 2 long stigmatic arms; ovule solitary, pendulous, orthotropous. *Fruit* a graniform nut or with 2 sagittate appendages, sometimes bursting irregularly; seed exendospermous.

A widespread and common family consisting of 2 genera; one of these, the dioecious *Phyllospadix* with about 3 species, occurs on the west coast of America and in Japan, whereas the monoecious genus *Zostera* with about 11 species is cosmopolitan.

Phillips in his *Genera of South African Flowering Plants*, p.53 (1951) places this genus in the family *Potamogetonaceae*.

Zostera L., Sp. Pl. 968 (1753); Gen. Pl. ed. 5 : 415 (1754); Aschers. in Pflanzenfam. 2, 1 : 201 (1889); A. Benn. in F.C. 7 : 50 (1897); F.T.A. 8 : 225 (1901); Graebn. in Pflanzenr. 4, 2 : 27 (1907); Setchell in Proc. Nat. Acad. Sci. 19 : 810 (1933); Adamson in Fl. Cape Penins. 37 (1950); Phill., Gen. ed. 2 : 53 (1951); Rendle, Class. Flow. Pl. ed. 2, 1 : 207 (1953); Hutch., Fam. Flow. Pl. ed. 2, 2 : 554 (1959); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2 : 941 (1962). Type species: *Z. marina L.*

Rhizome perennial, monopodial, creeping, much branched, compressed, orange-brown; roots several from a node, simple, covered with long root-hairs. *Stems*, if present, floriferous, annual. *Leaves* alternate, distichous, sheathing at the base; sheath tubular or convolute, with a small biauriculate ligule; lamina linear, striate, apex rounded, bilobed or emarginate, axillary scales 4 or 2. *Inflorescences* forming erect annual sympodial branches which each terminate in a "fertile" leaf, the latter enclosing in its sheath a unilateral spadix on which the male and female flowers are arranged alternately in 2 rows, with or without marginal bract-like infolded lobes or "retinacula" (interpreted by some botanists as a reduced perianth); stamen 1, sessile, unilocular, dorsifixed, pollen filiform; female consisting of a unilocular, 1-ovuled ovary terminating in a short style and 2 long stigmatic branches, protogynous (the stigmas protruding from the sheath during anthesis), ovule pendulous, orthotropous. *Fruit* an indehiscent nut or irregularly dehiscent, graniform, smooth or longitudinally striped or ribbed.

Eleven species in temperate seas of the world. One species in South Africa.

Zostera capensis Setchell in Proc. Nat. Acad. Sci. 19 : 815 (1933); Adamson in Fl. Cape Penins. 37 (1950). Type: Cape, Knysna Lagoon, *Duthie* s.n. (DAV 501307, holo.).

Z. nana sensu Krauss in Flora 344 (1845); sensu A. Benn. in F.C. 7 : 51 (1897); sensu Graebn. in Pflanzenr. 4, 2 : 32 (1907). *Z. capensis* forma *elator* Setchell, l.c. 19 : 815 (1933). Type: Knysna Lagoon, *Duthie* 1212 (DAV, holo.; PRE, K).

Perennial. *Roots* 2-8 per node, simple, densely covered with long root-hairs. *Rhizomes* with internodes 5-20 mm. *Stems*, if present, annual, erect, thin, bearing the axillary spathes. *Leaves* in clusters of 2-4, convolute, situated on suppressed side-branches of, and terminating the rhizomes; sheath long, convolute, flattened below, its small ligule forming 2 lateral rounded lobes; lamina linear, usually 10-30 cm (but up to 135 cm) long, 1-2 mm broad, margin and midrib distinct, with 2-4 secondary nerves on each side which consist of bands of smaller cells containing vascular bundles alternating with bands of larger cells containing numerous air channels, interspersed with scattered cross-bars, apex rounded to acute, asymmetrical, with a narrow central slit caused by the degeneration of the apical cells; axillary scales 2, linear-lanceolate. *Spikes* on peduncles up

to 35 mm long, spathe resembling the leaf-sheath, flattened, with the folded membranous margins, slightly inflated in fruit, 15-30 mm long, enclosing 3-15 flowers, the semi-persistent lamina situated above the spike; retinacula or bract-like scales linguiform, 0.5 mm, brown, style ultimately about 1.5 mm long and then equalling the 2 filiform stigmata in length. *Fruit* an indehiscent graniform nut, obliquely pendulous inside the spathe, narrowly ovoid, 2 mm long, yellowish brown, closely and faintly striate, smooth. Fig 14.

Recorded from the south-west coast of South Africa and the southern and eastern coasts as far as Mozambique and Madagascar. Common on muddy sandbanks in bays and estuaries, often just exposed at low tides. Flowering occasionally throughout the year, usually from the centre of a colony. According to Ward's measurements, salinity in St. Lucia Lake varied from 18-33.5% where *Zostera* occurred.

CAPE.—Alexandria: Kariega River Mouth, *Tölken* 383. Bathurst: Bushmans River Mouth, *Tölken* 382; *Mauve & Wells* 16; Kowie Lagoon, *Mauve & Wells* 6; Britten 2664; 809. Hopefield: Saldanha Bay, *Mauve* 4297; *Tölken* s.n. Humansdorp: Kabeljous River Lagoon, *Mauve & Wells* 54. Knysna: Lagoon, *Duthie* 1212; 1213; *Mauve & Wells* 65; Plettenberg Bay, *Schlechter* 5935. Peddie: Keiskama River Lagoon, *Comins* 1609. Kentani: Gxaxa River, *Pegler* 16. Port Elizabeth: Swartkops River Mouth, *Mauve & Wells* 41.

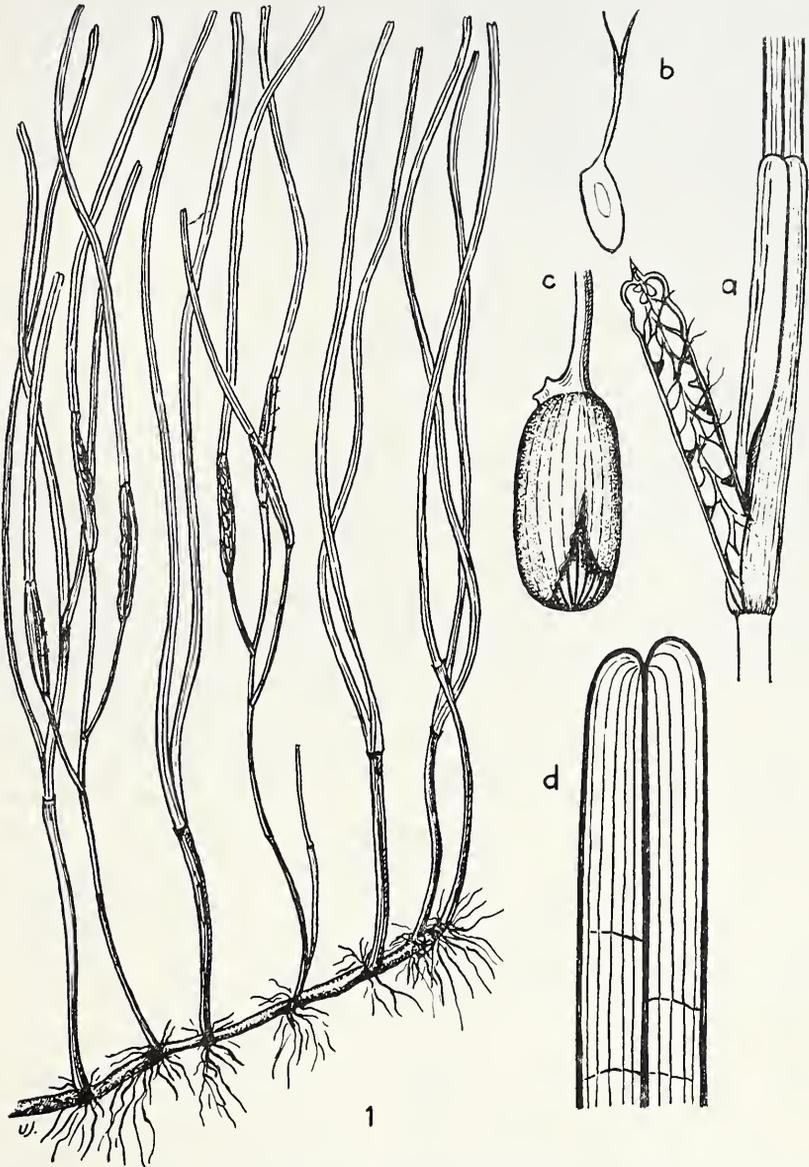


FIG. 14.—1, *Zostera capensis*, $\times 1$; a, flowering spike (extracted from spathe), $\times 5$; b, carpel, $\times 16$; c, fruit showing base of style, lateral hilum and partly exposed seed, $\times 16$; d, leaf-tip, $\times 10$.

NATAL.—Durban: Salisbury Island, *Ward* 4570. Hlabisa: St. Lucia Lake, *Ward* 4172; 4175; 4294. Lower Umfolosi: Richards Bay, *Ward* 4307. Mtunzini: Umlalazi Lagoon, *Ward* 4019; 4252–4256. Port Shepstone: Port Edward, lagoon, *Moss* s.n. Umlazi: Isipingo Lagoon, *Ward* 495.

The species is closely related to the European *Z. noltii* Hornem. and could perhaps be considered a southern population as suggested by Dandy. The two taxa are however completely isolated. The African plants appear to be larger, the leaf apex is asymmetrical, the retinacula are broader and the

testa of the nut is distinctly striate. *Z. nana* Roth is an illegitimate name for *Z. noltii* Hornem.

In the Flora Capensis 7 : 50 (1897), Bennett enumerates a second species, *Z. marina* L. var. *angustifolia* Hornem, based on a specimen in the Kew Herbarium without name or collector, said to have come from South Africa. The sheet in question bears two identical labels "near Holyhead, Aug. 22, 1828" and a third with CBS written on it. Setchell believes the plants to have come from Wales. This species has so far not been found in southern Africa.

POTAMOGETONACEAE

by A. A. OBERMEYER

Herbaceous annuals or usually perennials with deciduous stems forming colonies in fresh or occasionally brackish water, submerged except for the spikes, which are exerted during anthesis and, in some species, the floating leaf-blades. *Roots* in a circle around the nodes of the rhizome. *Rhizomes* usually well developed, rarely absent, persistent, or plants perennating by the formation of winterbuds ("turions"). *Stems* erect, submerged, annual, with the apical flower spikes just exerted. *Leaves* submerged and/or floating, alternate and/or opposite, usually with a well developed convolute or tubular stipular sheath. *Spikes* exerted (rarely also submerged in some North American species) few to many-flowered surrounded by a basal sheath. *Flowers* ebracteate, bisexual, actinomorphic, small; perianth-segments 4; stamens 4, sessile, extrorse, inserted on the claws of the segments; carpels 4–1, free, unilocular, ovule solitary, campylotropous. *Fruit* an achene or drupe, seed exendospermous.

Cosmopolitan, comprising two genera, namely, *Potamogeton* with about 100 species, widespread and common, and a closely related monotypic genus *Groenlandia* recorded from Europe, N.W. Africa and Asia.

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POTAMOGETON

Potamogeton L., Sp. Pl. 126 (1753); Gen. Pl. ed. 5 : 61 (1754); Cham. & Schlecht. in Linnaea 2 : 157 (1827); Aschers. in Pflanzenfam. 2, 1 : 207 (1889); A. Benn. in F.C. 7 : 45 (1897); F.T.A. 8 : 219 (1901); Graebn. in Pflanzenr. 4, 2 : 39 (1907); Adamson in Fl. Cape Penins. 36 (1950); Phill., Gen. ed. 2 : 53 (1951); Hutch., Fam. Flow. Pl. ed. 2, 2 : 556 (1959); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2 : 942 (1962). Singh in Bot. Gaz. 126 (2) : 137–144 (1965), morphological and anatomical studies in Helobiae. Type species: *P. natans* L.

Perennials, or rarely annuals, usually deciduous, surviving cold and dry periods by the persistent woody rhizome and/or the formation of scaly winterbuds ("turions"), or in more compatible conditions as evergreens. *Roots* simple or branched, several to many from a node, often with long root-hairs. *Rhizome* usually well developed, much branched, sympodial, absent or poorly developed in a few species. *Stems* erect, usually sparsely branched, deciduous. *Leaves* often heteromorphous; in many species only submerged leaves are produced which are thin, translucent, filiform to lanceolate, in others floating, coriaceous leaf-blades on long petioles are formed as well; terrestrial forms from mud-banks bear coriaceous leaves only;

alternate or the upper, which subtend the spikes, opposite; tissues of the lamina usually typical for each species, with or without a lacunar band on each side of the midrib, secondary nerves distinct, stipular sheaths convolute or tubular (the tubes usually splitting later on), adnate to the base of the lamina (viz. in *P. pectinatus* and some others found outside Africa) or free; petioles varying in length with the depth of the water in the case of the floating leaves. *Spikes* pedunculate, simple, emergent (in South African species), wind- or rarely water-pollinated (*P. pectinatus*), few- to many-flowered, ovoid to cylindrical, dense, lax or interrupted, lengthening during anthesis and fruiting. *Flowers* ebracteate, bisexual, actinomorphic, protogynous, small; perianth-segments 4, free, clawed, concave; stamens sessile, extrorse, straddling the claw of the segment, pollen globose; carpels 4, occasionally fewer, ovoid, with a beak bearing the stigma or the stigmatic area extended on the ventral suture; ovule solitary, laterally attached. *Fruit* an ovoid drupe with a short or a long beak, a soft epicarp and a hard endocarp; cotyledon bent like a hook, with a large hypocotyl.

A cosmopolitan genus containing about 100 species with 7 in Southern Africa.

The floral parts have been variously interpreted. Graebner, Rendle and others believed the "petals" to be appendages to the connective of the anther. Uhl's studies in 1947 and various subsequent botanists support Kunth's theory (1841) that the flower actually represents an inflorescence containing male flowers, each surrounded by a petaloid bract, and naked female flowers.

Gender of the generic names *Potamogeton* and *Aponogeton*.— "Both were regarded as neuter by their original authors but are now generally treated as masculine as in the Pflanzenreich and other works. The Greek word *geiton* (a neighbour) can be either masculine or feminine but not neuter. In view of the fact that the masculine gender has been adopted for them both, I see no reason to interfere with this view"—J. E. Dandy in letter dated 2.8.1963.

Leaves all submerged, narrow; stipules adnate to the lamina below where it forms a folded sheath with a whitish margin, free as a ligule above; spikes few-flowered, interrupted; stigma with large papillae, water pollinated (Subgenus *Coleogeton*).....1. *P. pectinatus*

Leaves either all submerged or also with floating blades variously shaped; stipules free from the leaf, folded or tubular; spikes usually not interrupted; stigma with small papillae, wind pollinated (Subgenus *Potamogeton*):

Submerged leaves very narrow 0.5–4 mm wide:

Leaves all submerged; lacunar system bordering midrib not developed or very narrow:

Stipule tubular at least when young, pale brown; leaves usually about 2 mm wide; fruit smooth

2. *P. pusillus*

Stipule folded; leaves usually 1 mm wide; fruit usually tuberculate and with a basal tooth

3. *P. trichoides*

Leaves submerged but with floating involucre leaves subtending the flower spikes; submerged

leaves with a well developed lacunar system bordering the midrib; stipule folded....4. *P. octandrus*

Submerged leaves over 4 mm wide or plants terrestrial:

Leaves all submerged, uniform:

Leaf margin toothed and undulate; spikes few-flowered; beak nearly as long as the fruit

5. *P. crispus*

Leaf margin entire, smooth or undulate, upper leaves sometimes floating, net-veined; spikes many-flowered; beak short.....6. *P. schweinfurthii*

Primary submerged leaves if in deep water soon disintegrating; mature leaves floating with an oblong, coriaceous lamina, margin smooth, veining indistinct; plants often creeping on mud-banks, exposed.....7. *P. thunbergii*

1. *Potamogeton pectinatus* L., Sp. Pl. 127 (1753); A. Rich., Tent. Fl. Abyss. 2 : 354 (1851); A. Benn. in J. Bot. Lond. 33 : 138 (1895); F.C. 7 : 49 (1897); F.T.A. 8 : 223 (1901), pro parte; Dur. & Schinz, Consp. Fl. Afr. 5 : 495 (1894); Graebn. in Pflanzenz. 4, 2 : 121, fig. 28 A–B (1907), pro parte; Dinter in Fedde, Rep. 22 : 383 (1926);

Dandy in Journ. Linn. Soc. Bot. 50 : 513 (1937); Adamson in Fl. Cape Penins. 36 (1950). Type: from Europe.

P. filiforme sensu A. Benn. in F.T.A. 8 : 223 (1901); *P. livingstonei* A. Benn. l.c. (1901). Syn-types: Malawi, Lake Nyasa, Kirk s.n.; Laws 3; Bellingham s.n. (BM, K). *P. pusillus* sensu Marloth, Fl. S. Afr. 4 : 13, fig. IV, 1, 5, 6 (1915). *P. pectinatus* var. *ungulatus* Hagstr. in Svensk. Vet. Akad.

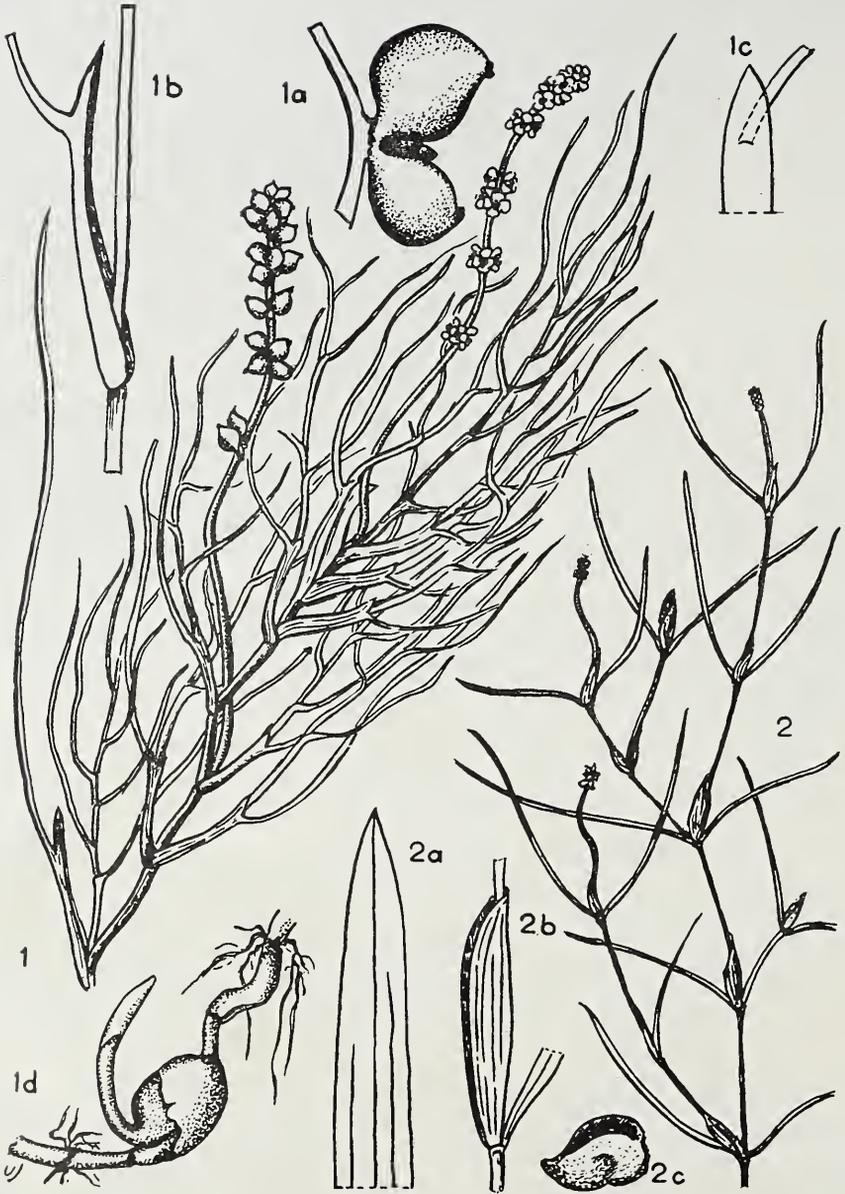


FIG. 15.—1, *Potamogeton pectinatus*, $\times 1$; 1a, fruits, $\times 4$; 1b, 1c, leaf-base with attached sheath, $\times 4$; 1d, winterbud, $\times 3$. 2, *P. trichoides*, $\times 1$; 2a, leaf apex, $\times 15$; 2b, free, open leaf-sheath, $\times 8$; 2c, fruit, $\times 1$.

Handl. n.s. 55 : 39 (1916). Type: Cape, Caledon District, Koude River, 1896, *Schlechter* 9592 (S, hol., PRE). Hagström does not mention a number but it is presumably this gathering.

Submerged perennials forming large colonies, found in fresh or brackish water, the upper parts dying down in cold or dry spells. *Rhizome* persistent, forming scaly winter buds ("turions"), much branched, with numerous long fine roots arising in whorls from the nodes, the roots bearing long root-hairs. *Stems* varying in length in proportion to depth of the water, branching freely, terete, slender. *Leaves* all submerged, often bunched above and spreading in a fan-shaped manner; stipules attached to the lamina, forming a folded sheath, often with whitish margins and terminating above in a large, rounded deciduous ligule; lamina usually curved outwards above the sheath, linear to filiform, 4–12 cm long and 1–2 mm broad, translucent, with cross-bars, if broad with lateral longitudinal veins, apex acute or rounded and apiculate. *Spikes* lengthening during anthesis and the fruiting stage, the lower flowers especially widely spaced, scape wiry, thin, whorls 4–8, consisting of 2–4 flowers each, stigmas large (the pollen or detached flowers floating on the water and thus contacting the large papillae on the stigmas). *Fruit* c. 4 mm long, yellowish-brown, convex, dorsally with 2 distinct broad lateral keels sloping inwards to the ventral straight keel, beak short. Fig. 15 : 1.

More or less cosmopolitan. Common throughout the Republic and South West Africa in brackish and fresh water.

CAPE.—Bredasdorp: Hagel, Kraal River, *Leighton* 2521. Caledon: Koude River, near Elim, *Schlechter* 9592. George: Swartvlei, *Chummet* s.n. Kentani: Gxaxa River, *Pegler* 438. Kimberley: Riverton, *Tapscott* s.n. Namaqualand: Steinkopf, *Meyer* sub Marloth 6465. Peninsula: Prince's Vlei, *Marloth* 7288; Zeekoevlei, *Adanson* 3580. Port Elizabeth: Swartkops River, *Ecklon & Zeyher* 644. Robertson: Breede River, *Koch* s.n.

NATAL.—Durban: Umgeni River Mouth, *Schlechter* 2969. Hlabisa: St. Lucia Lake, False Bay, *Ward* 4280. Ingwavuma: Kosi Estuary, *Tinley* 286.

O.F.S.—Boshof: Smitskraal, *Burt* *Davy* 11332. Kroonstad: Vals River, *Pont* 599.

TRANSVAAL.—Ermelo: Lake Chrissie, *Moss* 16293. Germiston: Lake, *Burt* *Davy* 2534. Potchefstroom: Vaal River, *Louw* 1634. Wolmaransstad: *Liebenberg* 2456.

S.W.A.—Grootfontein: Grosshuis, *Schoenfelder* 1008. Rehoboth: Buellspont, *Rodin* 2973.

This is the only South African species of *Potamogeton* tolerating brackish water. In Zululand at Lake St. Lucia, *Ward* measured patches of 45 × 32 feet with the adult plants mainly peripheral. Where they occurred salinity varied from 19 to 26.5% according to his tests. Occasionally the plants are encrusted with lime.

2. *Potamogeton pusillus* L., Sp. Pl. 127 (1753); Dandy & Taylor in J. Bot. Lond. 76 : 90 (1838); Clapham, Tutin & Warburg, Fl. Brit. Isles, ed. 2 : 953 (1962). Type: Europe (LINN 175.15, left hand specimen, lecto.).

P. panormitanus Biv., Nouv. Pi. 6 (1838); Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 98 (1916); Dandy in Journ. Linn. Soc. Bot. 50 : 523 (1937). Type: Europe, Sicily. *P. friesii* sensu A. Benn. in F.C. 7 : 48 (1897). *P. preussii* sensu A. Benn. in F.T.A. 8 : 222 (1901). *P. pusillus* var. *africanus* A. Benn. in Ann. Cons. Jard. Genève 9 : 102 (1905); Graebn. in Pflanzenr. 4, 2 : 115 (1907). Syntypes: Transvaal, *Wilms* 1656; 1657 (G); Natal, Umlazi River, *Dreege* 1206 (G); Umzinto, *Wood* 3055 (G, K, NH, BOL). *P. mucronatus* sensu Graebn. in Pflanzenr. 4, 2 : 113 (1907). *P. badius* Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 104 (1916). Type: Natal, Umlazi, *Dreege* 4458 (S, hol.). *P. exiguus* Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 106, fig. 42 (1916). Type: Cape Town, 53, *Andersson* (S, hol.). *P. subjavanicus* Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 129 (1916). Type: Cape, Swartkops River, 1830, prob. *Zeyher* (S, hol., PRE, photo.).

Submerged herbs arising from winter-buds or seed and forming no rhizome or a poorly developed one. *Roots* long and fine. *Stems* up to 100 cm, branching from near the base, internodes fairly equal in length, thin, slightly striate and compressed. *Leaves* all submerged, firm, translucent, linear, usually c. 20–40 mm long and 1–2 mm broad, apex obtuse, with 2 lateral longitudinal veins joining the midrib abruptly near the tip at unequal heights; areas between the lateral and central veins without a distinct lacunar system, sometimes with a narrow dense band of small cells flanking the midrib; stipular sheaths 6–17 mm, tubular, splitting later, usually semi-persistent, pale brown. *Spikes* axillary, usually shorter than the leaves; scape thin, becoming firm in fruit, 1–4 cm long; flowers 2–4 per whorl with up to 4 whorls per spike. *Drupe* 2–2.5 mm long and 1–1.5 mm broad, pale olive green, obovoid, smooth, ventral face convex, dorsal more strongly convex, with a faint brown keel when dry, beak short and straight. Fig. 16 : 2.

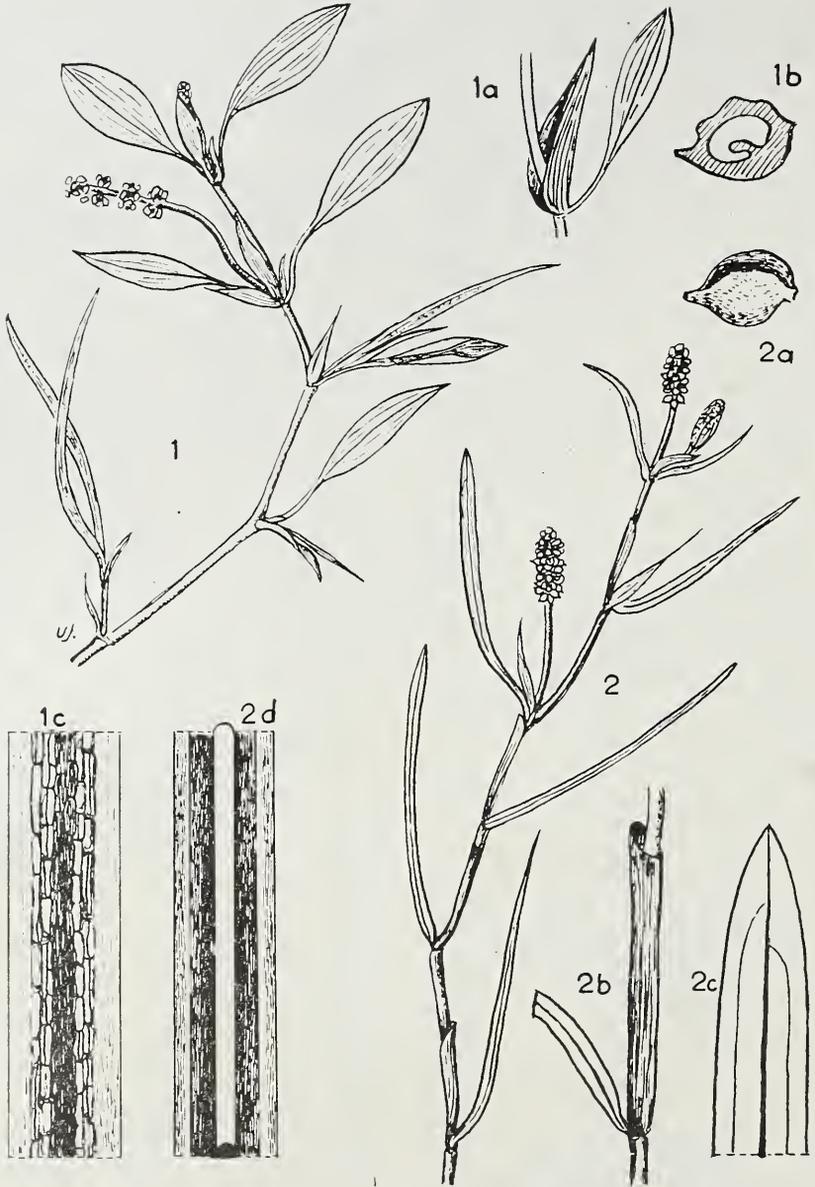


FIG. 16.—1, *Potamogeton octandrus*, habit, $\times 1$; 1a, free, open leaf-sheath, $\times 4$; 1b, drupe in longitudinal section showing hooked embryo; 1c, lamina showing lacunar tissue beside midrib. 2, *P. pusillus*, habit, $\times 1$; 2a, drupe, $\times 8$; 2b, free, tubular leaf-sheath, $\times 3$; 2c, leaf apex showing insertion of lateral nerves, $\times 7$; 2d, lamina showing raised midrib and dense tissue beside midrib, $\times 9$.

Widespread in the northern hemisphere and Africa. Fairly common in Southern Africa; occurs in fresh water.

CAPE.—Alexandria: de Bega River, *Archibald* 4206. Bathurst: Grahamstown, *MacOwan* 1992. Caledon: Stormsvallei, Riviersondereinde, *Zeyher* 1733 (BOL). Calvinia: Lokenburg, near Nieuwoudtville, *Story* 4419. King William's Town: Yellowwoods River, *Flanagan* 2189. Komga: near Komga, *Flanagan* 2374. Mqanduli: Qingqolo, *Pegler* 2042. Mount Currie: Kokstad, *Tyson* 1807. Port Elizabeth: Happy Valley, *Long* 1145. Port St. Johns: Umgazi River, *Bolus* 10374. Uitenhage: Swartkops River, *Mauve & Wells* 55.

NATAL.—Bergville: Cathedral Peak Forest Reserve, Inhlwasine River, *Killick* 1608. Camperdown: near Camperdown, *Rehmann* 7686. Durban: Umbilo, *Moss* 5449. Hlabisa: Hluhluwe Game Reserve, *Ward* 2505; 2576. Inanda: Umhlangwe River near Phoenix, *Schlechter* 3122. Umzingto: Dumisa, *Rudatis* 2139.

BASUTOLAND.—Between Bokong and Modiba Matso Rivers, *Coetzee* 519. Leribe: Hlotse River, Makokoane, *Dieterlen* 1033.

O.F.S.—Bloemfontein: Glen, Modder River, *Wager* s.n.

TRANSVAAL.—Johannesburg: *Moss* 9681. Lydenburg: *Wilms* s.n. Marico: Wonderfontein, *Burt* *Davy* 7610. Pietersburg: Houtbos, *Schlechter* 4405; Turfloop, *Schlechter* 4695. Potchefstroom: *Low* 1614. Pretoria: Rietvlei Dam, *Mauve* 4259.

SWAZILAND.—Mankaijana: Hlotane River, *Compton* 30876.

S.W.A.—Warmbad: Fish River Canyon, *Comins* 1795.

In a few representatives some of the younger upper leaves form a narrow spatulate floating lamina and they would therefore resort under the species *P. subjavanicus* Hagstr. Dandy suggests that this last-named species is a form of *P. pusillus* L. and he places the following gatherings under it; NATAL.—Eshowe: Gingindhlovu, *Gerstner* in NH 22187. Inanda: near Verulam, *Wood* 962. CAPE.—Vanrhynsdorp: Klaver, *Smith* 2602.

In appearance the plants resemble the tropical species *P. octandrus* Poir. but the tubular leaf-sheath of *P. subjavanicus* Hagstr. separates it from that species. So far no fruiting material has been collected.

3. *Potamogeton trichoides* Cham. & Schlecht. in *Linnaea* 2 : 175, t.4, fig. 6 (1827); Graebn. in *Pflanzenr.* 4, 2 : 119 (1907); Hagstr. in *Svensk. Vet. Akad. Handl.* n.s. 55 : 74, fig. 29 (1916); Dandy in *Journ. Linn. Soc. Bot.* 50 : 521 (1937); Clapham, Tu'in & Warburg, *Fl. Brit. Isles* ed. 2 : 955 (1962). Type: Europe.

Small wiry herbs forming dense masses, 50–75 cm high. *Rhizome* poorly developed or absent. *Stems* thin, 0.25 mm in diam., grooved, much branched. *Leaves* all submerged,

linear to setaceous, c.4 cm long and 1 mm broad, translucent, spreading, flat, apex acuminate, midrib prominent, yellowish; stipular sheaths open, deciduous, c.8 mm long, membranous. *Spikes* very small, shorter than the leaves, c.4-flowered, stalk wiry, often curved above; petals with long claws, carpel 1, rarely more, with a large peltate stigma. *Drupe* ovoid, c.1 mm long, ventral side nearly straight, beak short, sometimes tuberculate. Fig. 15 : 2.

Found in Europe, western Asia and Africa. Widespread but apparently rare in Southern Africa; in fresh water ponds.

CAPE.—Albany: near Grahamstown, Slaakraal, *Mauve & Wells* 18. Uitenhage: Redhouse, *Holland* 4169 (GRA).

NATAL.—Dundee: Verdrukdam, Hattingspruit, *Edwards* 3132.

TRANSVAAL.—Johannesburg: Tonquani, 12 miles N.W. of Johannesburg, *Mogg* 23777.

4. *Potamogeton octandrus* Poir. in *Lam., Encycl. Meth. Bot., Suppl.* 4 : 534 (1816). *Hutch.* in *F.W.T.A.* 2 : 307 (1836); Dandy in *Journ. Linn. Soc.* 50 : 517 (1937). Type: Cochinchina, *Loureiro* (BM, holo.).

Hydrogeton heterophyllus Lour., *Fl. Cochinch.* 1 : 244 (1790), non *Potamogeton heterophyllus* Schreb. (1771). Type: Cochinchina.

Potamogeton javanicus Hassk. in *Act. Soc. Sci. Ind.-Neerl.* 1, 8 : 26 (1856); A. Benn. in *Journ. Bot. Lond.* 29 : 121, 186 (1891); *l.c.* 33 : 138 (1895); *F.T.A.* 8 : 220 (1901); Dur. & Schinz, *Consp. Fl. Afr.* 5 : 495 (1894); Graebn. in *Pflanzenr.* 4, 2 : 46, fig. 14 A–C (1907). Type: Indonesia.

Herbs 20–100 cm high from a thin creeping rhizome, forming slender winter-buds. *Stems* with long internodes below, short above, grooved, producing numerous fairly short side branches above. *Leaves* dimorphous; submerged leaves alternate, translucent, soft, linear to narrowly linear-lanceolate, 3–7 cm long and 1–3 mm broad, apex acute or acuminate, the area between the midrib and lateral nerves consisting of lacunar, reticulated tissue with larger cells, the lateral nerves becoming faint towards the tip, approaching the midrib gradually; upper floating “involucral” leaves opposite, just below the flowering spikes, lanceolate to oblong-lanceolate, up to 2 cm long and 5 mm broad, narrowed into a petiole of 1 cm long, thinly coriaceous, not transparent, apple green, with about 7 nerves showing up distinctly below (some leaves showing transitional stages from the submerged to the

floating forms); stipular sheaths convolute, small, soon decaying, upper somewhat larger and broader. *Spikes* small, 25–40 mm long, lengthening during fruiting, whorls 3–7, each whorl usually 2-flowered, scape flattened, slightly thicker above, about 15 mm long. *Fruit* about 2 mm long and 1.5 mm broad, rounded to oblong in outline, broad-shouldered above, tapered to the base, ventral keel nearly straight, with a central tooth, dorsal keel crenulate ending in a distinct tooth, lateral keels convex ending in teeth near the base, beak fairly long and broad, upturned. Fig. 16 : 1.

Widely distributed in tropical Africa, Asia and Australia. So far recorded only from northern and eastern parts of Southern Africa.

NATAL.—Inanda: Umhlanga River near Phoenix, *Schlechter* 3125. Mtunzini: near Amatikulu, *Ward* 2560. New Hanover: York, Umshati River, *Wood* 4300.

TRANSVAAL.—Johannesburg: Florida Lake, *Wager* J.35945. Pretoria: Pienaars River, *Mauve & Schlieben* 9598. Waterberg: Badsloop, *Schlechter* 4780. Witbank: near Witbank, *Repton* 952.

S.W.A.—Okavango Native Territory: Okavango River at Runtu, *De Winter & Marais* 4477; *Merxmüller & Giess* 1891. Ovamboland: Kilevi on the Kunene River, *Schinz* 1001.

When in full flower the spikes appear yellow because of the copious pollen.

5. *Potamogeton crispus* L., Sp. Pl. 126 (1753); Solms in Beitr. Fl. Aethiop. 1 : 194 (1867); Dur. & Schinz, Consp. Fl. Afr. 5 : 493 (1894), pro parte; A. Benn. in Journ. Bot. Lond. 33 : 137 (1895); F.T.A. 8 : 221 (1901); Graebn. in Pflanzentr. 4, 2 : 97 fig. 23 (1907); Dandy in Journ. Linn. Soc. Bot. 50 : 537 (1937); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2, 956 (1962). Type: Europe (LINN 175-6).

P. crispus L. var. *najadoides* Graebn. in Pflanzentr. 4, 2 : 100 (1907). Type: Transvaal, Standerton, *Wilms* 1658 (Bf).

Fairly large plants 50–150 cm high, with much ramified perennating rhizomes which also form horny winterbuds. *Stems* slender, 4-angled, branched above. *Leaves* all submerged, sessile, linear-lanceolate, 3–9 cm long and 8–15 mm broad, apex obtuse, apiculate, margin finely serrate, markedly undulate, often reddish, shiny translucent, longitudinal veins 3–5, the laterals close to the margin; stipular sheath convolute, 10–20 mm, subtriangular, obtuse, early deciduous. *Spikes*

few-flowered, somewhat lax, peduncle 2.5–7 cm long, slender, narrowed upwards, usually curved; flowers 5–10. *Drupe* 2–4 mm long, ovoid-acuminate, laterally compressed, with a prominent pectinate dorsal keel, the ventral keel fairly straight, beak nearly as long as the fruit, falcate, tapered. Fig. 17.

Recorded from Europe, Asia, Africa and apparently introduced in America. Fairly common in fresh water in summer rainfall areas of Southern Africa.

CAPE.—Barkly West: Vaal River at Sydney, *Acocks & Hafström* 862. Komga: *Flanagan* s.n. Mount Currie: Clydesdale, Umzimkulu River, *Tyson* 2125. Prieska: Orange River, *Bryant* 733. Taungs: Harts River, *Parke*.

O.F.S.—Bloemfontein: Glen. Modder River, *Mostert* 892. Boshof: Smitskraal, Vaal River, *Burt Davy* 21. Kroonstad: Vals River, *Pont* 598.

NATAL.—Camperdown: *Wood* 11107. Hlabisa: Hluhluwe Game Reserve, *Ward* 2667. Ingwavuma: Mahlangwe Pan, *Tinley* 222. Umlazi: Umlaas *Wood* 154.

TRANSVAAL.—Brits: Assen, junction of Pienaars and Crocodile Rivers, *Obermeyer* in TRV 34714. Pilgrim's Rest: Kruger National Park, Olifants River, *Codd* 6193. Pretoria: Rust de Winter Dam, *Wouda* 1. Vereeniging: *Wager* in TRV 10455.

Clos in France (Bull. Soc. Bot. France 3, 1856), in his researches on the peculiar propagation of *P. crispus*, drew attention to the unique horny turions. The detached compressed shoot forming the turion grows no further, but its axillary buds form new plants.

6. *Potamogeton schweinfurthii* A. Benn. in F.T.A. 8 : 220 (1901); Graebn. in Pflanzentr. 4, 2 : 79, fig. 19 (1907); Hutch. in F.W.T.A. 2 : 307 (1936); Dandy in Journ. Linn. Soc. Bot. 50 : 526 (1937). Type: Sudan, Upper Nile Province, *Schweinfurth* 1223. (K, sheet 1, lecto.; NH).

P. lucens var. *fluitans* sensu A. Benn. in F.C. 7 : 48 (1897); F.T.A. 8 : 221 (1901). *P. capensis* Scheele ex Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 203, fig. 101 (1916). Syntypes: Cape, Uitenhage, Swartkops River, *Zeyher* (S, 919, 8799); Natal, Umshlangwe River, *Schlechter* 3120 (S). *P. promontoricus* Hagstr. in Svensk. Vet. Adad. Handl. n.s. 55 : 182, fig. 94 (1916). Type: Cap. Bonae Spei, *Drege* (UPS). *P. venosus* A. Benn. in Trans. & Proc. Bot. Soc. Edin. 29 : 52 (1924). Type: Natal, Umshlangwe, *Wood* 3015 (K, holo.; NH, BOL).

Large submerged plants up to 200 cm long from a perennial creeping woody rhizome with internodes 4–8 cm long. *Stems* erect 30–200 cm high, 1–3 mm in diam., terete. *Leaves* submerged or occasionally

the upper floating, sessile, linear-lanceolate, attenuated to the base and apex, 10–20 cm long and 1–2 cm broad, apex apiculate, margin smooth, finely undulate, distinctly net-veined with the cross-veins oblique, ascending, midrib prominent, lamina of the submerged leaves thin and soft, the exposed ones coriaceous, shiny; stipules persistent, folded, the lower amplexicaul, the upper spreading, large, lanceolate, 2–4 cm long. *Spikes* on swollen scapes, 4–10 cm long, many flowered. *Drupe* ovoid, 3–4 mm, smooth, ventral side fairly straight, dorsal rounded, beak short, occasionally with lateral keels. Fig. 18.

Widespread in northern and eastern tropical Africa extending southwards to the eastern Cape, Natal, Transvaal and South West Africa. Common in rivers in the Transvaal.

CAPE.—Kimberley: Danielskuil, *Wilman* 1252. Uitenhage: Swartkops River, *Ecklon & Zeyher* 640.

TRANSVAAL.—Klerksdorp: Schoonspruit near Klerksdorp, *Nelson* 224. Letaba: Kruger National Park, Rooi Rotse, *Van der Schijff* 5679. Potchefstroom: Vaal River at Schoemansdrift, *Louw* 1512. Pretoria: Rietvlei Dam, *Mauve* 4257; Rust de Winter Dam, *Wouda* 3. Vereeniging: Vaal River, *Moss* 13372.

NATAL.—Hlabisa: Hluhluwe Game Reserve, *Ward* 2567; 2577; 4203. Ingwavuma: Lake Sibayi, *Tinley* 67.

S.W.A.—Grootfontein: Otavi, *Dinter* 5254. Rehoboth: Buellspport, *Strey* 2004; *Rodin* 2975.

7. *Potamogeton thunbergii* Cham. & Schleich. in *Linnaea* 2 : 221, t.6, fig. 21 (1827). Type: Cape, Swellendam, Hartebeeskraal near Brak River, *Mund & Maire* (B†, holo.).

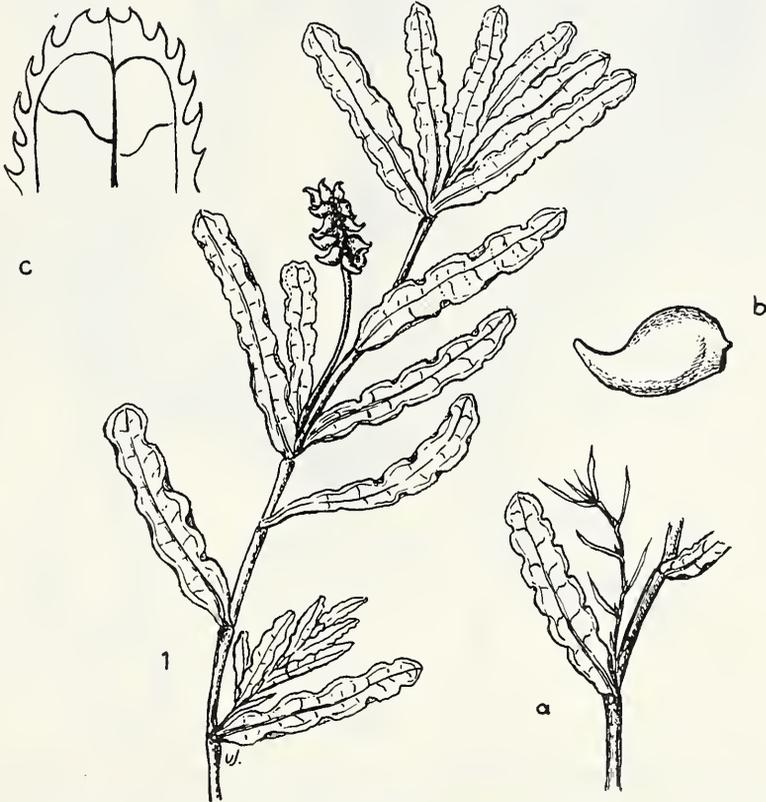


FIG. 17—1, *Potamogeton crispus*, $\times 1$; a, overwintering side shoot, $\times 1$; b, drupe, $\times 5$; c, leaf apex showing teeth and nerves, $\times 5$.



FIG. 18.—1, *Potamogeton schweinfurthii*, $\times 1$; a, submerged sessile leaf, $\times 1$; b, drupe, $\times 9$.



FIG. 19.—1, *Potamogeton thunbergii*, $\times 1$; a, submerged petioled leaf, $\times 1$; b, youngsprouting shoots from winterbuds, $\times 1$; c, diagrammatic figure of flower showing perianth segments, part of stamens and 2 carpels, $\times 6$; d, young drupe, $\times 6$; e, mature drupe, $\times 4$.

P. capensis Mund & Maire ex Cham. & Schlecht. l.c. (The name *P. capensis* Scheele nom. nud. in herb. Buchenau, Bremen, was quoted in error under this species by Bennett in F.C. 7 : 46 (1897); it belongs to *P. schweinfurthii*). *P. natans* sensu Thunb., Prodr. 32 (1794); sensu A. Benn. in F.C. 7 : 46 (1897). *P. natans* var. *capensis* sensu Dur. & Schinz, Consp. Fl. Afr. 5 : 494 (1895). *P. richardii* Solms in Schweinf., Beitr. Fl. Acthiop. 194, 292 (1867); Dur. & Schinz, Consp. Fl. Afr. 5 : 496 (1895); A. Benn. in F.C. 7 : 47 (1897); F.T.A. 8 : 220 (1901); Graebn. in Pflanzenr. 4, 2 : 56 (1907); Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 104 (1916); Wild in Kirkia 2 : 20, t.8 (1961). Type: Ethiopia, *Schimper* 135 (BM, K). *P. fluitans* sensu A. Benn. in F.C. 7 : 46 (1897). *P. fluitans* subsp. *americanus* proles *thunbergii* sensu Graebn. in Pflanzenr. 4, 2 : 61 (1907). *P. americanus* var. *thunbergii* sensu A. Benn. in F.C. 7 : 47 (1897). ? *P. fibrosus* Hagstr. in Svensk. Vet. Akad. Handl. n.s. 55 : 160 (1916). Type: Without locality or collector, 91 (S, holo.). Dandy provisionally includes it under this species.

Perennial with rhizomes much ramified, matted, woody, usually orange-brown, terete, with the internodes up to 8 cm long; scaly winterbuds formed in autumn. *Stems* erect, usually unbranched, up to 100 cm long. *Leaves* with submerged and floating forms or, if on land, with aerial blades; in deep water the submerged (juvenile) leaves decay before or during flowering; all the leaves petioled, the length varying with the depth of the water; lamina of the submerged leaves linear to linear-lanceolate, tapering to the base and apex, 8–20 cm long and 8–16 mm broad, thin, net-veined, with the transverse veins oblique, ascending; floating lamina elliptic to ovate, obtuse to rounded at the base, apex rounded to acute, about 5 cm long and 2.5 cm broad (up to 8 × 3.5 cm) coria-

ceous, veins indistinct; intermediate forms between the submerged and floating forms occur; leaves of land forms usually smaller, midrib prominent below; stipules folded, membranous, lower amplexicaul, upper spreading, ovate, acuminate, variable in size, up to 6 cm long. *Spikes* on somewhat swollen arcuate scapes, 5–10 cm long, flowering part cylindrical up to 5 cm long in fruit, many flowered. *Drupe* rounded, compressed c.4 mm long, green to brown, the convex dorsal side 3-carinate, the keels terminating in 3 basal knobs, sides loping inwards to a ventral keel which is indented or straight. Fig. 19.

Distributed from east tropical Africa to South West Africa and the eastern Cape; common in the Transvaal. Grows on mudbanks and in deep water.

CAPE.—Albany: Vlei 4 miles E. of Grahamstown, *Britten* 5033. Alexandria: near Bushmans River, *Comins* 1846. Knysna: Portland, *Duthie* 1172. Prince Albert: Swartberg, *Pocock* S.232.

BASUTOLAND.—Leribe: near Hlotse, *Dieterlen* 831.

NATAL.—Bergville: *Edwards* 2408. Durban: Bluff, *Huntley* 135. Hlabisa: Makhakhatana, *Vincent, Ward & Wells* 5. Umvoti: *Edwards* 2752.

TRANSVAAL.—Boksburg: *Codd* 6114. Letaba: Westfalia Estate, *Sheepers* 849. Middelburg: *Strey & Schlieben* 3836. Potchefstroom: Leu-fontein, *Louw* 1720. Pretoria: Pienaars River, *Mauve & Schlieben* 9595.

S.W.A.—Caprivi: Singalamwe, *Killick & Leistner* 3229. Grootfontein North: Runtu, Okavango River, *Merxmüller & Giess* 1889.

Closely related to *P. nodosus* Poir. from Europe and N.W. Africa, but distinguished from it by its smaller leaves (which attain only half the size of the European species) the drupe which has well developed knobs on the dorsal side and a straight ventral keel, etc.

RUPPIACEAE

by A. A. OBERMEYER

Submerged slender grasslike herbs found in saline pools near the sea. *Rhizome* matted, perennial. *Stems* erect, thin. *Leaves* setaceous, sheathing at the base. *Inflorescence* on a short or long spirally coiled peduncle, flowers 2 on each spike, bisexual, at unequal heights and opposite sides of the rhachis, just exerted above the water at anthesis, stamens 2, with divergent locules, pollen luniform; carpels 4 or more, becoming long stipitate in fruit.

Monogeneric.

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RUPPIA

Ruppia L., Sp. Pl. 127 (1753); Gen. Pl. ed. 5 : 61 (1754); Aschers. in Pflanzenfam. 2, 1 : 210 (1889); A. Benn. in F.C. 7 : 49 (1897); F.T.A. 8 : 224 (1901); Graebn. in Pflanzenz. 4, 2 : 142 (1907); Adamson in Fl. Cape Penins. 36 (1950); Phill., Gen. ed. 2 : 54 (1951); Hutch., Fam. Flow. Pl. ed. 2, 2 : 558 (1959); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2 : 959 (1962). Singh in Bot. Gaz. 126 (2) : 138 (1965). Type species: *R. marina* L.

Perennial herbs completely submerged, forming large colonies with branches up to about 75 cm long. *Roots* simple, 1–2 per node, densely covered with very long root-hairs. *Rhizomes* creeping, branched, thin, internodes angled. *Stems* thin, branching freely. *Leaves* alternate or opposite above, spreading, lamina linear to setaceous, up to 10 cm long and 1 mm broad, stipular sheaths attached to the base of the lamina, wide, folded, membranous, obtuse at the apex, amplexicaul at the base. *Inflorescences* at first enclosed in the swollen sheaths of the apical leaves, consisting of 2 opposite flowers inserted at different heights, viz. spicate but appearing sub-umbellate in fruit because of the stipitate drupes; peduncle remaining short in one species, accrescent in the other, becoming long and spirally coiled. *Flowers* bisexual, naked, protandrous; stamens 2, opposite, the separated locules divergent with their short filiform connectives attached to the short swollen columnar filament, pollen luniform, buoyant; carpels usually 4, occasionally more, sessile at first, becoming long-stipitate in fruit, ovule solitary, pendulous, campylotropous, stigma sessile, peltate. *Fruits* indehiscent on stipes 1–3 cm long, pyriform, often oblique, beaked, sometimes verruculose; seed hard, testa brown.

Two species recognised which are found in temperate and subtropical regions in brackish water near the sea or, rarely, in mountain lakes in the tropics. (According to some authors the genus can be divided into 10–15 species).

Phillips in his Genera of South African Flowering Plants p.54 (1951) places this genus in the family Potamogetonaceae.

Fruiting scape usually short and recurved, occasionally up to twice as long as fruiting stipes; leaves acute.....1. *R. maritima*
 Fruiting scape long and spirally twisted; leaves obtuse or rounded..... 2. *R. spiralis*

1. **Ruppia maritima** L., Sp. Pl. 127 (1753); Aschers. in Pflanzenfam. 2, 1 : 210 (1889); Rendle in Cat. Afr. Pl. Welw. 94 (1899); Graebn. in Pflanzenz. 4, 2 : 142 (1907). Adamson in Fl. Cape Penins. 36 (1950). Type: Europe (LINN 1761).

R. rostellata Koch in Reichb., Icon. Pl. Crit. 2 : 66, t.174, fig. 306 (1824); A. Benn. in F.T.A. 8 : 224 (1902). Type: Europe.

Leaves acute; scape usually short and straight not more than about twice as long as the fruiting pedicels; otherwise characters of the genus. Chromosome number $2n=20$. Fig. 20 : 2.

Cosmopolitan; common in brackish water with weak salinity along the coast from South West Africa to Zululand.

CAPE.—East London: Hagahaga Mouth, *Flanagan* 2366. Knysna: Groenvlei, *Martin* 4452. Peninsula: Maitland Bridge, *Wolley Dod* 3644; Noordhoek Flats, *Mauve* 4254.

NATAL.—Ingwavuma: Ndumu Game Reserve, *Tinley* 507.

S.W.A.—Swakopmund: Swakop River Mouth, *Merxmüller & Giess* 1739.

2. **Ruppia spiralis** L. ex Dum., Fl. Belg. 164 (1827); A. Benn. in F.C. 7 : 50 (1897); F.T.A. 7 : 224 (1901); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2 : 959 (1962). Type: Europe (LINN 176·2).

R. maritima L. subsp. *spiralis* (L. ex Dum.) Graebn. in Pflanzenz. 4, 2 : 142 (1907).

Leaves obtuse or rounded; scape long, spirally coiled, the flowers just exerted during anthesis; otherwise characters of the genus. Chromosome number: $2n=40$. Fig. 20 : 1.

Cosmopolitan but rare in the tropics. Needs a more saline medium than *R. maritima*. Found along the coast from Namaqualand to northern Natal.

CAPE.—Bathurst: Port Alfred, Saltvlei, *Britten* 2694. Clanwilliam: Lamberts Bay, Langevlei, *Tölken* 335. George: Swartvlei, *Mauve & Wells* 68. Namaqualand: Hondeklip Bay, *Pillans* in *BOL* 18256. Peninsula: Kommetjie Effluence, *Wolley*

Dod 3472; Noordhoek salt pan, *Tölken* 444; Rugby, *Tölken* 449. Port Elizabeth: Redhouse, *Holland* 4449.

NATAL.—Hlabisa: Lake St. Lucia, *Ward* 4173; 4176; 4178; 4180; 4295.



FIG. 20.—1, *Ruppia spiralis*, $\times 1$; 1a, flowering spike with ripe anthers, 1b, flowering spike with shrivelled anthers and ripe carpels, $\times 10$; 1c, leaf-tip, $\times 12$; 1d, drupe, $\times 10$. 2, *R. maritima*, $\times 1$; 2a, leaf-tip, $\times 12$; 2b, drupe, $\times 10$.

ZANNICHELLIACEAE

by A. A. OBERMEYER

Submerged annual or perennial herbs with the leafy stems permanent or deciduous. *Roots* adventitious appearing from an annular skinfold at the rhizome-nodes. *Rhizomes* creeping, matted, bracteate. *Leaves* alternate, opposite or ternate, often congested above, setaceous, linear, strap-shaped or tubular, the stipules adnate to the base of the lamina or free-forming a folded or tubular sheath; those of the upper fertile leaves modified into bracts with the lamina reduced or wanting. *Flowers* unisexual, monoecious or dioecious, solitary or cymose; "perianth" absent or present, flask-shaped or rarely of 3 small scales; male with 2 (rarely 1 or 3) united anthers, 6, 4, 2 or 1 locular, with an apical appendage, filament (or pedicel) lengthening rapidly at anthesis, pollen globose or filamentous, pollination hydrophyllous; carpels free, style long or short, simple, stigma capitate, peltate, funnel-shaped, or 2-4 lobed, ovule solitary, pendulous. *Fruit* a drupelet with the cotyledon spirally coiled, exendospermous; rarely viviparous (*Amphibolis antarctica*).

Cosmopolitan; 4 marine genera and 3 others which inhabit brackish or fresh water. Four genera recorded in Southern Africa, 2 of these marine.

Phillips in his *Genera of South African Flowering Plants* p.54 (1951) places the genera *Zannichellia* and *Althenia* in the family Potamogetonaceae. The other two genera had not yet been recorded for South Africa in 1951 but were also placed in the family Potamogetonaceae by Graebner in *Das Pflanzenreich* 4, 2 (1907).

Marine plants; dioecious; pollen filamentous:

- Leaves coriaceous, about 1 cm broad, falcate; styles with 2-4 stigmatic arms;
anthers attached at equal heights.....1. **Cymodocea**
Leaves grass-like, linear to setaceous; style simple, attached laterally to the globose
carpel; one anther situated above the other.....2. **Halodule**

Brackish or fresh water plants; monoecious; pollen globose:

- Anther 2-4 locular; leaves opposite or alternate, linear; fruits curved, pectinate, apex
caudate.....3. **Zannichellia**
Anther 1-locular; leaves crowded above, setaceous; fruits straight, smooth, with a
long pin-like apical appendage.....4. **Althenia**

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1. CYMODOCEA

Cymodocea Koenig in Koen. & Sims, *Ann. Bot.* 2 : 96, t.7 (1805); Aschers. in *Pflanzenfam.* 2, 1 : 210 (1889); A. Benn. in *F.T.A.* 8 : 228 (1901); Graebn. in *Pflanzenr.* 4, 2 : 146 (1907); Macnae in *Nat. Hist. of Inhaca Island, Mozambique* 28, fig. 8f (1958). Type species: *C. nodosa* (Ucria) Aschers.

Submerged marine perennials with long, creeping, jointed, woody or fibrous, bracteate rhizomes. *Roots* 1-6, arranged in a regular pattern which is typical for each species, branched, densely covered with semi-persistent roothair-bases on the younger parts. *Rhizomes* sympodial or simple. *Stems* erect, short or long, covered with prominent transverse leafscars. *Leaves* in apical, distichous clusters, early deciduous, lamina strap-shaped or ribbon-like, straight or falcate, coriaceous or thin, stipular sheath adnate to the lamina, amplexicaul at the base, folded. *Flowers* dioecious, on much abbreviated lateral branches just below the leaf clusters, surrounded by reduced leaves (bracts). *Male flowers* consisting of 2 fused stamens with the 2 pairs of apiculate locules facing opposite directions (filaments presumably lengthening rapidly during anthesis and soon disintegrating as in *Zanni-hellia*); pollen filiform. *Female*

flowers consisting of 2 sessile, ovoid, longitudinally compressed, collateral carpels, with a short style and 2 long subulate stigmatic branches, ovule solitary, pendulous. *Fruit* not well known.

Seven species are found in pantropical waters; one occurs in America, the others are Old World species. One species is recorded from Zululand.

Cymodocea ciliata (Forsk.) Ehrenb. ex Aschers. in Sitzb. Ges. Naturf. Fr. Berlin 3 (1867); *Linnaea* 35 : 162 (1867), pro parte; Schweinf., Beitr. Fl. Aethiop. 292. 309 (1867); Aschers. in Pflanzenfam. 2 : 210, fig. 163 (1889); Dur. & Schinz, Consp. Fl. Afr. 5 : 500 (1889); A. Benn. in F.T.A. 8 : 229 (1902); Graebn. in Pflanzenr. 4, 2 : 151, fig. 33, A, B (1907); Macnae in Nat. Hist. of Inhaca Island, Mozambique 28 fig. 8f. (1958); Ward in Lammergeier 2 : 21 (1962). Type: Egypt, Red Sea, *Forskål* (CP, BM).

Zostera ciliata Forsk., Fl. Aeg.-Arab. 157 (1775).

Thalassia cilata (Forsk.) Koenig in Koen. & Sims, Ann. Bot. 2 : 97 (1806); Kunth, Enum. 3 : 120 (1843).

Phucagrostis ciliata (Forsk.) Ehrenb. & Hempr., Symb. Phys. Bot. t.6, ined., ex Aschers. l.c.

Perennial, woody, rhizomatous herbs, glandular-punctate. *Roots* 6 (occasionally some bifurcating) appearing in a circle from definite points on the fourth node and internode of each section of the sympodial rhizome, long, much-branched, forming dense mats, woody, with long scattered root-hairs their thickened bases persisting as short bristles. *Rhizome* sympodial, each section consisting of 4 internodes, the fourth forming the erect stem, a lower bud continuing the rhizome; internodes angled, smooth, orange brown, with deltoid, amplexicaul, early deciduous bracts. *Stems* erect, up to 50 cm, unbranched, or rarely with a short side branch, with prominent annular, curved leaf-scars, the lowest internodes up to 15 mm long, the upper shorter, 1-2 mm long, flattened, orange-brown, occasionally forming a few rootlets below. *Leaves* about 6-10, in distichous apical tufts, early deciduous, strap-shaped, falcate, 7-15 cm long and 7-15 mm broad, leathery, margin with erect teeth in upper half and on the obtuse to truncate apex, midrib distinct and with about 10 lateral nerves on each side; below the lamina is attached to a light brown, punctate, flat, stipular sheath which is tapered to the base, with folded margins and a narrow rim-like ligule above; axillary scales setaceous, 3-6. *Flowers* on much abbreviated side branches near the base of the leaf-clusters;

the leaves also reduced in size to form bracts. *Male flowers* consisting of 2 fused stamens with the 2 pairs of apiculate locules facing opposite directions; filaments (or pedicels) presumably lengthening rapidly during anthesis and soon disintegrating, pollen filamentous. *Female flowers* at first sessile, peduncle accrescent, knobbed, 4-14 mm long, flattened, erect, adjacent to the main stem with 2 fertile pairs of bracts, the inner of a pair about $\frac{1}{3}$ of the outer in size; the 2 collateral carpels situated on the apex of the peduncle, surrounded by groups of setae (axillary scales), carpels ovoid, compressed lengthwise with a short style 4 mm long divided into 2 subulate stigmatic arms about 25 mm long, ovule solitary, pendulous. *Fruit* (immature?) cylindrical, about 15 mm long, 2 mm broad, apex truncate. Fig. 21 : 1.

Distributed from the Red Sea eastwards in the Indian Ocean to the tropical Asiatic coasts of the Pacific and the tropical east coast of Australia; southwards along the tropical and subtropical east coast of Africa as far as Zululand. Common and plentiful to dominant on the tropical east African coast, in the infratidal zone, adhering to rocks or coral reefs, rarely uncovered for a short period at very low tides. The colonies are usually unisexual, rarely bisexual. In Zululand it is found attached to sandstone rock-pools exposed to wave action.

NATAL.—Ingwavuma: Mabibi Rocks, 33 miles S. of Mozambique border, *Tinley & Ward* 24; Kosi Estuary, *Edwards* 3611; Black Rock, *Ward* 3710; sandstone reef near Big Kosi Lake, *Rodin* 4627. Ubombo: Sordwana Bay, Jesser Point, *Ward* 3357. Lower Umfolozi: Mapalane, *Ward* 3929; 3930; 3391.

There is a marked difference in the appearance of plants growing on sheltered warm coral reefs, where there is no wave action, and those found in sandstone rock crevices and in pools on beaches exposed to waves and to lower temperatures, which happens to be the habitat of the South African plants. These plants show gnarled rhizomes, more flexible stems and thinner narrower leaves; moreover the orange colour is absent. The description given here is based on the more typical form from the sheltered, warmer coral reefs. Anatomically the various parts of the two forms showed very little difference. There were 8-10 vascular bundles in the typical form, whereas the more slender form developed only 6-8 bundles in the cortex of the stem and rhizome. The internodes of the stem are

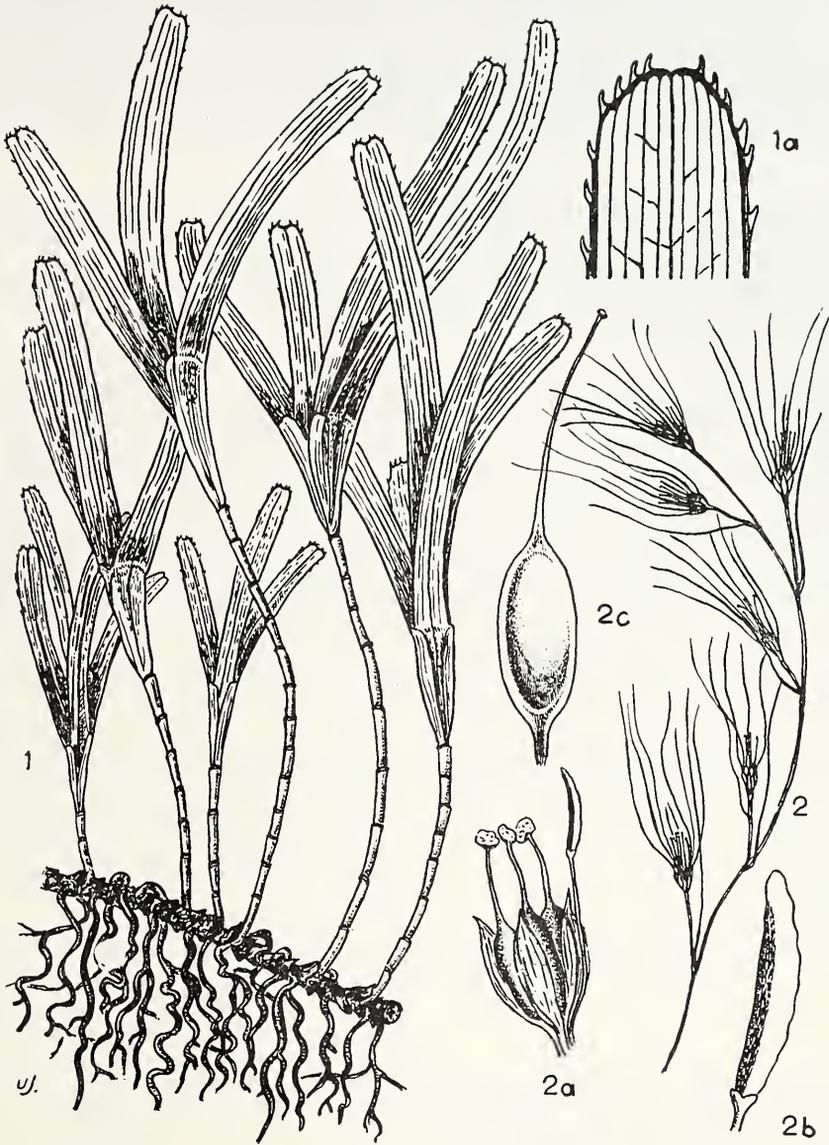


FIG. 21.—1, *Cymodocea ciliata*, $\times 1$; 1a, leaf-tip, $\times 5$. 2, *Althenia filiformis*, $\times 1$; 2a, female and male flowers, $\times 6$; 2b, unilocular anther, $\times 12$; 2c, drupe, $\times 10$.

longest below but shorten upon reaching water level. Sheltered plants become taller than those exposed to much wave action.

A small structure appearing to be a young fruit was seen on *Moss* 20674 from Inhaca, Mozambique. It was oblong, flattened, 15×2 mm, truncate and apiculate above, ribbed (perhaps through desiccation) and glandular.

So far all collections from the Republic have been sterile, possibly because of the water being too cold. Ward, who studied the species in its natural habitat, suspects that it does not tolerate being covered by sand. As a result it generally occurs at the northern and north-eastern sections of the sandstone outcrops in these bays. The greatest depth recorded by him was 40 cm below the lowest water level in open habitats, 64 cm in a pool.

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2. HALODULE

Halodule Endl., Gen. Suppl. 1 : 1368 (1841); Aschers. in *Linnaea* 35 : 163, 187 (1868); *Pflanzenfam.* 2, 1 : 212 (1889); Sauvageau in *Journ. Bot. France* 4 : 321 (1890); den Hartog in *Blumea* 12 : 289 (1964). Type species: *H. uninervis* (Forsk.) Aschers.

Diplanthera Thouars, Gen. Nov. Madag. 2 : 3 (1806); Steinheil in *Ann. Sci. Nat.* 2, 9 : 98 (1838); Aschers. in *Pflanzenfam. Nachtr.* 37 (1889); Graebn. in *Pflanzenf.* 4, 2 : 151 (1907); non Gleditsch (1764).

Halodula Benth. & Hook.f., Gen. Pl. 3 : 1019 (1883).

Perennial slender grass-like herbs with a creeping rhizome, rooting at the nodes. *Leaves* distichous, 2–4 per shoot, linear to setaceous, straight, flat, dark green, midrib and margins ending in short apical teeth; stipular sheath long, attached to the lamina, convolute, flat, forming 2 rounded auricles above, ligule a narrow apical ridge. *Flowers* dioecious, unisexual, solitary, on a short side branch, surrounded by membranous leaf-sheaths. *Male flowers* consisting of a double fused stamen with the bi-ocular, sometimes apiculate, anthers inserted at different heights facing opposite directions, attached dorsally to the filament, dehiscing longitudinally, occasionally with 3 small protuberances inserted at different heights on the connective, pollen confervoid. *Female flower* consisting of 2 collateral carpels on a short clavate verrucose peduncle, style long, subulate, ovule solitary, pendulous. *Fruit* a globose, hard berry.

A pantropical marine genus consisting of 7 closely related species usually forming extensive sea-meadows on intertidal sandbanks. One species in South Africa.

Halodule uninervis (Forsk.) Aschers. in Boiss., *Fl. Orient.* 5 : 24 (1882); *Pflanzenfam.* 2, 1 : 213 (1889); Sauvageau in *J. Bot. France* 4 : 321 (1890); den Hartog in *Blumea* 12 : 297 (1964). Type: Yemen, near Mocha Coast, *Forsk.* (type could not be located).

Zostera uninervis Forsk., *Fl. Aeg.-Arab.* CXX: 157 (1775).

Diplanthera uninervis (Forsk.) Aschers. in *Pflanzenfam. Nachtr.* 37 (1897); Graebn. in *Pflanzenf.* 4, 2 : 152 (1907); Macne in *Nat. Hist. of Inhaca Island, Mozambique* 28, fig. 8a (1958).

Cymodocea australis sensu A. Benn. in *F.T.A.* 8 : 229 (1902).

Grass-like perennials. *Roots* up to 6, arranged in a semi-circle at the nodes of the main rhizome, simple, long, densely covered with long root-hairs; the roots from the abbreviated nodes of the rhizome-branches appearing singly, inserted left and right to form a double row. *Rhizome* with internodes up to 4 cm long, giving off much abbreviated side branches with internodes 0.5–3 mm long,

ending in a leafy shoot; the internodes covered at first with membranous long, imbricate, amplexicaul, convolute bracts, their blackish bases persistent, giving the rhizome-branches their typical beaded appearance. *Leaves* 2–4 on very short, erect shoots; leaf-sheaths (the lower without a lamina) long, folded, bi-auriculate; lamina linear to setaceous, straight or somewhat falcate, flat, dark green, c.100 mm long and 2 mm broad, midrib and margins terminating above in 3 short teeth, the truncate area between the teeth sometimes slightly convex or concave, often with a dark spot below the median tooth; secondary nerves indistinct, lamina with scattered tannin cells. *Flowers* solitary, beside a young leaf, surrounded by membranous, somewhat dilated sheaths; *male* pedunculate with one anther inserted above the other, the locules facing opposite directions; *female* with 2 carpels situated laterally on a clavate peduncle which bears 3 small apical protuberances; style inserted laterally,

long, subulate, ovule solitary, pendulous. *Fruit* globose, 1.5 mm in diam., hard, orange, papillate. Fig. 22 : 1.

Tropical east Africa from the Red Sea to Zululand, Madagascar, Asia. Recorded once from the Republic.

NATAL.—Lower Umfolozi: Mapelane area, sandstone shelf in upper infratidal zone, *Ward* 3931 (sterile).

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3. ZANNICHELLIA

Zannichellia L., Sp. Pl. 969 (1753); Gen. Pl. ed. 5 : 416 (1754); Aschers. in Pflanzenfam. 2, 1 : 213 (1889); A. Benn. in F.C. 7 : 50 (1897); F.T.A. 8 : 224 (1901); Graebn. in Pflanzenr. 4, 2 : 153 (1907); Adamson in Fl. Cape Penins. 35 (1950); Phill., Gen. ed. 2 : 54 (1951); Rendle, Class. Flow. Pl. ed. 2, 1 : 208 (1953); Hutch., Fam. Flow. Pl. ed. 2, 2 : 559 (1959); Clapham, Tutin & Warburg, Fl. Brit. Isles ed. 2 : 960 (1962); Singh in Bot. Gaz. 126 (2) : 141 (1965). Type species: *Z. palustris* L.

Submerged annuals, perennating occasionally. *Roots* 1–3 per node, simple, densely covered with long root-hairs, penetrating the substratum spirally. *Rhizome* creeping, matted, sympodial, giving off simple or sparsely branched erect stems. *Leaves* ternate, opposite or alternate, linear, sessile, with a free cupular sheath subtending the axils, or the leaf base expanded into a folded sheath forming auriculate stipules above; axillary scales 2, minute. *Flowers* monoecious, unisexual solitary, or with a collateral vegetative bud or one of the opposite sex beside it; males ephemeral, on long filaments (pedicels) anthers 4–8-locular, with an apical knob; pollen globose, copious; female surrounded by a spathe, solitary or pseudo-umbellate, ovary surrounded by a closely appressed flask-shaped “perianth”, style exerted, tubular, stigma spoon- or funnel-shaped, large, with wavy membranous margins, ephemeral, the ovule pendulous. *Fruit* a somewhat bean-shaped drupelet, stipitate and crowned by the persistent style, pectinate on the dorsal and occasionally on the ventral side; seed with a long, spirally coiled hypocotyl, exendospermous.

Two species; one a widespread variable species (regarded by some as multispecific) the other endemic to the Cape Peninsula and neighbouring coastal areas. They inhabit brackish and fresh water and multiply rapidly.

Flowers umbellate; leaves usually ternate or opposite, sheaths cupular, free from lamina (section *Zannichellia*).....1. *Z. palustris*

Flowers solitary; leaves alternate, lamina expanded below to form a convolute sheath (section *Pseudalthenia*).....2. *Z. aschersoniana*

1. *Zannichellia palustris* L., Sp. Pl. 969 (1753); Aschers. in Pflanzenfam. 2, 1 : 213 (1889); A. Benn. in F.C. 7 : 50 (1897); Campbell in Proc. Calif. Acad. Sci. ser. 3, Bot. 1 (1897); Graebn. in Pflanzenr. 4, 2 : 153 (1907); Adamson in Fl. Cape Penins. 35 (1950); Rendle, Class. Flow. Pl. ed. 2, 1 : 208, fig. 83 c–e (1953); Hutch., Fam. Flow. Pl. ed. 2, 2 : 559, fig. 355 (1959). Type: Europe, (LINN 1085.1).

Z. palustris subsp. *pedicellata* Wahlenb. & Rosen in Nov. Act. Upsal. 8 : 227, 254 (1821); Graebn. in Pflanzenr. 4, 2 : 156 (1907); Marloth in Fl. S. Afr. 4, 10, fig. 2 (1915). *Z. pedicellata* Fries, Novit, Mant, 3 : 133 (1842); Wager in Trans.

The drawings of the flowers were made from fertile material collected on Inhaca Island in Mozambique. The male flower belongs to *Mogg* 27172, the female to *Mauve & Verdoorn* 23. Both specimens agree with den Hartog's concept of *Halodule wrightii*, being finer and smaller plants. It is likely that the peduncle or filament of the male flower will elongate at anthesis. The stigmas of the female flower had degenerated and could not be observed.

Roy. Soc. S. Afr. 16 : 202 (1928). Type: Europe. *Z. stylaris* Presl, Bot. Bemerk. 112 (1844). Type: Cape, *Drege* 8801. *Z. palustris* var. *pedicellata* Aschers. in Fl. Brandenb. 669 (1864); Dur. & Schinz, Consp. Fl. Afr. 5 : 498 (1895).

Submerged brittle annuals forming dense mats resembling fine grass. *Rhizome* thin, branching freely. *Stems* erect, thin, up to 50 cm long but usually shorter. *Leaves* 1–3 per node, linear, 2–5 cm long and 1–2 mm broad, gradually tapered above, below surrounded by a free tubular, membranous, scarious sheath; axillary scales minute, lanceolate. *Flowers* monoecious, unisexual,

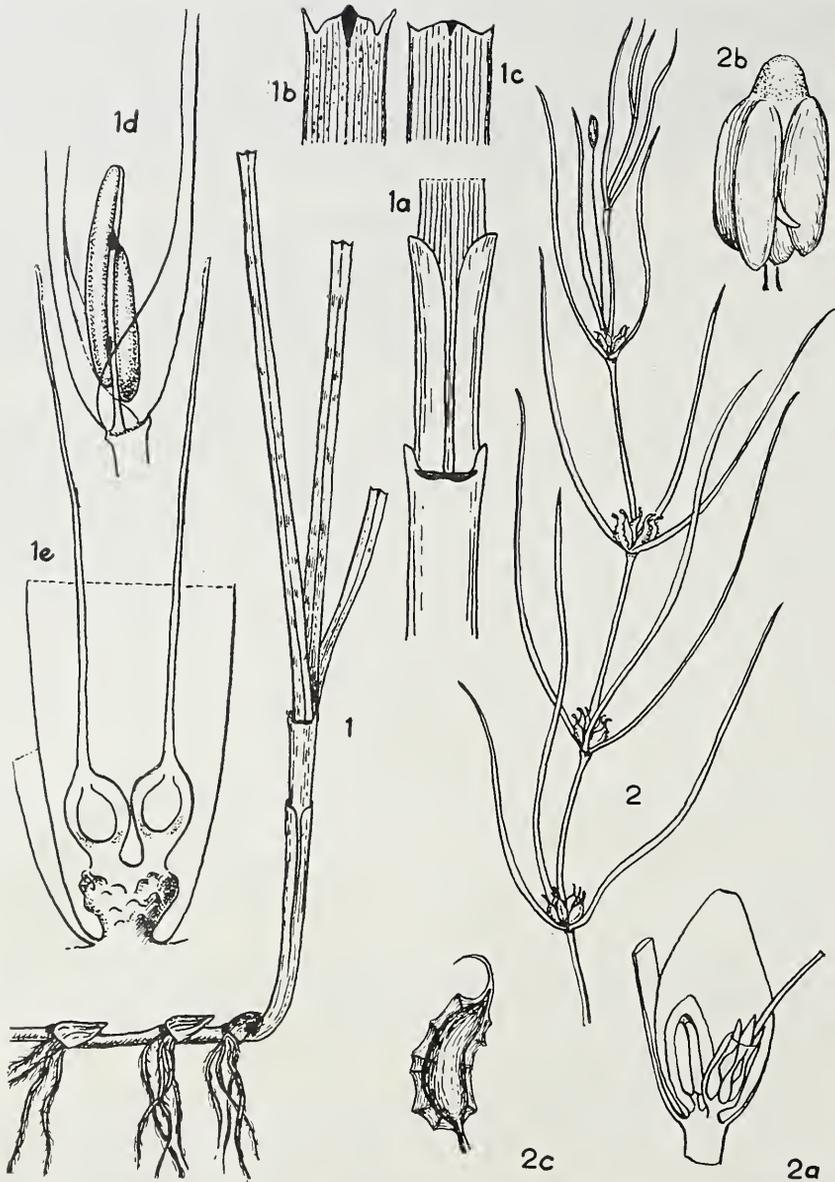


FIG. 22.—1, *Halodule uninervis*, $\times 1$; 1a, leaf-sheaths, $\times 2$; 1b, 1c, leaf-tips, $\times 4$; 1d, young male flower, $\times 9$; 1e, female flower, $\times 10$. 2, *Zannichellia palustris*, $\times 1$; 2a, diagrammatic drawing of immature flowers, $\times 10$; 2b, 4-locular stamen showing small pustule, $\times 22$; 2c, fruit, $\times 8$.

the male and female flowers aggregated in the axils of the leaf whorls, occasionally the upper axils producing only males, each surrounded by a membranous tubular sheath. *Male flower* consisting of a solitary stamen; filament lengthening rapidly at anthesis, up to 2 cm long, anther 4–8 locular, with a glandular apical knob and a small pustule at the base of the connective on the axial side, pollen globular. *Female flowers* 1–6, arranged in a pseudo-umbel, enclosed at first in a cupular spathe; peduncle 1–5 mm long, carpel ovoid, stipitate, style tubular, stigma spoon-shaped, soon disintegrating. *Drupelet* bean-shaped, 2 mm, crested and knobbed on the convex side, (occasionally also ventrally) apex pin-shaped (the style and stigma-base being persistent), stipitate. Fig. 22 : 2.

Cosmopolitan but absent from Australia. Widespread but not common in Southern Africa; occurs in fresh or brackish water.

CAPE.—Bathurst: Kowie. *Britten* 5254. Colesberg; Stormsfontein, near Colesberg, *Zeyher* 1888. Cradock: *Sister Mary Francis*. Hay: Niekerkshoop, *Marloth* 4912. Herbert: Campbell, *Wilman* sub KMG 1393. Kimberley: Pretorius Vlei, *Hafström* 1070. Middelburg: Grootfontein College, *Comins* 843. Oudtshoorn: near Kamenassie, *Britten* 3161. Port Elizabeth: Swartkops River, *Schlechter* 6080. Williston: Walkraal dam, *Foley* 201.

O.F.S.—Bloemfontein: *Moran*. Fauresmith: Fauresmith Reserve, *Verdoorn* 1574.

TRANSVAAL.—Brakpan: *Wager*.

S.W.A.—Grootfontein: *Abenab*, *Dinter* 7403; *Namutoni*, *De Winter* 2981. Maltahöhe: *Nomtsas*, *Giess* 2283. Okahandja: *Gross Barmen*, *Wiss & Kinges* 998. Swakopmund: *Nonidas*, *Swakop River*, *Galpin & Pearson* 7447.

Campbell (l.c. 1897) gives a detailed account of the morphology of *Zannichellia palustris*, especially of the development of the flower. He found that the stem-apex divides dichotomously, the one half, forming the floral part, being recognizable by its broader shape. This is due to a second dichotomous division giving rise to a second flower. This splitting may be repeated three or four times and as a result 2–8 flowers may appear. The spathe, or cup-like envelope at the base of the flower cluster, should be considered the homologue of the bracts found on the nodes of the main axis. It is also believed to be the equivalent of the Aroid spathe.

When examining the root, the presence of a definite dermatogen layer extending over the root-cap was observed by Campbell. This is not very

common. The axillary scales (squamae intravaginales) were thought to be secretory organs, giving off the mucilage so often encountered in the younger parts of the plants.

2. *Zannichellia aschersoniana* *Graebn.* in *Pflanzenr.* 4, 2 : 157 (1907); *Adamson* in *Fl. Cape Penins.* 35 (1950); *Reynecke* in *Journ. S. Afr. Bot.* 30 : 93 (1964). Syntypes: Cape Peninsula, *Wolley Dod* 3586; 3381 (B†, PRE, BOL).

Annuals with slender rhizomes. *Stems* upright, up to 60 cm long, 0.75 mm in diam., usually unbranched. *Leaves* alternate, linear, 2–7.5 cm long and 1–2 mm broad, narrowed gradually to the rounded apex, expanded below to form a sheath 5 mm long, which is auriculate above. *Male flower* a single stamen at first enveloped in a thin, membranous spathe, filament lengthening rapidly at anthesis, up to 25 mm long, the 4 locules forming a rectangular anther (squared in cross-section), dehiscent longitudinally, with a rounded apical knob and 2 small basal pustules on opposite sides of the connective. *Female flowers* surrounded by a vaginate spathe and an inner flask-shaped “perianth” which is truncate above and closely appressed to the ovary and immature style; during anthesis the style lengthens rapidly and displays a large, ephemeral spoon- or funnel-shaped stigma. *Fruit* an asymmetrically graniform to somewhat bean-shaped drupelet, c.4 mm long, dorsally and occasionally ventrally, pectinate, stipitate below, crowned by the persistent style-base, brownish orange. The fruits formed below on the rhizomes geotropic, borne on stalks usually about 2 cm long (up to 6 cm); the fruits at right angles to the stalk. Fig. 23.

Endemic to the Cape Peninsula and neighbouring coastal areas; northwards it is reported from Lamberts Bay, eastwards from Still Bay; in brackish pools near the sea.

CAPE.—Caledon: near Gordons Bay, *Parker* 4923. Clanwilliam: Lamberts Bay, *Lange Vlei*, *Tölkén* 333. Peninsula: *Kommetjie*, *Wolley Dod* 3381; *Noordhoek Flats*, *Mauve & Simons* 4251; *Rietvlei*, near Milnerton, *Stephens* (51 of waterplant series); *Mauve & Simons* 4252.

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4. ALTHENIA

Althenia Petit in *Ann. Sci. Obs.* 1 : 451 (1829); *Aschers.* in *Pflanzenfam.* 2 : 213 (1889); *Aschers. & Graebn.*, *Synops. Mitteleurop. Fl.* 1 : 365 (1897); *Graebn.* in *Pflanzenr.* 4, 2 : 158 (1907); *Schonland* in *Kew Bull.* 365 (1924); *Adamson* in *Fl. Cape Penins.* 36 (1950); *Phill.*, *Gen. ed.* 2 : 54 (1951); *Hutch.*, *Fam. Flow. Pl. ed.* 2, 2 : 559 (1959).

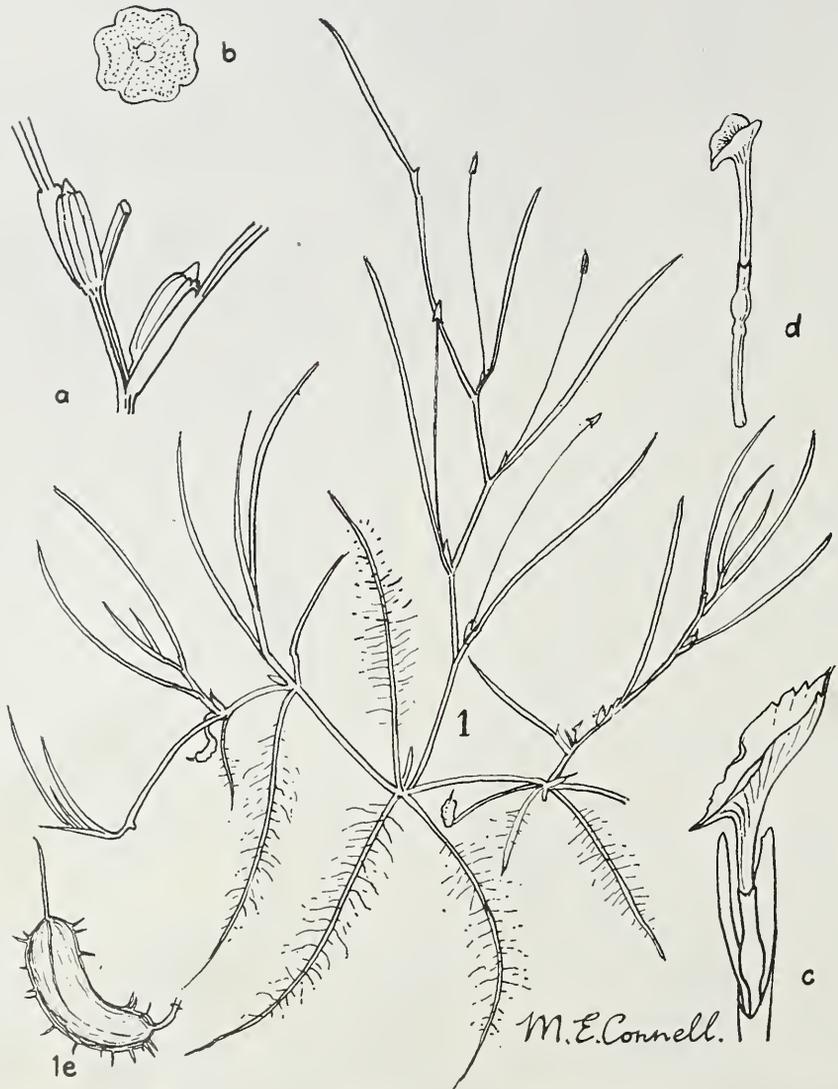


FIG. 23.—1, *Zannichellia aschersoniana*, $\times 1$; a, young male flowers, $\times 6$; b, cross-section of anther; c, young female flower, $\times 10$; d, older female flower; e, fruit, $\times 6$.

Very small, creeping, submerged annuals. *Roots* 4–7 from a node, simple, long, densely covered by long root-hairs. *Rhizome* branched, slender, with a deciduous, lanceolate, amplexicaul scale from each node. *Stems* simple, erect, up to 15 cm long, filiform. *Leaves* usually aggregated above, filiform-setaceous, up to 5 cm long, sheaths folded, membranous, about 5 mm long, above forming a forked appendage 2–3 mm long, becoming frayed with age. *Flowers* aggregated above. *Male flowers* solitary, on a pedicel which elongates up to 4–5 mm during anthesis so that the anther is just exerted; often with 3 as yet undeveloped female flowers beside them; perianth a small 3-toothed cup, with the unilocular anther sessile or subsessile, pollen globose. *Female flowers* usually 3 together, ovary stipitate, enfolded in a membranous bract, narrow-ovoid, unilocular, with a long style and a saucer-shaped apical stigma. *Fruit* a stipitate, cylindrical, slightly oblique, drupelet crowned by the persistent pin-like style and stigma-base.

A monotypic genus found in southern Europe, northern and southern Africa.

Althenia filiformis Petit in Ann. Sci. Obs. 1 : 451 (1829), etc. l.c. Type: France.

S.W.A.—Lüderitz: Lüderitzfelder Teiche, *Dinter* 6414.

Description as for the genus. Fig. 21 : 2.

Found in brackish pools near the sea on the western and southern coasts of Southern Africa.

CAPE.—Humansdorp: mouth of Kabeljous River, *Gillett* 2334. Namaqualand: Hondeklip Bay, *Pillans* in BOL 18258. Peninsula: Paarden Eiland, *Adanson* 3391; Rugby, *Tölken* 445. Port Elizabeth: Chatty River near Redhouse, *Holland* sub *Schonland* 4450; Veeplaats, saltpan, *Archibald* 5018.

It was observed that the bracts surrounding the flowers are modified leaf-sheaths, the ligules especially being well developed. All stages between the normal leaf and the bract with a tiny caudate appendage, representing the lamina, were observed. *Schonland* in his note on the discovery of this species in South Africa (*Kew Bull.* 1924, p.365) failed to detect the unilocular stamens, but they are present in the *Holland* collection from the Chatty River.

NAJADACEAE

by A. A. OBERMEYER

Submerged herbaceous annuals or perennials, with simple adventitious roots devoid of root-caps. Upright branches forked repeatedly, brittle, smooth or prickly. *Leaves* sessile, in pseudo-whorls of 3 or more; with an open folded basal sheath and a linear dentate lamina; with 2 axillary scales. *Flowers* monoecious or dioecious, solitary or sometimes aggregated above, unisexual, small. *Male flower* a single stamen enveloped in bud by a closed spathe; closely adhering to the 1–2 or 4-locular anther is a thin inner envelope which is bilobed at the apex; pollination hydrophyllous, pollen globose or ellipsoid, without exine, contents granular. *Female flower* a single ovoid carpel surrounded by a spathe or naked; ovule solitary, basal, erect, anatropous, style filiform, with 2–3 stigmatic branches (viz. in Old World species). *Fruit* a small narrow-ovoid nut, epicarp reticulated, embryo straight, with a large hypocotyl and radicle, exendospermous.

Monogeneric.

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NAJAS

Najas L., Sp. Pl. 1015 (1753); Gen. Pl. ed. 5 : 445 (1754); A. Braun in Journ. Bot. Lond. 2 : 274 (1864); Magnus, Beitr. z. Kennt. Gatt. *Najas* (1870); Pflanzenfam. 2, 1 : 214-218 (1889); Benth. & Hook. f. Gen. Pl. 3 : 1018 (1883); Rendle in Trans. Linn. Soc. Bot. 2, 5 : 379-444, t. 39-42 (1899). A. Benn. in F.C. 7 : 51 (1897); F.T.A. 8 : 225 (1902); Rendle in Pflanzenr. 4, 12 : 1 (1901); Phill., Gen. ed. 2 : 55 (1951); Lawrence, Taxonomy of Vascular Plants 378 (1951); Hutch., Fam. Flow. Pl. ed. 2, 2 : 561 (1959); de Wilde in Acta Bot. Neerl. 10 : 164-170 (1961); Fl. Males. ser. 1, 6 : 157 (1962). Wild in Kirkia 2 : 37 (1961). Type species: *N. marina* L.

Description as for the family.

About 35 species widely distributed but absent from very cold areas. Found in fresh or brackish water; 3 widespread species in Southern Africa.

Several species of this genus were closely studied by botanists in Europe and in America, e.g. Magnus, Schumann, Rendle, Bailey, Campbell and recently, de Wilde. Campbell noted the absence of a root-cap in the American species, *N. flexilis*. In *N. pectinata* I found no root-hairs. The "ternate" phyllotaxis is made up of two subopposite amplexicaul leaves while the third is one of a "pair" produced in the axil of the lower leaf: the other leaf of this "pair," however, does not develop but remains minute and scale-like; in its axil is found a vegetative bud or a male or female flower.

De Wilde, in his studies of Asian material, found that on occasion the male or female flower developed a spathe, although they were normally naked in these species. Furthermore he observed the different stages in the transformation of an open scale to a closed, bottle-shaped spathe, concluding that it must be considered the homologue of a leaf.

Campbell noticed how the male and female flowers of *N. flexilis* were strikingly similar in the early stages, both developing from an apical bud which divides dichotomously to form a flower and a sterile branch. Besides the outer envelope, or spathe discussed above, the young stamen develops an inner envelope which, according to Campbell, might be the homologue of the ovular integument. Magnus and Rendle on the other hand interpret this inner envelope as a perianth.

Stems usually with scattered prickles, succulent; septa of leaf indistinct; stigmas 3; usually found in brackish water (Section *Najas*).....1. *N. marina* subsp. *delilei*

Stems smooth, herbaceous; septa of leaf distinct; stigmas 2; found in fresh water (Section *Caulinia*):

Leaves with about 6-12 macroscopic triangular, spinetipped teeth; dioecious; male flower surrounded by a sheath.....2. *N. pectinata*

Leaves filiform with 40-60 microscopic teeth; monoecious; male flower naked.....3. *N. granuinea*

1. *Najas marina* L., Sp. Pl. 1015 (1753).

Type: Europe (LINN 1156.1-2).

subsp. *delilei* (Rouy) Maire in Fl. Afr. Nord 1 : 205 (1952). Type: Lower Egypt, Fareskour, *Delile* (MPU, holo.; PRE, photo.).

N. delilei Rouy in Fl. France 13 : 294 (1912), nom. nov. *N. muricata* Del., Fl. Egypte 281, t. 50, fig. 1 (1813), non Thuillier (1799). Type: as for *N. delilei*. *N. marina* L. var. *muricata* (Del.) A. Braun ex K. Schum. in Fl. Bras. 3, 3 : 725 (1894); Rendle in Trans. Linn. Soc. Bot. ser. 2, 5 : 397, 440 (1899); Pflanzenr. 4, 12 : 8 (1901); A. Benn. in F.T.A. 8 : 226 (1901). *N. armata* Lindb. f. in Acta Soc. Sci. Fenn., B, 1, 2 : 8 (1932), nom. nov. for *N. muricata* Del.; Täckholm, Fl. Egypt 1 : 113 (1941). *N. marina* subsp. *armata* (Lindb.f.) Horn of Rantzien in Kew Bull. 1952 : 29 (1952).

Caulinia muricata (Del.) Spreng., Syst. 1 : 20 (1825).

Annuals up to 60 cm high, somewhat succulent, often decumbent in shallow water, rooting at the nodes. *Stems* (in S.A. specimens seen) c. 2 mm in diam., spinoso-dentate or occasionally smooth, prickles similar to those of the leaves; lower internodes up to 7 cm long, upper shorter. *Leaves* linear, c. 20 mm long and 2 mm broad, the margin and often also the midrib dorsally spinoso-dentate with the apical cell of the spine sharp, brown; basal sheath small, 4 mm, auriculate, membranous, obtuse, denticulate or smooth. *Flowers* dioecious, solitary; male surrounded by a bottle-shaped spathe contracted into a thin denticulate, oblique neck; stamen 2-4 celled, the septa often incompletely developed, pollen ellipsoid; *female* naked, with an ovoid ovary 3 mm, style with 3 erect stigmatic papillate branches about half as long as the ovary.

Fruit an ovoid nut 4 mm long, coarsely honey-combed. Fig. 24 : 2.

North-western Europe, Africa, Asia to western Australia. Rare in Southern Africa; in brackish pools in eastern coastal belt; also recorded from the Kruger National Park. Apparently selective in its habitat. (N.B. Not a marine species).

CAPE.—George: Lange Vlei, *Stephens* 30. Knysna: Karatara Lake, *Martin* 4514.

NATAL.—Ingwavuma: Nyamiti Lake, *Ward* 3208; Nhlanga Lake, *Tinley* 356.

TRANSVAAL.—Letaba: Kruger National Park, Tsende River, *Brynard & Pienaar* 4312.

2. *Najas pectinata* (Parl.) Magnus in *Illustr. Fl. Egypte* (Mém. Inst. Egypt. 2, 1) 145 (1889); *Ber. Deutsche Bot. Ges.* 12 : 219 (1894); *Dur. & Schinz, Consp. Fl. Afr.* 5 : 500 (1898); *Horn of Rantzien in Kew Bull.* 1952 : 38 (1952); *Wild in Kirkia* 2 : 37 (1961). Type: Egypt, Medinet-el-Fayoum, *Figari* (Fl. holo., PRE, photo.).

Caulinia pectinata Parl., *Fl. Ital.* 3 : 665 (1858).

Najas horrida A. Braun ex Rendle in *Trans. Linn. Soc. ser. 2, 5* : 422, t.42, fig. 183-191 (1899); *ib.* 443 (1900); *Pflanzenr.* 4, 12 : 17 (1901). Type: Nigeria, Nupe, *Barter* 1065. *N. interrupta* K. Schum. in *Pflanzenw. Ost. Afr. C.* 94 (1895); *A. Benn. in F.C.* 7 : 51 (1897); *F.T.A.* 8 : 228 (1902); *Rendle in Trans. Linn. Soc. ser. 2, 5* : 423 (1899); *Pflanzenr.* 4, 12 : 17 (1901); *Marloth, Fl. S. Afr.* 4 : 9, fig. 1a (1915); *Horn of Rantzien in Kew Bull.* 1952 : 38 (1952). Type: Tanganyika, Lake Victoria, *Fischer* 614 (B†, K, lecto).

Submerged perennial plants forming dense brownish clumps 30-100 cm high, some of the upper leaf-tips just exerted above the surface of the water. *Stems* much ramified, rooting at the nodes; upper stems erect, thin, terete, smooth, 0.5-1 mm in diam., lower internodes up to 12 cm long, abbreviated above, the shoots appearing bushy. *Leaves* aggregated in upper axils, spreading to falcate from above the sheath, narrowly linear, 2-3 cm long, 0.5-1 mm broad, spinosodentate, with 6-18 yellow, sharp teeth which curve upwards on each side, sometimes teeth innocuous and small, apex attenuate, spinous, septa distinct; sheath usually auriculate, amplexicaul, minutely dentate above, 3 mm long. *Flowers* dioecious. *Male flowers* at first enveloped in a tight membranous bottle-shaped sheath with a few minute teeth surrounding the aperture; stamen solitary, 3 mm long; during anthesis the filament lengthens rapidly up to 3 mm and the stamen bursts out of the spathe above; inner envelope swollen,

forming 2 small pyramidal gibbositities above; anther 4-lobular the integuments splitting downwards and curling up outwards, the inner septa remain standing as a 2-winged column; the whole stamen soon disintegrating after shedding its pollen; pollen globose. *Female flowers* without a spathe, 2 mm long, ovary turbinate, contracted into a short style and 2 filiform stigmas. *Nut* cylindrical, 2.5 mm long, apiculate, marked with quadrate pits. Fig. 24 : 1.

A common inland fresh-water species found in Natal, Transvaal, South West Africa and further north to Egypt; also in Madagascar. Avidly eaten by fish. Common name: Sawgrass.

NATAL.—Hlabisa: Hluhluwe Game Reserve, *Ward* 2566; 2945. Ingwavuma: Ndumu Game Reserve, *Tinley* 457. Lower Umfolosi: Richards Bay, fresh water lake, *Wager*.

TRANSVAAL.—Brits: Hartebeestpoort Dam, *Talbot*. Potgietersrus: Mosdene, near Naboomspruit, *Mauve* 4201. Pretoria: Rietvlei Dam, near Pretoria, *Repton* 2002; Rust de Winter, *Wouda* 4; Pienaars River Dam, *Mauve & Vahrmeyer* 4303. Waterberg: near Nylstroom, *Prosser*. Without locality, *McLea* in *BOL* 6383.

S.W.A.—Okavango Native Territory: Okavango River, Niagana, *Dinter* 7264; lagoon at Kapako Camp near Mupini Mission Station, *De Winter & Marais* 5031.

Although the species was assumed to be monoecious by previous workers, the plants examined in the herbarium and in the wild state were found to be dioecious. Winterbuds in the form of thickened nodes and leafbases were observed. A surprising degree of desiccation can be tolerated.

The plant described as *N. interrupta* K. Schum., which is more slender and less spinous, appears to be a deep-water form.

In many aquatic plants, e.g. *Najas Lagarosiphon* etc., the upper internodes are retarded in their development, giving the plants the characteristic bushy appearance. This retardation allows for easy adaptation to a rising water-level.

3. *Najas graminea* Del., *Fl. Egypte*, 2 : 282, t.50, fig. 3 (1813); *A. Benn. in F.T.A.* 8 : 226 (1901). Type: Egypt, Rosetta Delta, *Delile* (MPU, holo.).

Small, unarmed plants with much branched shoots, 10-60 cm long, often plumose above because of the closely packed leaves. *Roots* many, long, filiform, with a dense covering of long root-hairs towards the tip. *Stems* with terete, brittle internodes, 1 mm in diam. *Leaves* 16-25 mm long, 0.5-6 mm wide, teeth microscopic, about 40-55 on

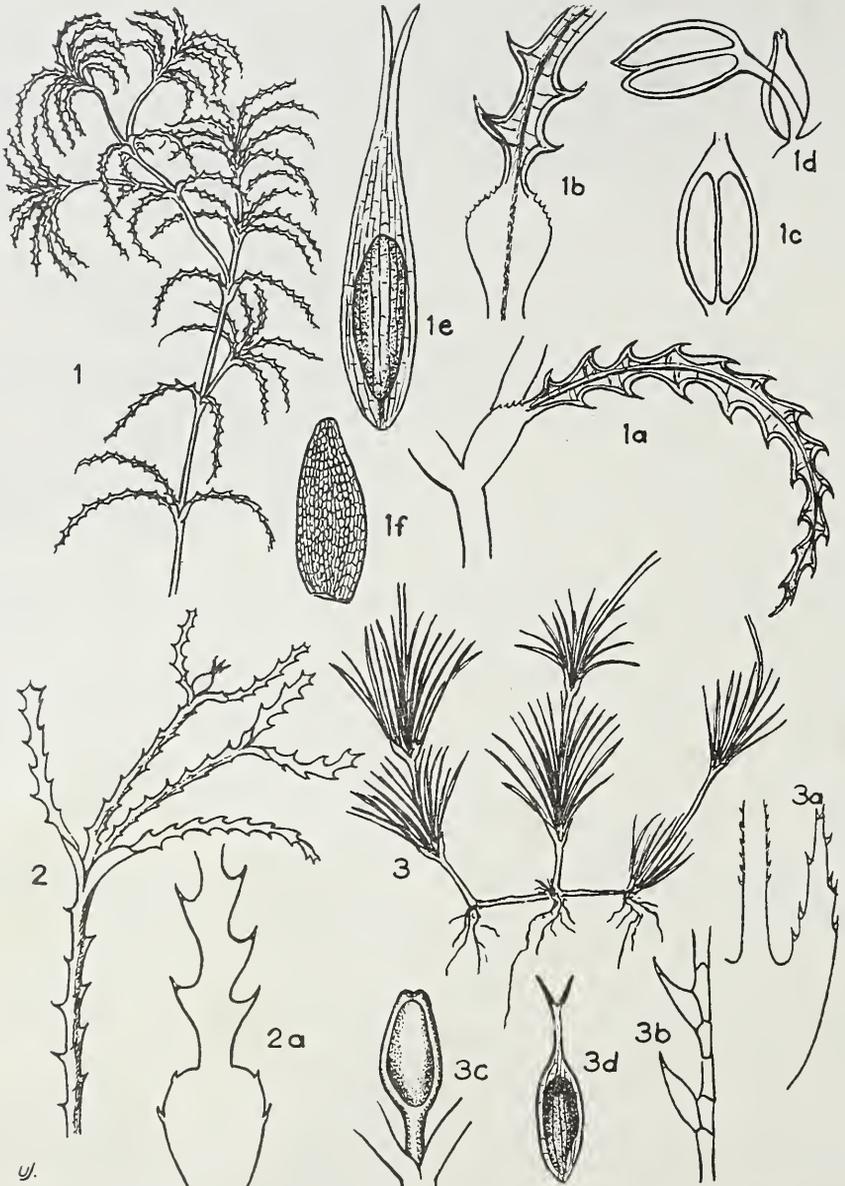


FIG. 24.—1, *Najas pectinata*, $\times 1$; 1a, leaf, $\times 3$; 1b, leaf-sheath, $\times 7$; 1c, young male flower enclosed in tubular spathe, $\times 10$; 1d, ripe male flower, $\times 10$; 1e, female flower, $\times 25$; 1f, seed, $\times 12$. 2, *N. marina*, $\times 1$; 2a, leaf-sheath, $\times 5$. 3, *N. graminea*, $\times 1$; 3a, leaf-sheath, $\times 12$; 3b, leaf margin, $\times 100$; 3c, male flower, $\times 12$; 3d, female flower, $\times 12$.

each side; sheaths with linear-setaceous auricles about 1.5 mm long, bearing some minute teeth. *Flowers* monoecious. *Male flowers* solitary, in upper leaf axils, naked; pedicel at anthesis 1 mm long, anther 1 mm long, oblong, apically with 2 small obtuse ridges. *Female flowers* usually in lower axils, sessile, about 1.5 mm long, the ovary about as long as the short style and the 2 long stig-

matic arms. *Fruit* oblong, 1.5 mm. Fig. 24 : 3.

Collected once in Southern Africa but widely distributed elsewhere. Recorded from Egypt, tropical East Africa, Asia, Australia; introduced in Italy and Britain.

TRANSVAAL.—Pretoria: Wallmansthal, 20 miles E. of Pretoria on farm Haakdoringfontein, *Mauve* 4342.

APONOGETONACEAE

by A. A. OBERMEYER

Fresh-water aquatics. *Rhizome* tuberous (in South African species) densely covered with thin, dead and living roots. *Leaves* submerged, aerial or with a floating blade, linear to elliptic, with the base attenuate, obtuse or cordate, petiolate, innermost lateral nerves placed close to the midrib, others more widely spaced, transverse nerves at right angles to laterals, close together (lamina fenestrated in some species from Madagascar). *Spikes* exerted, simple or forked (rarely 3–8 fid in some species from Madagascar), enveloped in bud by a hood-shaped spathe which is usually early caducous (persistent in a few species outside Africa). *Flowers* ebracteate, bisexual and protrandrous or female, arranged dorsally or around the axis; perianth-segments (or bracts) 1–3, persistent or deciduous (viz. in *A. stuhlmannii* and some closely related species) white, pink, red, mauve or yellow, folded inwards in the budstage, spreading afterwards, turning green with age if persistent. *Stamens* 6–16, free, hypogynous, anthers small, bilocular, with the locules facing opposite directions, basifixed; pollen ellipsoid to globose, pollination entomophilous. *Gynoecium* of 3–6 (–9 in apomicts) free, sessile, carpels, turbinate, attenuated into a style; style curving outwards and forming a stigmatic ridge on the ventral suture; ovules 2–8, basal, anatropous. *Follicles* membranous, opening on the adaxial side, the outer skin soon disintegrating; seeds fusiform, in some species with a soft spongy outer covering, without endosperm, embryo straight.

Monogeneric.

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APONOGETON

Aponogeton L.f., Suppl. 32 (1781); Benth. & Hook.f., Gen. Pl. 3 : 1013 (1880); Engler in Bot. Jahrb. 8 : 261 (1887); Pflanzenfam. 2, 1 : 218 (1889); A. Benn. in F.C. 7 : 42 (1897); F.T.A. 8 : 216 (1901); Krause & Engler in Pflanzenr. 4, 13 : 1 (1906); Phill., Gen. ed. 2 : 55 (1951); Hutch., Fam. Flow. Pl. ed. 2, 2 : 552 (1959). Type species: *Aponogeton monostachyos* L.f.

Description as for the family.

A genus of about 25 species, widespread in Africa, Asia and Australia. Five species recognized in Southern Africa.

Spike bifid:

Spikes with the flowers dorsally arranged in 2 rows; perianth-segments 1-2, spreading, longer than the stamens; winter rainfall region:

- Perianth-segment 1, large; spikes many-flowered, fragrant.....1. *A. distachyos*
 Perianth-segments 2; spikes 4-8-flowered, scentless.....2. *A. angustifolius*

Spikes with the flowers arranged all around the axis or, if secund, not in 2 rows; perianth-segments usually 3, equalling the stamens in length; summer rainfall region:

- Lamina awl-shaped to lanceolate, base attenuated; scape not swollen above; flowers white, pinkish or lilac, in fairly short secund or cylindrical spikes, obtuse at the apex.....3. *A. junceus*
 Lamina oblong-lanceolate, base cordate; scape swollen above; flowers yellow or white, in long cylindrical tapered spikes.....4. *A. desertorum*

Spike simple, few-flowered; perianth-segments deciduous, small; delicate fugitive plants

5. *A. stuhlmannii*

1. *Aponogeton distachyos* L.f., Suppl. 215 (1781); Thunb., Nov. Gen. 4 : 74 (1781); Ait., Hort. Kew. 1 : 495 (1789); Andr., Bot. Rep. 5 : t.290 (1803); Gawl. in Bot. Mag. t.1293 (1810); Spreng., Syst. 2 : 465 (1825); Engl. in Bot. Jahrb. 8 : 272 (1887); Dur. & Schinz, Consp. Fl. Afr. 5 : 492 (1894); A. Benn. in F.C. 7 : 43 (1897); Krause & Engl. in Pflanzenr. 4, 13 : 21 (1906); Marloth, Fl. S. Afr. 4 : 13, 14, tab.3, fig. 3 (1915); Verdoorn in S.A. Journ. Nat. Hist. 3, 2 : 17 (1922); Adamson in Fl. Cape Penins. 37 (1950). Type: Cape, *Thunberg* (LINN 479-3, pro parte, viz. the leaves and the spike second from right, lecto.).

Tubers up to 6 cm in diam., dark. *Leaves* with a floating lamina, lanceolate to oblong, 6-20 cm long and 2-7 cm broad, apex acute to obtuse, base rounded or shortly attenuate. *Spikes* bifid, many-flowered, up to 6 cm long. *Flowers* many, scented, dorsally arranged in 2 spreading rows, with the flowers on the one side slightly above those of the other; perianth-segments solitary, oblong to ovate-lanceolate, up to 18 mm long, delicate, white or occasionally pink, accrescent and green in fruit. *Stamens* 8-16, arranged in a circle, filaments thin, 3 mm long, anthers purple to black. *Carpels* 2-6 with c.4 ovules in each carpel. *Follicles* turbinate, c.1 cm long with a straight beak, 1-4 seeded, seeds 9 mm long, with a spongy outer covering. Fig. 25 : 2.

Common in the winter-rainfall area of the Cape Province and, eastwards, to Plettenberg Bay; in ponds, rivers and ditches. Often cultivated in Europe and said to have gone wild in the south of France. Flowers from March to September.

CAPE.—Caledon: Elgin, Palmiet River, *Smith* 2554. Ceres: Verkeerde Vlei, *Compton* 12055. Clanwilliam: Olifants River near Keerom, *Pillans*

8777. George: Diep River, *Galpin* 4778. Humansdorp: Langkloof, Nuweplaas, *Theron* 1385; Ratelsbosch, *Fourcade* 363. Knysna: Plettenberg Bay, *Rodin* 1173. Laingsburg: Cabidu Dam, *Compton* 22892. Peninsula: *Marloth* 172; Rondebosch, *Schlechter* 832. Riversdale: Vet River near Riversdale, *Muir* 193. Stellenbosch: Faure, *Strey* 606. Swellendam: *Thode* A2401.

Common names: Wateruintjie, Cape Hawthorn. Both tubers and fruiting spikes are eaten. A cultivated plant of unknown origin (*Schlieben* 10499) regularly produced simple spikes.

Dandy and Stearn, who investigated the typification of *A. distachyos*, regard sheet 479.3 in the Linnaean herbarium as the lectotype (although comprising 2 species) for Linnaeus and his son made annotations on the back of this sheet and quoted Thunberg as the collector. The 3 spikes on the left and the one on the right should be excluded as they represent *A. angustifolius*. Although sheet 479.2 consists of *A. distachyos* only, it cannot be selected as the type since it was collected by Sparrman.

2. *Aponogeton angustifolius* Ait., Hort. Kew. 1 : 493 (1789); Willd., Sp. Pl. 2 : 928 (1799); Gawl. in Bot. Mag. t.1268 (1810); Spreng., Syst. 2 : 465 (1825); Engl. in Bot. Jahrb. 8 : 272 (1887); Dur. & Schinz, Consp. Fl. Afr. 5 : 492 (1895); A. Benn. in F.C. 7 : 43 (1897); Krause & Engl. in Pflanzenr. 4, 13 : 21 (1906); Marloth, Fl. S. Afr. 4 : 13, 14, t.3 (1915); Adamson in Fl. Cape Penins. 37 (1950). Type: Cape Peninsula, *Masson*, introduced to Kew in 1788 (K. holo.).

A. crinifolium Lehm. ex Schlecht. in Linnaea 10, Litt. Ber. 76 (1836); A. Benn. in F.C. 7 : 45 (1897). Type: Cape Flats, inundated places, *Pappe* (BM, holo.; NBG).

Tubers globose, 2 cm in diam., brown. *Leaves*: primary rarely developed, submerged, filiform to linear, with a wavy margin, tapered above and below; later leaves petioled and with a floating lamina, narrowly lanceolate to oblong, c.5 cm long and 1 cm

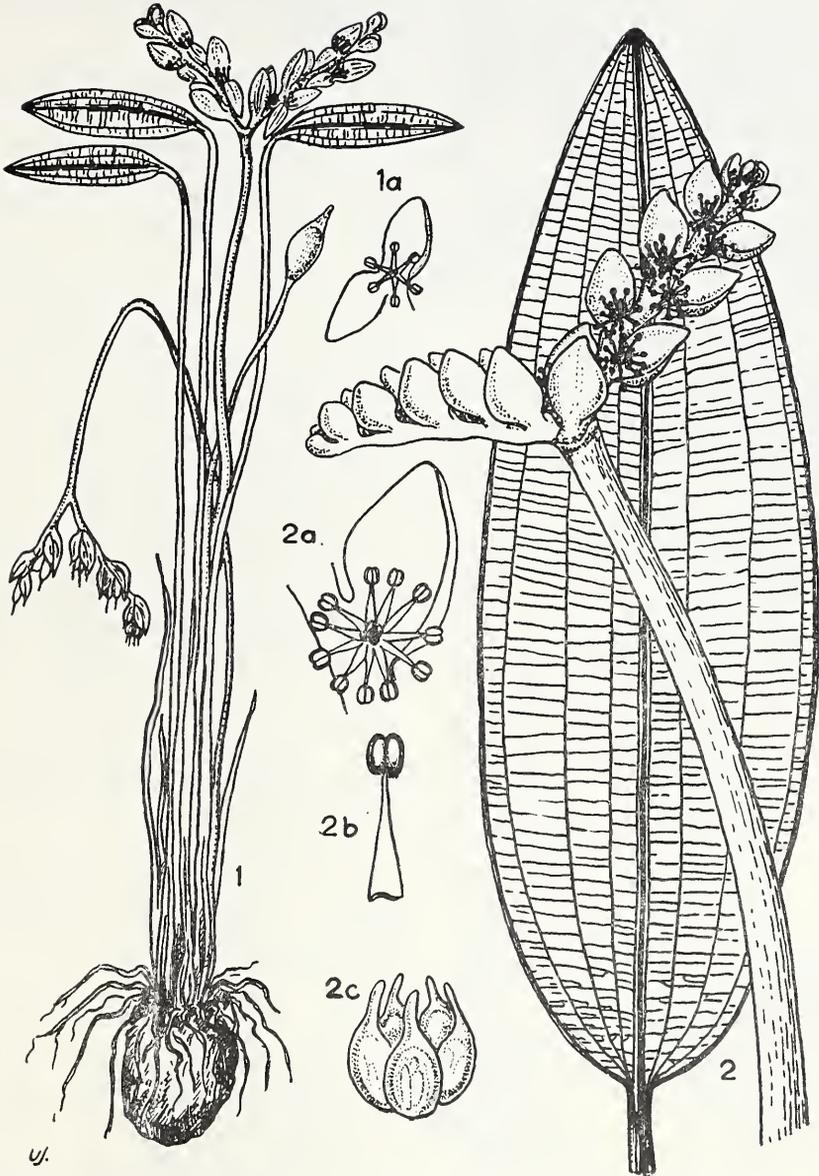


FIG. 25.—1, *Aponogeton angustifolius*, $\times 1$; 1a, flower. 2, *A. distachyos*, leaf and inflorescence, $\times 1$; 2a, flower, $\times 3$; 2b, stamen, $\times 8$; 2c, carpels, $\times 2$.

broad, apex acute, base rounded to attenuate, lateral nerves indistinct, margin slightly prominent. *Spikes* bifid, compact at first, lengthening during anthesis, in fruit up to 2 cm long, laxly 4–8-flowered. *Flowers* scentless, situated dorsally on the rhachis; perianth-segments 2, white with a pinkish tinge below, oblong-lanceolate, 5–10 mm long, accrescent in fruit. *Stamens* usually 6, filaments subulate, 2–4 mm long, anthers black. *Carpels* 2–4, ovules 2. *Follicles* narrow-ovoid, green, membranous, 8 mm long, with a straight beak; seeds 7 mm long, with a thin spongy outer covering. Fig. 25 : 1.

Confined to the south-western Cape.

CAPE.—Malmesbury: Darling, *Bolus* 12894; Darling Flora Reserve, *Winkler* 98. Peninsula: near Muizenberg, *Schlechter* 1253; Princess Vlei, *Walgate* sub *Adamson* 3674; Grassy Park, *Compton* 13690; Isoetes Vlei, *Barker* 9748. Stellenbosch: flats, *Strey* 602a, b. Worcester: *Leipoldt* s.n.; *Tölken* 1072.

Linnaeus and his son confused this species with *A. distachyos*. On sheet LINN 479.3 there are 4 flower spikes of *A. angustifolius*, but the leaves and the second spike from the left belong to *A. distachyos* (see p. 86).

3. *Aponogeton junceus* *Lehm. ex Schlecht.* in *Linnaea* 10, *Litt. Ber.* 76 (1836); *Steud.*, *Nom.* 114 (1841); “*A. junceum* *Lehm.*” *Del.*, *Sem. Hort. Hamb.* (1883), *nom. nud.* “*A. junceus* *herb. Zeyher*” *teste Hook.f.* in *Bot. Mag. t.6399* (1878). *Type:* Hort. Hamburg, ex *Caffraria*, *Ecklon* s.n.

A. spathaceus *E. Mey. ex Hook.f.*, *Bot. Mag.* sub *t.6399* (1878); *Engl. in Bot. Jahrb.* 8 : 272 (1887); *Dur. & Schinz*, *Consp. Fl. Afr.* 5 : 493 (1894); *A. Benn. in F.C.* 7 : 44 (1897); *Rendle in Cat. Afr. Pl. Welw.* 2 : 94 (1899); *A. Benn. in F.T.A.* 8 : 216 (1901). *Krause & Engl. in Pflanzenr.* 4, 13 : 1 (1906); *E. Mey. in Drege, Zwei Doc.* 165 (1843), *nom. nud.*; *Linnaea* 20 : 215 (1847), *nom. nud.* *Type:* Cape, *Albert, Drege.* —*var. junceus* (*Lehm. ex Schlecht.*) *Hook.f.* in *Bot. Mag. t.6399* (1878); *A. Benn. in F.C.* 7 : 45 (1901). *Type:* Hort. Hamburg ex *Caffraria*, *Ecklon* (Bt). *A. natalense* *Oliv. in Hook., Ic. Pl. t.1471a* (1884); *A. Benn. in F.C.* 7 : 44 (1897). *Syntypes:* Natal, *York, McKen* (K); between Karkloof and Umgeni, *Rehmann* (K; BOL). *A. rehmannii* *Oliv. in Hook., Ic. Pl. t.1471b* (1884); *A. Benn. in F.C.* 7 : 44 (1897); *Oberm., Schweick. & Verd. in Bothalia* 3 : 225 (1937). *Type:* Transvaal Bushveld, between Kleinsmit and Kameelpoort, *Rehmann* 4835 (K, *holo.*). —*var. hereeroensis* (*Schinz*) *Krause & Engl. in Pflanzenr.* 4, 13 : 16 (1906). —*var. major* *Glover in Ann. Bol. Herb.* 1 : 106 (1915), *nom. nud.*, based on S.W.A., Great Karasberg — *Naruda Süd, Pearson* 8456; 3457. *A. hereeroensis* *Schinz in Bull. Herb. Boiss. ser.*

2, 1 : 764 (1901). *Syntypes:* S.W.A., ponds east of Windhoek, *Dinter* 587 (Z); just north of Waterberg, *Dinter* (Z).

Tubers globose, up to 3 cm in diam., greyish brown. *Leaves* heterophyllous; filiform to subtrigonous, 4–25 cm long; or apically expanded into an erect spatulate lamina; or a floating, oblong blade up to 17 cm long and 4.5 cm broad is formed, with the base and apex attenuate or rounded. *Spikes* bifid, usually 2–4 cm long and 8 mm broad (up to 9 cm long and 2.5 cm broad), lengthening during anthesis, many-flowered. *Flowers* bisexual or female, (through suppression of stamens), scentless, situated dorsally on the rhachis or only so near the base, with the upper flowers arranged all around the rhachis; perianth-segments 1, 2 or 3, oblong-lanceolate, white, pink or mauve, with a shiny, soft texture, becoming green and firm with age. *Stamens* usually 6, slightly longer than the perianth-segments, equalling more or less the carpels; filaments swollen at the base, tapered above; pollen ellipsoid. *Carpels* up to 7 in lower flowers, usually 3 in upper, ovoid, with a curved beak above, stigmatic ridge dark, ovules 1–8, basal. *Follicles* green, firm, somewhat transparent, 3–5 mm long; seeds fusiform, 2 mm long, outer spongy covering thin; usually 1 or 2 seeds ripening per follicle. Fig. 26.

Widespread in Southern Africa, with the exception of the winter-rainfall area, and extending to Rhodesia and Angola. Common in fresh-water ponds, marshes and rivers, growing on the bank, or submerged with the lamina floating and the flower spikes exerted.

CAPE.—Albany: Slaaikraal, near Grahamstown, *Mauve & Wells* 24. Gordonia: Obobogorap, 120 miles N.W. of Upington, *Leistner* 1780. Kentani: *Pegler* 1869. Mafeking: Moshesh near Mosyra, *Bruckner* 412. Maraisburg: 10 miles N. of Hofmeyr, *Acocks* 16335. Riversdale: Oakdale, *Muir* 2747. Uitenhage: *Zeyher* 1734.

O.F.S.—Fouriesburg: Witzieshoek, *Junod* in *TRV* 17497. Kroonstad: *Pont* 590; *Acocks* 20994.

BASUTOLAND.—Tsekilo's, *Jacot-Guillarmod* 2537. Mokhotlong, Thabana Ntlenyana, *Cootzee* 572.

NATAL.—Hlabisa: Hluhluwe Game Reserve, *Ward* 2200; 2493. Lions River: near Nottingham Road, *Edwards* 2675. Maritzburg: *Schlechter* 3300. Umzinto: Dumisa, *Rudatis* 1583.

TRANSVAAL.—Bloemhof: Christiana, “Kaffraria”, *Burt Davy* 12798. Bronkhorstspuit: in river near town, *Mauve* 4261; *Repton* 448. Carolina: *Roberts* in *TRV* 14873. Pietersburg: Brak River, *Bremekamp & Schweickerdt* 38. Pretoria: Wallmansthal, 20 miles N.E. of Pretoria, *Dyer, Verdoorn & Mauve*



FIG. 26.—1, *Aponogeton juncus*, typical plant, $\times 1$; a, form with floating leaves ("rehmannii"), $\times 1$; b, form with broad erect leaves ("natalense"), $\times \frac{1}{2}$; c, $\text{\textit{f}}$ flower, $\times 10$; d, stamen, $\times 6$; e, young carpel, $\times 4$; f, fruiting carpel, $\times 3$.

4273; *Mauve* 4344. Soutpansberg: farm Eyem, north of Blaauwberg, *Obermeyer, Schweickerdt & Verdoorn* 84. Waterberg: Mosdene near Naboom-spruit, *Galpin* M.374.

S.W.A.—Rehoboth: Buellspoor, Klein Aub, *Strey* 2512. Grootfontein: Otavi, *Dinter* 5261; *Merxmüller* 2138.

The "species" *A. junceus*, *A. natalense* and *A. rehmannii* are here regarded as forms of one variable, complex species. They are high polyploids and very likely unstable. Approximately 118–126 chromosomes were counted and many appeared to be linked. The plants are often apomicts, the stamens changing into carpels.

4. *Aponogeton desertorum* Zeyh. ex Spreng. f., Syst. 5, Suppl. 14 (1828); Wild in Kirkia 2 : 36 (1961). Type: Cape, Uitenhage, *Zeyher* 191 (B).

A. kraussianus Hochst. in Krauss in Flora 343 (1845); Krauss, Beitr. Fl. Cap. & Natal, 172 (1846); A. Benn. in F.C. 7 : 44 (1897); F.T.A. 8 : 217 (1901). Type: Cape, Uitenhage, *Krauss* 1604 (B†; K). *A. leptostachyus* E. Mey. ex Engl. in Pflanzenr. 4, 13 : 12 (1906); Drege, Zwei Doc. 165 (1844), nom. nud.; Engl. in Bot. Jahrb. 8 : 270 (1887), nom. subnud. Type: Cape, Uitenhage, between Zuurberg and Bruintjieshoogte, *Drege* (B). *A. holubii* Oliv. in Hook., Ic. Pl. t.1470 (1884); Dur. & Schinz, Consp. Fl. Afr. 5 : 492 (1894); A. Benn. in F.C. 7 : 44 (1897); F.T.A. 8 : 217 (1901); Oberm., Schweick. & Verd. in Bothalia 3 : 225 (1937). Syntypes: Bechuanaland, Henry's Pan. *Holub* 1036–39 (K). *A. dinteri* Engl. & Krause in Bot. Jahrb. 36 : 92 (1905). Syntypes: South West Africa, Otjimbingue, *Fischer* 165; *Dinter*, cultivated at the Botanic Garden, Berlin (B†). *A. eylesii* Rendle in Journ. Bot. Lond. 70 : 76 (1932). Type: Rhodesia, Salisbury, Rua River, *Eyles* 852 (BM, holo.).

Tubers small, globose, 1–2 cm in diam., brown. *Leaves* 6–9 per plant, petioles flattened, striate, lamina floating, oblong, 5–17 cm long and 2–6 cm broad, apex obtuse, apiculate, base cordate, thinly coriaceous, often with many immersed oil glands in the epidermis (no submerged leaves seen). *Spike* bifid, lengthening during anthesis, 3–12 cm long, scape flattened, usually swollen above. *Flowers* white (in eastern Cape) or yellow, eventually somewhat laxly arranged all around the rhachis, the thick fruiting carpels below and the elongated young apical part giving the spikes their typically tapered appearance; perianth-segments 2, narrow-oblong to narrow-obovate, 2 mm long. *Stamens* usually 6, filiform, somewhat flattened, 2 mm long, spreading, anthers small, early deciduous, pollen ellipsoid, copious. *Carpels* 5–3, ovoid, 2 mm long, with a terete style, with the stig-

matic ridge short, apical, glutinous, usually dark; the 4–8 ovules usually visible through the transparent walls of the carpels and follicles; seeds cylindrical, 2 mm long, mostly about 6 ripening in each follicle. Fig. 27 : 1.

Recorded from the eastern Cape, Transvaal, Bechuanaland and South West Africa; also in Angola and Rhodesia. Found in rock pools or temporary river pools, developing extremely fast under favourable conditions. The flowers were noted as white in the eastern Cape, but are yellow further north.

CAPE.—Albany: Committees, *Dyer* 2183. Alexandria: Coerney River Valley, *Zuurberg, Archibald* 5247. Bedford: near Bedford, *Acocks* 20286. East London: *Rattray* 259. Komga: near Komga, *Flanagan* 1094; Gonubi Drift between Komga and Kei Road, *Flanagan* 2193. Somerset East: *Zuurberg, Annsvilla, Long* 952. Uitenhage: Swartkops River, *Zeyher* 915 (NBG, S).

TRANSVAAL.—Pietersburg: Brak River, *Bremekamp & Schweickerdt* 39; Rapetsc, *Schlechter* 4673. Soutpansberg: Duvenage's Pan, near Amisfort, *Schweickerdt & Verdoorn* 625.

S.W.A.—Gibcon: Packriem, *Range* 1361. Grootfontein: Otavi, *Dinter* 5477; Okongawa, Granitbank, *Dinter* 6966. Kaokoveld: Kowares, *Hall* 343. Outjo: Between Outjo and Otjikondo, *Barnard* in SAM 33299. Rehoboth: Buellspoor, *Strey* 2080. Warmbad: Great Karasberg — Naruda Süd, Kciop River, *Pearson* 8456. Welwitschia: near Ugab River Bridge, *Hardy & De Winter* 1495. Windhoek: Neudam Experimental farm, *Van Vuuren* 1022.

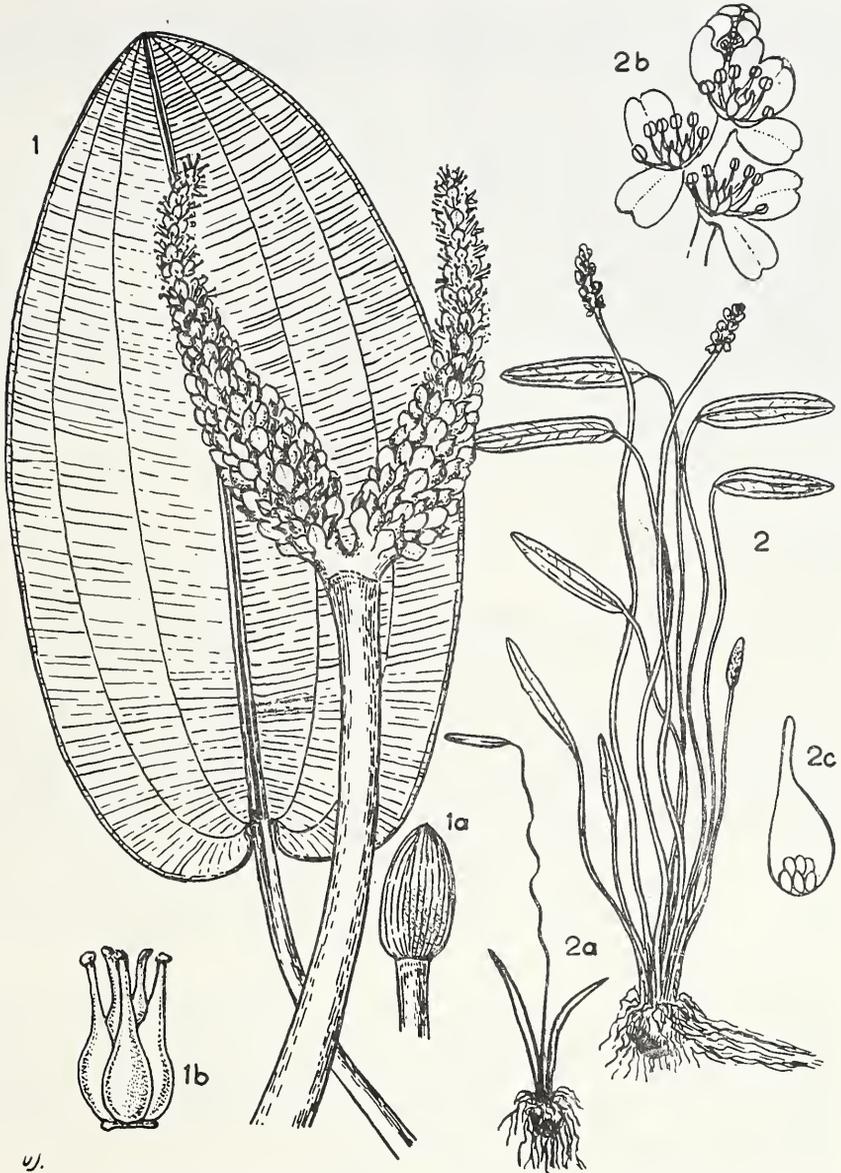
Although the type specimen, *Zeyher* 191, could not be located, there were two *Zeyher* collections in the S.A. Museum Herbarium (Nos. 912 and 4305) which were named *A. desertorum* Spreng. by *Zeyher* himself. The description of the type is very short but it does mention that the leaves are cordate, which make it undoubtedly this species.

Mentioned under the Speke & Grant Expedition, Botany, in Trans. Linn. Soc. 29 : 158 (1875) is *Aponogeton leptostachyus* var. *minor* Bak. It is based on *Grant* 1863, from Ganga Thembo in the Sudan. With its bright purple flowers, it may be a synonym of *A. abyssinicus* Hochst. Engler, in his monograph (Bot. Jahrb. 8 : 270, 1887), regards *A. abyssinicus* as a variety of *A. desertorum*, but they appear to be distinct.

Common name in Rhodesia: Dog with Two Tails.

5. *Aponogeton stuhlmannii* Engl. in Notizbl. Bot. Gart. Berlin 1 : 26 (1895); A. Benn. in F.T.A. 8 : 218 (1901); Krause & Engl. in Pflanzenr. 4, 13 : 12, t.9 (1906). Type: East Africa, Usinja, Bugando, *Stuhlmann* 3541 (B, holo.!, PRE, photo.).

A. gracilis Schinz ex A. Benn. in F.C. 7 : 43 (1897); *A. gracilis* Schinz in Dur. & Schinz, Consp. Fl. Afr. 5 : 492 (1895), nom. nud.; in Bull. Herb. Boiss. ser. 2, 1 : 736 (1901); Krause & Engl. in Pflanzenr. 4, 13 : 19, t.9 (1906). Type: Transvaal, Pietersburg, Houtbos, *Rehmann* 5761 (K, holo.).



ψ.
 FIG. 27.—1, *Aponogeton desertorum*, leaf and inflorescence, $\times 1$; 1a, young inflorescence covered by spathe, $\times 1$; 1b, carpels, $\times 1$; 2, *A. stuhlmannii*, $\times 1$; 2a, seedling, $\times 1$; 2b, part of spike, $\times 3$; 2c, carpel, $\times 15$.

Small tuberiferous herbs 3–12 cm high, with the upper parts fugaceous. *Tubers* developing new plants laterally, globose, up to 1 cm in diam. brown, densely covered above with long, fine, white matted roots. *Leaves*: the primary (representing the petioles only) submerged, awl-shaped falcate, about 2 cm long, 1 mm in diam., present in young seedlings; later leaves forming a long filiform petiole and a floating lamina, linear-oblong, 2–4 cm long and 5–6 mm broad, apex and base obtuse. *Spikes* simple, about 9-flowered, short at first, elongating in fruit, up to 2 cm long; spathe spotted, membranous; flowers at first dorsiventrally arranged in 2 rows, afterwards the rachis twists in a zig-zag fashion and the arrangement then appears more cylindrical; perianth-segments 2, white, oblong, 5 mm long, deciduous, apex obtuse or

emarginate. *Stamens* about 6, filaments narrowly subulate, 1–2 mm long, anthers yellow, turning black. *Carpels* c.3, whitish to purplish or bluish, transparent, with 4–6 basal ovules; style about as long as the ovary. *Follicles* turbinate, 1–4 seeded; seeds black, shiny, fusiform, 2 mm long. Fig. 27 : 2.

Recorded from the Transvaal and South West Africa; also in East Africa and Rhodesia. Usually found in granite rockpools that are dry most of the year. A fugaceous plant developing very fast under favourable conditions, the tuber becoming dormant again when the pool dries up.

TRANSVAAL.—Bronkhorstspuit: farm Roodepoortjie 149, *Repton* 4714a, b. Pietersburg: Houtbosberg, *Schlechter* 4707. Soutpansberg: Dongola, Greefswald, *Pole Evans* 4523; *Verdoorn* 2268; farm Zoutpan 193, *Obermeyer*, *Schweickerdt* & *Verdoorn* 317a.

S.W.A.—Otjiwarongo: Waterberg Plateau, *Boss* in TRV 35082.

JUNCAGINACEAE

by A. A. OBERMEYER

Perennial or annual, glabrous, scapose marsh herbs or aquatics. *Roots* fibrous. *Rhizome* stoloniferous or bulbous, often covered with fibres from old leaf-bases. *Leaves* basal, distichous, rush-like, erect or occasionally floating, linear to cylindrical, forming a broad open basal sheath; axillary scales present. *Inflorescence* a simple raceme or spike, ebracteate; flowers anemophilous, protogynous, bisexual or unisexual and dioecious or polygamous, actinomorphic or somewhat irregular, perianth-segments 6–2, the inner whorl raised above the outer. *Stamens* 6–4, anthers sessile or subsessile, epipetalous. *Carpels* 6–3, free or connate, uniovulate, ovule erect or pendulous. *Fruit* with 6 carpels or usually fewer by abortion, dry, cylindrical, ovoid, obovoid or globose, free or, if connate, separating upwards from a central axis. *Seed* exendospermous.

A small cosmopolitan family, well represented in Australia, frequenting saline or fresh-water habitats. The chief genus, *Triglochin*, is the only one rich in species and is widely distributed, being the only genus occurring in Southern Africa. Two monotypic genera, *Mauudia* and *Tetroncium* are confined to Australia, the Antarctic and South America. Hutchinson places *Scheuchzeria*, also a monotypic genus from the North Temperate Zone, in a family by itself, the Scheuchzeriaceae. Other taxonomists, e.g. Buchenau, Marloth, Adamson, etc., unite the two families but, in this case, the name Juncaginaceae, being older, must get priority. *Lilaea*, another monotypic genus from America, included in this family by Bentham and Hooker, Rendle and others, is best placed in a separate family, the Lilaeaceae, according to more recent authors, who take into consideration the conclusions of Uhl's research on Helobiae.

A. Benn. in F.C. 7 : 41 (1897); Rendle in Cat. Afr. Pl. Welw. 2 : 93 (1899); A. Benn. in F.T.A. 8 : 215 (1901); Buchen. in Pflanzenr. 4, 14 : 7 (1903); Phill., Gen. ed. 2 : 56 (1951); Adamson in Fl. Cape Penins. 38 (1950); Rendle in Class. Flow. Pl. ed. 2, 1 : 208 (1953). Type species: *T. palustris* L.

Herbaceous scapose marsh plants, perennial (annual in some Australian spp.). *Roots* fibrous with a spongy outer covering that soon disintegrates and a wiry thin stele; with thin side roots; root-hairs long. *Rhizome* stoloniferous or bulbous, covered with fibres from old leaf-bases. *Leaves* basal, distichous, rush-like, forming a broad open, ligulate sheath below, cylindrical to setaceous, glaucous, somewhat succulent; axillary scales minute, linguiform. *Inflorescence* a simple raceme overtopping the leaves; scape terete, firm; flowers ebracteate on decurrent, erecto-patent pedicels, actinomorphic, perianth segments 6, green, the 3 inner raised above the outer whorl, conchiform with the 6 sessile anthers inserted inside the hollow segments (occasionally some stamens aborted in species outside South Africa), locules extrorse, dorsifixed, ditheous, dehiscent longitudinally, pollen globose; the segment and the stamen semi-persistent, falling together; carpels 6 or the outer whorl suppressed, connate, styles plumose, sessile or subsessile, the solitary ovule erect. *Follicles* cylindrical, globose, ovoid, or obovoid sometimes spurred below, separating upwards from a central columella. *Seed* erect, embryo straight.

A genus of about 14 species, cosmopolitan (about half of these Australian). Two species found in Southern Africa, in salt marshes, on stream banks and mountain slopes.

"The generic name *Triglochin* was treated as neuter by Linnaeus and by many authors following him. But the word is a compound of the Greek *Tri-* (three) and *glochin* (projecting point), and as *glochin* is feminine, the name *Triglochin* is to be treated as feminine". J. E. Dandy, in a personal communication.

Follicle elongate, 5–10 mm long with 3 fertile carpels and no sterile carpels 1. *T. bulbosa*
 Follicle rounded, 2 mm long with 3 fertile carpels alternating with 3 sterile ones 2. *T. striata*

1. *Triglochin bulbosa* L., Mant. 2 : 226 (1771); Jacq., Ic. Rar. 2, t.454; Coll. Suppl. 102 (1786–1793); Thunb., Prodr. 67 (1794); Fl. Cap. ed. Schult. 2 : 347 (1823); Ker Gawler in Bot. Mag. t.1445 (1812); Micheli in DC., Monogr. Phan. 3 : 99 (1881); Buchen. & Hieron. in Pflanzenfam. 2 : 224 (1889); A. Benn. in F.C. 7 : 42 (1897); F.T.A. 8 : 215 (1901); Buchen. in Pflanzenr. 4, 14 : 11 (1903); Marloth, Fl. S. Afr. 4 : 14, t.2, fig. 5 (1915); Adamson in Fl. Cape Penins. 39 (1950). Type: Cape (LINN 466·3; PRE, photo).

T. elongata Buchen. in Pflanzenr. 4, 14 : 10, fig. 3 (1903). Syntypes: Cape, Malmesbury, near Hopefield, *Bachmann* 1692; 1693 (B†); Pondoland, *Bachmann* 309 (B†). *T. laxiflora* sensu A. Benn. in F.C. 7 : 42 (1897), as to *Rehmann* 8581, *Wood* 925; sensu Buchen. in Pflanzenr. 4, 14 : 11 (1903), as to *Schlechter* 10424; sensu Adamson in Fl. Cape Penins. 38 (1950). *T. tenuifolia* (sphalm. *tenuifolium*) Adamson in Journ. S. Afr. Bot. 5 : 30 (1939); Fl. Cape Penins. 39 (1950). Type: Cape, Table Mountain, *Adamson* 968 (BOL, holo.). *T. compacta* (sphalm. "*compactum*") Adamson in Journ. S. Afr.

Bot. 9 : 152 (1943); Fl. Cape Penins. 39 (1950). Type: Cape, near Houtbay, *Compton* 14436 (NBG, holo.). *T. milnei* Horn af Rantzien in Svensk. Bot. Tidskr. 55 : 85 (1961). Type: Zambia, Mwinilunga, *Milne-Redhead* 3012 (K, holo.). *T. bulbosa* L. subsp. *tenuifolia* (Adamson) Horn af Rantzien in Svensk Bot. Tidskr. 55 : 106 (1961).

Perennials, variable in size; when crushed emitting a pungent smell (like a Jerusalem Artichoke). *Roots* fibrous and with several larger contractile roots. *Rhizome* stoloniferous or cormous (when the stolons are arrested in hard soils), often forming cormlets, the fibrous covering hard and sclerotic in dry surroundings or soft or nearly absent in moist conditions. *Leaves* variable in size, 5–35 cm long and 0·5–2 mm broad, filiform to semi-terete, with a shallow ventral groove, gradually tapering to an acicular apex, expanded below to form an open, semi-amplexicaul sheath, glaucous, succulent; the primary leaves, if present, bract-like, scaly, brown. *Inflorescence* an erect central, few to many flowered raceme;

scape terete, firm; pedicels patent to erecto-patent, decurrent, lengthening in fruit, 2–10 mm long; flowers green with the apiculate tips of the segments often purplish, segments conchiform, 2–3 mm long; stigmas 3, papillose, purple, sessile, 3 outer carpels vestigial, 3 inner soon lengthening at anthesis and after fertilization. *Follicles* 5–10 mm long, narrowly ovoid-acuminate to cylindrical, tipped by the 3 persistent, hook-like style-bases, with a very short spur below. Fig. 28 : 1.

Widely distributed in Southern Africa, extending to tropical Africa and the Mediterranean; common along the coast in salt marshes and bordering lagoons; the typical (cormous) form is found on mountain slopes in non-saline habitats.

CAPE.—Bathurst: Alexandria, *Dyer* 3365. Calvania: Lokenburg, *Acocks* 17470. Ceres: Ceres Road (Wolseley), *Schlechter* 8979. East London: Kwenqura River Mouth, *Galpin* 5815. George: Kaamans River, *Wilman*. Kentani: Mazeppa Bay, *Story* 4470. Malmesbury: Mamre Hills, *Barker* 1596. Oudtshoorn: De Rust, *Acocks* 20454. Peninsula: Karbonkelberg, *Leighton* 446; sandy shore towards Camps Bay, *Wolley Dod* 3459; Diep River, *Wolley Dod* 2573. Robertson: Bonnievale, *Marloth* 11592. Stellenbosch: Koelenhof, *Strey* 670.

NATAL.—Durban: Congella, *Wood* 11985. Mtunzini: Richards Bay, *MacNae*. Umlazi: Isipingo, *Green* 37.

The typical form, judging from the (nearly leafless) type (LINN 466.3), must have come from a montane habitat. Adamson's species *T. tenuifolia* resembles it closely and must be regarded as a synonym. Many similar slender plants hailing from the south-western Cape mountains have the fruiting pedicels long and patent, but this is not a constant character although used by many systematists. In the type plants the pedicels, although immature, appear to be erecto-patent and fairly short.

Ecklon in *Linnaea*, p.131 (1832), already observes that the species may grow in saline sand or on mountain slopes. That the plants can adapt themselves to saline or non-saline conditions was proved by cultivation at the Botanical Research Institute.

In mud the stolons elongate but in firm soils they are arrested and form corms. These become covered with the persistent sclerotic fibres of the leaf bases. The species *T. elongata*, *T. compacta* and *T. milnei*, based on the differences in the underground parts, must be considered synonyms of *T. bulbosa* L. (If Horn of Rantzen had been aware of Adamson's species *T. compacta*, I am sure he would have referred the material from Zambia and Natal to this species.) The plants flower freely and intermittently during summer and produce much fertile seed. Those growing in moist habitats become large and coarse, with short erect pedicels, whereas the montane form remains small and slender. *T. palustris* L., from Europe, is said to make temporary bulbs (winterbuds) in autumn. The formation of storage organs in *T. bulbosa* may

serve a similar purpose. Both the stoloniferous and cormous forms, the latter also with cormlets, are present in Wolley Dod's gathering (No. 2573) from the Cape Peninsula.

2. *Triglochin striata* Ruiz & Pavon, Fl. Peruv. et Chil. 3 : 72 (1802); Micheli in DC., Monogr. Phan. 3 : 101 (1881); A. Benn. in F.C. 7 : 42 (1897); Rendle in Cat. Afr. Pl. Welw. 2 : 93 (1899); A. Benn. in F.T.A. 8 : 216 (1901); Buchen. in Pflanzenz. 4, 14 : 10 (1903); Adamson in Fl. Cape Penins. 38 (1950). Type: South America.

T. maritima sensu Thunb., Prodr. Fl. Cap. 1 : 67 (1794); Fl. Cap. ed. Schult. 2 : 340 (1823), non L. —var. *β. micrantha* E. Mey., *Linnaea* 7 : 131 (1832). *T. natalensis* Gand. in Bull. Soc. Bot. France 66 : 294 (1919). Type: Durban, *Schlechter* 2857 (K).

Perennials, variable in size, 5–50 cm high, forming long, woody stolons. *Roots* firm and coarse interspersed with thin young matted feeding roots. *Rhizome* woody, sparsely covered with fibres. *Leaves* arranged in a compact fan-shaped manner with the sheaths broad, distinctly ligulate, lamina cylindrical, 5–30 cm long, succulent, green, apex obtuse. *Inflorescence* ultimately overtopping the leaves, the flowers arranged in dense spiral whorls, pedicels arcuate, decurrent, very short at first, up to 3 mm long in fruit. *Flowers* small, segments 1 mm long; carpels 6, the 3 inner fertile alternating with the 3 sterile outer. *Follicles* globose, 2 mm in diam., 3-costate, compressed, shortly stipitate, apiculate. Fig. 28 : 2.

Recorded from the temperate zones of the Americas, Australia, New Zealand and Southern Africa, extending to Angola in the west and Mozambique in the east; occurs in saline marshes and borders of lagoons near the sea, often in mangrove swamps.

CAPE.—Bathurst; Kowie River Lagoon, *Mauve & Wells* 8. Caledon: Hermanus, *Rogers* 26576. Clanwilliam: Graafwater, *Acocks* 19778. East London: *Galpin* 7353. Humansdorp: Kabeljous River mouth, *Mauve & Wells* 56. Knysna: Ruigtevlei, *Martin* 4541. Peninsula: Noordhoek salt pan, *Tölken* 442; Ronde Vlei, *Andreae* 238. Port Elizabeth: Chatty River, *Mauve & Wells* 45. Port St. Johns: *Wager*. Riversdale: Gouritz River Mouth, *Tölken* 353. Willowvale: Bashee River Mouth, *Macnae*.

NATAL.—Durban: *De Winter* 7718. Hlabisa: St. Lucia Estuary, *Ward* 3392. Ingwavuma: Kosi Estuary, *Tinley & Ward* 12. Mtunzini: Richards Bay, *Macnae*. Ubombo: Sordwana Bay, *Tinley* 452.

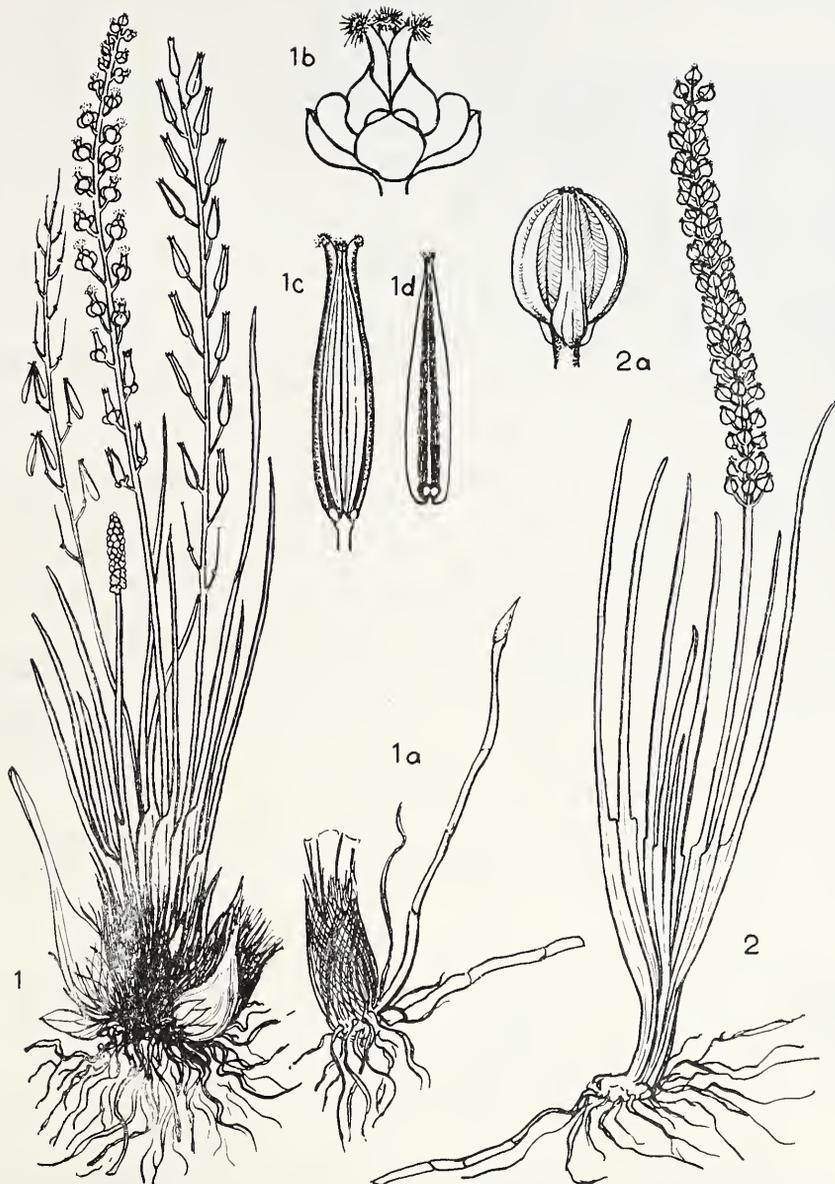


FIG. 28.—1, *Triglochin bulbosa*, $\times 1$; 1a, base of plant with stolons, $\times 1$; 1b, flower, $\times 6$; 1c, follicles, $\times 5$; 1d, follicle, axial view, $\times 5$. 2, *T. striata*, $\times 1$; 2a, follicles, $\times 10$.

ALISMATACEAE

by A. A. OBERMEYER

Perennial, usually deciduous, occasionally annual, aquatic or marsh herbs, lactiferous. *Roots* thin, abundant, branched. *Rhizome* woody and irregular or tuberous, suckering or forming runners bearing winterbuds. *Leaves* basal, subdistichous, with the usually long petioles expanded below to form an open sheath; blade erect, entire, lanceolate, ovate hastate or sagittate, rarely floating and/or submerged and then phyllodic; with distinct parallel veins converging to the apex and lobes, connected by cross-veins; with an apical hydathode; axillary scales present. *Inflorescence* usually a tall pedunculate compound, usually trimerous, raceme or panicle, reduced in some species to one flower. *Flowers* bisexual and/or unisexual (rarely dioecious) regular, bractiferous; sepals 3, green, persistent; petals 3, delicate, fugaceous. *Stamens* 3- ∞ , free; filaments filiform or expanded below; anthers bilocular, basifixed, pollen sphaeroid, pollination entomophilous, occasionally cleistogamous; staminodes present in some species. *Carpels* 2- ∞ , free (or united at the base in *Damasonium*, a genus outside South Africa), if numerous situated on a flat or convex receptacle, arranged spirally or in a ring, unilocular, the style terminal or ventral, stigma apical, uni-ovulate (pluri-ovulate in *Damasonium*); in unisexual male flowers sterile carpels may be present. *Fruit* a follicle, drupe or achene, buoyant; seeds with a horseshoe-shaped embryo, exendospermous.

Predominantly a family of the northern hemisphere, in temperate and tropical regions, with 13 genera and about 70 species. In Southern Africa 3 genera are found, each represented by one widespread species.

Leaves linear-lanceolate to ovate, base cuneate to cordate:

Plants dioecious; petals minute or absent; achenes irregularly crowded on the receptacle.....3. **Burnatia**

Plants monoecious; petals larger than the sepals; achenes neatly arranged in a circle on the receptacle.....1. **Alisma**

Leaves hastate.....2. **Limnophyton**

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1. ALISMA

Alisma L.. Sp. Pl. 342 (1753); Gen. Pl. ed. 5 : 160 (1754); Micheli in DC., Monogr. Phan. 3 : 31 (1881); Benth. & Hook.f., Gen. Pl. 3 : 1004 (1883); Wright in F.T.A. 8 : 207 (1901); Buchen. in Pflanzenr. 4, 15 : 12 (1903); Carter in F.T.E.A. Alismataceae: 5 (1960). Type species: *A. plantago-aquatica* L.

Aquatic scapose herbs, perennial from a woody, irregular rhizome, suckering. *Roots* fine, very abundant. *Leaves* erect, blade variable, linear-lanceolate to elliptic, base rounded or cordate. *Inflorescence* a verticillate, pyramidal, compound panicle or often reduced. *Flowers* pedicellate, bisexual; stamens 6, in pairs opposite the petals, filaments filiform; carpels 10-20, free, situated in a circle on the torus, compressed laterally, style ventral, short, filiform; ovule campylotropous. *Achenes* many, compressed, sulcate.

Cosmopolitan; considered monospecific by some, subdivided into several species and subspecies by others. One species recognized in Southern Africa.

1. *Alisma plantago-aquatica* L., Sp. Pl. 342 (1753); Wright in F.T.A. 8 : 207 (1902); Buchen. in Pflanzenr. 4, 15 : 13 (1903); Adamson in Fl. Cape Penins. 39 (1950); Carter in F.T.E.A. Alismataceae: 5 (1960); Wild in Kirkia 2 : 36, t.13a (1961). Type: Europe (LINN, 473·1). Chromosome number $2n = 14$.

Perennial, stoloniferous, scapose, up to 1 m high. *Roots* thin, densely covering the rhizome. *Leaves* with erect petioles up to 40 cm long; lamina ovate, rounded to cordate at the base, usually about 10 cm long and 6 cm broad (larger in tropical specimens), nerves usually 5, laterals closely parallel to one another, ascending. *Inflorescence* a much branched pyramidal panicle (occasionally poorly developed); peduncle about 50 cm high (taller in tropical specimens), terete; panicle with about 6 whorls, the lower compound, ultimately bearing 1–6 pedicelled flowers in terminal umbels; bracts scarious, acuminate, lowest 25 mm long, younger becoming progressively smaller, deciduous; pedicels up to 2 cm long; sepals ovate, green, 2 mm long; petals white or pink; carpels

about 20. *Achenes* ovate, 2 mm long, compressed laterally, deeply furrowed dorsally. Fig. 29 : 1.

Cosmopolitan. Apparently a recent adventive in South Africa, recorded from one area near Cape Town and from the Transvaal highveld, the Vaal River and its tributaries; common where found.

CAPE.—Peninsula: near Cape Town, *Moss* 4185.

O.F.S.—Vrededorst: Parys, *Obermeyer* in TRV 31673.

TRANSVAAL.—Heidelberg: Alberton, *Dimovic* in J28023. Johannesburg: *Moss* 8404. Potchefstroom: Nootgedacht, Vaal River, *Louw* 1640.

The seeds are buoyant because of subepidermal air-tissue and may float for many months. Eaten by waterbirds, the seeds pass unharmed through the alimentary canal.

Common name: Water-plantain.

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2. LIMNOPHYTON

Limnophyton *Miq.*, Fl. Ind. Bat. 3 : 242 (1855); Benth. & Hook.f., Gen. Pl. 3 : 1005 (1833); Wright in F.T.A. 8 : 209 (1902); Buchen. in Pflanzenfam. 2, 1 : 231 (1889); Pflanzenr. 4, 15 : 21 (1903); Phill., Gen. ed. 2 : 56 (1951); den Hartog in Fl. Males. 1, 5 : 324 (1957); Carter in F.T.E.A. Alismataceae: 7 (1960). Type species: *L. obtusifolium* (L.) *Miq.*

Aquatics or marsh herbs. *Leaves* hastate, glabrous or pubescent. *Panicle* pyramidal, whorled; flowers bisexual and male in lower whorls, male only in upper; sepals 3, boat-shaped, reflexed after anthesis; petals 3, white, orbicular, clawed; stamens 6, filaments bulbous below; carpels numerous, crowded on a small globose receptacle, style ventral, ovule solitary, basal. *Achenes* asymmetrical, globose, shortly stipitate, with 2 lateral air-chambers between the exocarp and endocarp.

Three species of which one occurs in Southern Africa and is widespread in tropical Africa and south-east Asia; the other 2 are endemic in tropical Africa. Found in or beside fresh water pools or slow-flowing rivers.

Limnophyton obtusifolium (L.) *Miq.*, Fl. Ind. Bat. 3 : 242 (1855); Wright in F.T.A. 8 : 209 (1902); Buchen. in Pflanzenr. 4, 15 : 22, fig. 10 (1903); den Hartog in Fl. Males. 1, 5 : 324 fig. 4 (1957); Carter in F.T.E.A., Alismataceae: 9 (1960). Type: Asia, *Plukenet*, t.220, fig. 7 in Herb. Sloane, Vol. 97, fol.181 (BM, lecto.).

Sagittaria obtusifolia L., Sp. Pl. 993 (1753).

Apparently annuals, perennating occasionally, up to 1 m high. *Roots* fibrous, spongy, with transverse septa. *Rhizome* small. *Leaves* on long petioles which are triangular in cross-section, spongy, the transverse septa distinct in juveniles; lamina erect, hastate, with the angle between the basal lobes obtuse (more than 90°), the lobes small at first, about as long as the upper part of the

blade in mature leaves, apex obtuse, nerves 13–15, the 3–4 lower curving downwards, glabrous or glabrescent, pellucid dotted. *Inflorescence* a pyramidal panicle up to 1 m high when fully developed, often much reduced in young or small plants; scape stout, woody; flowers in 3–7 dense whorls the lower compound; bracts scarious; lanceolate-acuminate, reflexed with age; fruiting pedicels up to 15 mm long, swollen and woody, sterile pedicels wiry. *Achenes* about 30, forming a globose head 12 mm in diam., each fruit hard, brown, obpyramidal, 5 mm long, shortly stipitate, ridged. Fig. 29 : 2.

Widespread in tropical Africa, Madagascar and south-east Asia. Recorded from the Transvaal and Natal at low altitudes; common where found.

NATAL.—Umbombo: Mkuzi Game Reserve, *Ward* 3070; *Tinley* 618.



FIG. 29.—1, *Alisma plantago-aquatica*, $\times \frac{1}{4}$; 1a, fruit, $\times 5$; 1b, seed, $\times 10$. 2, *Limnophyton obtusifolium*, $\times \frac{1}{4}$; 2a, seed. 3, *Burnatia enneandra*, $\times \frac{1}{4}$; 3a, fruit, $\times 2$; 3b, seed, $\times 12$.

TRANSVAAL.—Pilgrim's Rest: Kruger National Park, near Skukuza, *Codd* 6071; Tshokwane, Leeupan, *Van der Schijff* 2765; 4194. Soutpansberg: Dongola Reserve, Schroda Lily Pool, *Pole Evans* 4587.

It is possible that *L. angolense* Buchen. may occur in the northern region of South West Africa. It can be distinguished from *L. obtusifolium* by

being more hirsute, by its long-attenuate bracts its longer and more slender pedicels and its achenes which are longitudinally ridged when dry; the angle between the lobes of the leaf at the base is acute. The inflorescence too appears more cylindrical, as the lower side branches remain shorter. The syntypes are *Baum* 364 from Kubango, and *Mechow* from Malange, Angola.

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3. BURNATIA

Burnatia Micheli in DC., Monogr. Phan. 3 : 81 (1881); Benth. & Hook.f., Gen. Pl. 3 : 1007 (1883); Wright in F.T.A. 8 : 212 (1901); Buchen. in Pflanzenz. 4, 15 : 59 (1903); Carter in F.T.E.A. Alismataceae: 13 (1960). Type species: *B. enneandra* Micheli.

Rautanenia Buchen. in Bull. Herb. Boiss. 5 : 855 (1897); Pflanzenfam. Nachtr. 2 : 3 (1900); Pflanzenz. 4, 15 : 59 (1903); Phill., Gen. ed. 2 : 56 (1951).

Perennial, aquatic, scapose herbs. *Rhizome* bulbous covered with short thin roots. *Leaves* erect, on long petioles, blades linear to lanceolate, the base decurrent to rounded. *Inflorescence* overtopping the leaves, a trimerous compound umbel, sometimes reduced and few-flowered; with 3 basal acuminate bracts which at first envelope the umbel in bud, scarious, semi-persistent; upper bracts reduced or absent. *Flowers* 3 in a whorl, evenly spaced, pedicelled; male flowers with 3 concave sepals, petals 3, smaller than the sepals, stamens 9; sterile carpels about 12; female flowers with 3 concave sepals, petals 0 or minute, staminodes 0–1–2; carpels many, closely arranged on a small receptacle, compressed, stigma ventral, discoid, papillose, subsessile, ovule basal, solitary. *Achene* obovate-orbicular laterally compressed, with 2 narrow circular wings.

Monospecific, confined to tropical and subtropical Africa; forming clumps in or near temporary pools or marshes, the parts above ground dying down after flowering.

Burnatia enneandra Micheli in DC., Monogr. Phan. 3 : 81 (1881); Buchen. in Pflanzenfam. 2 : 229, 232 (1889); Pflanzenz. 4, 15 : 60 (1903). Type: Sudan, Kordofan, *Kotschy* 192 (BM, K).

Echinodorus? schinzii Buchen. in Bull. Herb. Boiss. 4 : 413 (1896). Type: South West Africa, Ovamboland, Omulonga, *Rautanen* 51 (*Z. holo.*).

Rautanenia schinzii (Buchen.) Buchen. in Bull. Herb. Boiss. 5 : 854 (1897); Wright in F.T.A. 8 : 212 (1901); Buchen. in Pflanzenz. 4, 15 : 59 (1903).

Scapose herbs up to 1 m high. *Leaves* wholly or partially submerged with a flattened petiole up to 60 cm long, gradually widening to form a linear to lanceolate lamina above, up to 18 cm long and 3 cm broad but very variable. *Male inflorescence* forming a delicate, finely branched pseudo-umbel with the small flowers on filiform pedicels up to 1 cm long; sepals orbicular, concave, 4 mm long, delicate pale green to purplish with transparent margins; petals 1–2.5 mm long, narrow; stamens included, white; sterile

carpels light green. *Female inflorescence* smaller than the male with fewer branches and the flowers in trimerous subsessile clusters; sepals delicate, orbiculate, concave, 1.5 mm long; petals absent (present as minute scales in robust specimens, vide Carter); carpels about 12 on a short cylindrical torus, compressed and with 2 lateral ear-shaped or horseshoe-shaped rims or folds. *Achenes* black, 1.5 mm long. Fig. 29 : 3.

Widespread in tropical Africa. Recorded from northern South West Africa and the Caprivi Strip where it is locally common.

S.W.A.—Okavango Native Territory: Okavango River Flats between Runtu and Mupini, *Marais* 1114. Grootfontein: near Andara, *Merxmüller* 2088. Caprivi: Katima Mulilo area, *Killick & Leistner* 3113.

Sweet smelling, like Eau de Cologne.

Carter in F.T.E.A. Alismataceae: 15 (1960) also enumerates as synonyms *Burnatia alismatoides* Peter and its variety *elliptica* Peter, *B. enneandra* Mich. var. *linearis* Peter and *B. oblonga* Peter, all from Tanganyika. The types were preserved at Berlin, but have been destroyed.

HYDROCHARITACEAE

by A. A. OBERMEYER

Fresh-water or marine, annual or perennial herbs, partially or completely submerged. *Roots* terrestrial or floating. *Leaves* radical, in rosettes or cauline, alternate, opposite or in verticils, submerged or with floating blades. *Flowers* submerged in marine genera, in others exerted during anthesis, monoecious or dioecious, unisexual or rarely bisexual; usually exerted from a pedunculate, or rarely sessile, tubular, bifid spathe, or rarely subtended by 2 free, opposite bracts; male flowers usually numerous and, in some genera, become detached and free floating; female flowers mostly solitary inside the spathe. *Male flowers* with perianth regular, rarely irregular (*Vallisneria*), 1–2-seriate with the 3–2 outer segments often sepaloid, valvate, and the 3–2 inner petaloid, imbricate; stamens 3–many (rarely 1), in one or more trimerous whorls, the inner occasionally staminodial; anthers with parallel locules, opening longitudinally; rudimentary ovary sometimes present; pollen sphaeroid or, in marine genera, confervoid or united in strings; pollination in marine genera hydrophyllous, in others entomophilous. *Female flowers* with an inferior, 1-celled ovary, with 3–6 or rarely more parietal placentas which at times protrude towards the centre; number of styles equalling the number of placentas; stigmas simple or bifid. *Fruit* rounded or tubular, fleshy or leathery, usually rostrate with persistent style-bases, the seeds being dispersed by the dissolution of the walls which become mucilaginous; rarely fruits dry and dehiscent. *Seeds* exendospermous, with a large embryo.

A family consisting of 14 divergent genera, several of which are monotypic, and about 80 species. Three are marine with a mainly tropical and subtropical distribution, while the others are found in fresh water, widely distributed both in tropical and temperate regions. In Southern Africa one marine and two fresh-water genera, comprising 10 species, have been recorded.

Egeria densa Planch., a South American species, sometimes wrongly identified as *Elodea* or *Anacharis*, has become an obnoxious adventive in New Zealand and has been introduced into Natal, where it should be carefully watched. So far no records of it becoming naturalised have come to light, but it is cultivated in many ponds in parks, universities, gardens and in aquaria. A large pond on the Tongaat Sugar Estates has to be cleared regularly to allow other aquatics, such as *Nymphaeas*, to grow and flower. It was probably imported in Medley Wood's time when a submerged aquatic was needed as an "oxygen plant" for the fishes introduced to combat malaria-carrying mosquito larvae. Only male plants were imported (females being rare) but they propagate at an alarming rate. The species resembles *Lagarosiphon major* but is coarser and has the leaves in whorls of 2–5. The yellow or cream-coloured male flowers remain attached to the plant and are entomophilous. The perianth forms a long filiform tube with the 3 inner segments forming a cup about 1 cm in diameter, which is exerted above the surface. There are 9 stamens.

The genus *Hydrilla* Rich., wrongly included by Phillips, Gen. ed. 2 : 57 (1951), is absent from Southern Africa.

Marine plants; leaves linear to lanceolate-ovate, in pairs from a creeping rhizome; flowers apetalous, submerged. 1. **Halophila**

Fresh-water plants; leaves rosulate or cauline; flowers with petals, exerted above water during anthesis:

Forming long leafy submerged stems from a perennial rhizome; spathes sessile, axillary. 2. **Lagarosiphon**

Rosulate, acauline annuals; spathes pedunculate. 3. **Ottelia**

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1. HALOPHILA

Halophila Thouars, Gen. Nov. Madag. 2 (1808); Aschers. & Guerke in Pflanzenfam. 2, 1 : 247 (1889); Wright in F.T.A. 7 : 10 (1898); Phill., Gen. ed. 2 : 57 (1951); den Hartog in Fl. Males. 1, 5 : 407 (1958). Type species: *H. stipulacea* (Forsk.) Aschers.

Marine perennials with a much-branched creeping rhizome. *Roots* simple, 1 or rarely 2 from a node, densely covered by long root-hairs. *Rhizomes* bearing at the nodes an abbreviated shoot and a pair of leaves, each surrounded by a basal scale. *Leaves* opposite, sessile or petiolate, linear, lanceolate, oblong or ovate, entire or serrulate, glabrous or pubescent; midrib distinct, with a prominent lateral nerve next to the margin, which is connected to the midrib by many oblique secondary nerves. *Flowers* monoecious or dioecious, unisexual, usually solitary in the axil of a secondary shoot, rarely 1–2 male and a female flower together in a spathe; spathe of 2 free, membranous bracts. *Male flowers* shortly pedicelled, with 3 perianth segments; stamens 3, anthers sessile, 2–4 celled, extrorse; pollen adhering to form threads, pollination hydrophyllous. *Female flower* sessile; ovary ovoid, 1-celled, beaked, bearing 3 reduced perianth segments near the apex; styles 2–5, linear. *Fruit* ovoid, rostrate, thin-walled. *Seeds* few to many, small, globose.

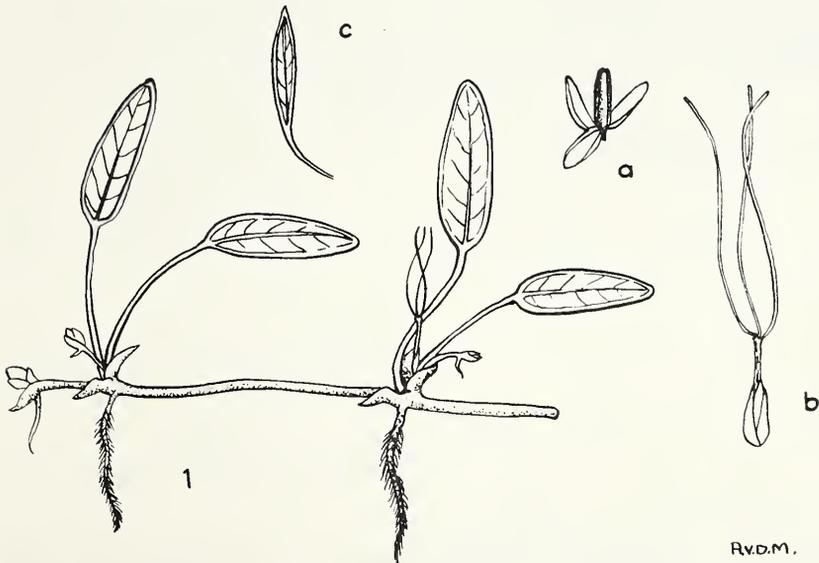
Found in Africa, Asia, Australia and America; there are 9 species of which some are widely distributed, others endemic. One widespread species occurs in Southern Africa.

***Halophila ovalis* (R.Br.) Hook.f.**, Fl. Tasm. 2 : 45 (1858); Aschers. in Linnaea 35 : 173 (1868); Balf.f. in Trans. Bot. Soc. Edinb. 13 : 290, t.2, fig. 11–13, 17, etc. (1879); Aschers. & Guerke in Pflanzenfam. 2, 1 : 249, fig. 182 (1889); Setchell in Bull. Torr. Bot. Club 47 : 570 (1920); Kausik & Rao in Journ. Mysore Univ. 3 : 41 (1942); Perrier de la Bâthie, Fl. Madag. fam. 26 : 4, fig. 1, 3–5 (1946); Macnae in Nat. Hist. Inhaca Island,

Mozambique 28, fig. 8b, c (1958); den Hartog in Fl. Males. 1, 5 : 408 (1958); Subramanyam, Aquatic Angiosperms 62, t.44 (1962). Type: Australia.

Caulinia? *ovalis* R.Br., Prodr. Fl. Nov. Holl. 339 (1810).

Halophila ovata sensu Wright in F.T.A. 7 : 10 (1898). *H. linearis* den Hartog in Acta Bot. Neerl. 6 : 46 (1956). Type: Mozambique, Inhaca Island, Cohen in Herb. Moss 20652 (BM, holo.).



R.V.D.M.

FIG. 30.—1, *Halophila ovalis*, $\times 1$; a, male flower, $\times 1$; b, female flower, $\times 1$; c, linear leaf, $\times 1$.

Dioecious. *Rhizomes* long, branching; internodes about 2–4 cm long, light yellow, thin, brittle. *Leaves* in pairs, subtended by bracts; petiole 1–3 cm long; lamina variable in shape and size, linear to lanceolate or ovate (“racquet-shaped”), 10–15 mm long and 2–8 mm wide, green often with brown transverse lines, apex acute, or rounded, base attenuate or rounded. *Male flowers* shortly pedicellate, with 3 concave perianth segments, 4 mm long and 2 mm broad; anthers oblong, 2–4 celled. *Female flowers* enclosed in 2 concave, ovate bracts, consisting of an ovoid, beaked ovary 4 mm long, terminating in 3 styles 10–20 mm long, soon deciduous. *Fruit* globular, 4 mm in diameter with the beak persistent. *Seeds* c. 20, rounded, 1 mm long, tuberculate, reticulate. Fig. 30.

Occurs along the eastern coast as far south as Knysna Lagoon, submerged in from 1–30 ft. of water, nearly or just exposed at very low tides.

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2. LAGAROSIPHON

Lagarosiphon Harv. in Journ. Bot. Lond. 4 : 230 (1841); Benth. & Hook.f., Gen. Pl. 3 : 450 (1883); Wright in F.T.A. 7 : 2 (1897); F.C. 5, 3 : 1 (1912); Phill., Gen. ed. 2 : 58 (1951); Oberm. in Bothalia 8 : 139 (1964). Type species: *L. muscoides* Harv.

Submerged (except for the flowers during anthesis), dioecious, rooted herbs from a perennial rhizome. *Stems* long, terete, leafy; branches arising from inside a spathe next to a flower, the leafy apices compact, the internodes elongating later. *Leaves* widely spaced below, dense above, alternate, subopposite or whorled, linear to linear-lanceolate, margin dentate with unicellular teeth, tissues of the lamina differing in each species (cf. fig. 32), with 2 minute axillary scales (intra-vaginal squamulae). *Male inflorescence* axillary; spathes fused, obovate, ovate or lanceolate, compressed or cup-shaped, dentate; the axis (rudimentary scape) producing numerous pedicellate flowers (up to 50 or more) consecutively; the buds in South African species become detached and rise to the surface (because of an enclosed air bubble) where they expand and recurve suddenly to form a bell-shaped, floating flower; perianth with 2 whorls of 3 segments each, the outer slightly narrower; stamens 3, the filaments ultimately parallel to the water surface with the anthers at right angles to them; each pollen-sac containing 4 tetrads, grains large; staminodes 3, longer than the stamens, papillate, usually coloured above, joined at the top (acting as a sail). *Female inflorescence* axillary; spathe-valves fused, narrowly oblong, ovoid or cylindrical, entire or toothed, containing 1–3 flowers; perianth-tube exerted laterally near the apex of the spathe, lengthening (meanwhile giving off gas bubbles to buoy it up) until it reaches the surface of the water (ultimate length of flower varies with the species); limb 6-lobed; staminodes 3, minute, filiform; ovary 1-locular with 3 parietal placentas; styles 3, adnate to the perianth-tube, each divided into 2 long, papillate, often brightly coloured stigmatic arms; ovules 6–30, orthotropous, funicle short or long, straight or bent. *Capsule* protruding from the torn spathe (the larger inner spathe-valve bursting along the midrib), rostrate (the persistent perianth-base forming a beak), ultimately becoming mucilaginous and disintegrating. *Seeds* cylindrical, shortly stipitate, apex acute, size varying with each species, closely ribbed or honey-combed, buoyant at first, sinking later.

A widespread, common species found along the coast of eastern Africa and the Red Sea to Indonesia, Japan, Hawaii, Australia and Tasmania.

NATAL.—Durban Bay, western mud-bank near Maydon Wharf, Ward 4571.

CAPE.—Bathurst: Kowie West, Britten 2663; 5204; Kenton-on-Sea, Bushman's River Mouth, Mauve & Wells 17 (with ♂ and ♀ flowers, January, 1964). Knysna: Lagoon, near Brenton, Duthie 1215; Lagoon west of Leisure Isle, Mauve & Wells 62 (with ♂ and ♀ flowers, January, 1964).

In southern Africa (including Mozambique) the plants seen were just covered at low spring tides. From other parts of the world they are reported from a depth of up to 10 metres. Flowers are rare. The narrow-leaved form described by den Hartog as *H. linearis* (from Mozambique) may be a variety of *H. ovalis*. Like most aquatics, multiplication is mostly vegetative and, as a result, homogeneous colonies are developed. As the narrow-leaved form, however, grows together with or near the wide-leaved form (at least in southern Africa), it seems unlikely that it could be a separate species. Intermediates do occur and no other differences could be detected.

About 16 species occur in Africa; two are endemic to Madagascar; five are found in South Africa, in fresh water. *L. major* is reported as an adventive in Europe and New Zealand.

Leaves thin, transparent, 0.5–2 mm broad, cells usually longer than broad:

Leaves with a hyaline margin consisting of at least 3 layers of cells without chlorophyll; the marginal teeth not on excrescences.....1. *L. muscoides*

Leaves green to the margin; teeth on small excrescences:

Leaves in verticils of 6–8; central band narrow, not much different from the rest of the lamina
2. *L. verticillifolius*

Leaves alternate or rarely in verticils; central band usually wide, at least near the base with the cells much larger and with transverse veins.....3. *L. crispus*

Leaves fairly solid, opaque, 2–3 mm broad, cells small, somewhat papillose-rhomboid:

Teeth of leaves minute, blunt, ascending.....4. *L. major*

Teeth of leaves on triangular excrescences, sharp, patent.....5. *L. ilicifolius*

1. **Lagarosiphon muscoides** Harv. in Journ. Bot. Lond. 4 : 230, t.22 (1842); Wright in F.T.A. 7 : 3 (1897); F.C. 5, 3 : 1 (1912); Marloth, Fl. S. Afr. 4 : 15, fig. 6, t.2 (1915); Wager in Trans. Roy. Soc. S. Afr. 16 : 191 (1928); Ernst-Schwarzenbach in Ber. Schweiz. Bot. Ges. 55 : 56 (1945); Oberm. in Bothalia 8 : 140 (1964). Syntypes: Cape, Albany, *Zeyher*; without locality, *Drege* (TCD).

Hydrilla dregeana Presl, Bot. Bemerk. 112 (1844). Type: Cape, Port Elizabeth, Swartkops River, *Drege* 2276c. *H. muscoides* (Harv.) Planch. in Ann. Sci. Nat. ser. 3, 11 : 79 (1849).

Stems 0.5–2 mm in diameter, usually weak. *Leaves* alternate, spreading, soft, thin, transparent, light green, linear, average size 10 mm long and 1.5 mm broad, apex acute, margin with 3 rows of hyaline cells which contain no chlorophyll; teeth many, acicular, pointing upwards, leaf-tip with 2 slightly larger teeth; cells of lamina elongate-oblong, with 2–3 rows of cells on each side of the midrib somewhat lighter in colour. *Male inflorescence* with spathe-valves flat, obovate, about 4 mm long and 2 mm broad, with about 23 teeth on each side and with up to 40 flower-buds inside; flowers white to pink. *Female inflorescence* with spathe-valves ovoid, about 4.5 mm long and 1.5 mm broad, with about 25 long, acute teeth on each side; perianth white, maximum length about 25 cm; ovary flask-shaped, stigmas purple; ovules about 12, funicles straight (or bent in narrow ovaries). *Capsule* narrow-ovoid, 5–10 mm long, with about 9 seeds breaking away from the placenta and pushed upwards one behind the other, each about 2.5 mm long. Figs. 31; 32 : 1.

Widespread in the summer rainfall areas of Southern Africa, from Uitenhage in the eastern Cape to Natal, Orange Free State, northern Cape,

Transvaal and South West Africa. Also extends to Bechuanaland, Southern Rhodesia and tropical east Africa.

CAPE.—Albany: near Grahamstown, *Dickens* s.n. Barkly West: Holpan, *Acocks* 2308. Hay: Papkuilsloot, *Wilman* 1247. Port Elizabeth: Gamtoos River, *Schlechter* 6059.

O.F.S.—Fauresmith: near Luckhoff, *Smith* 499. Kroonstad: *Pont* 602.

BASUTOLAND.—Banan, *Guillarmod* 2066. Leribe: Makokoane, *Dieterlen* 1031.

NATAL.—Bergville: *Edwards* 2409.

TRANSVAAL.—Belfast: *Obermeyer* in TRV 36067. Benoni: *Moss* 11175. Christiana: *Burt Davy* 12792. Letaba: *Krugger National Park*, Bobubu, *Van der Schijff* 5671. Potchefstroom: Witpoort, *Louw* 1708. Pretoria: near Hammanskraal, *Mauve & Schlieben* 9599. Soutpansberg: Duwenhage's pan, *Schweickerdt & Verdoorn* 627.

S.W.A.—Gibeon: Haribes, *Volk* 12405. Grootfontein: Kumkaus, *Kings* 2836; Grosshuis, *Schoenfelder* 5684; Naruchas, *Dinter* 7212; 7384. Okahandja: *Bradfield* 390. Rehoboth: Buellspoor, *Strey* 2118; *Rodin* 2940.

A form which is much larger in all respects but has the same distribution as the normal form, is often found together with it. The following gatherings belong to it:—

CAPE.—Komga: *Flanagan* 1335.

NATAL.—Dundee: Worthington Dam, *Hammer*. Estcourt: Tabamhope Research Station, *West* 900.

TRANSVAAL.—Pietersburg: Blouberg, *Strey & Schlieben* 8579. Standerton: *Burt Davy*.

S.W.A.—Kaokoveld: *Barnard* 593.

2. **Lagarosiphon verticillifolius** Oberm. in Bothalia 8 : 142 (1964). Type: Natal, Hlabisa, Hluhluwe Game Reserve, *Ward* 2551 ♀ (PRE, holo.).

Stems 0.5–1 mm in diameter, fairly firm, densely leafy. *Leaves* in verticils of 5–7, occasionally sub-whorled; lamina spreading, soft, thin, transparent, linear, average size 10 mm (up to 2 cm) long and 0.5 mm broad;

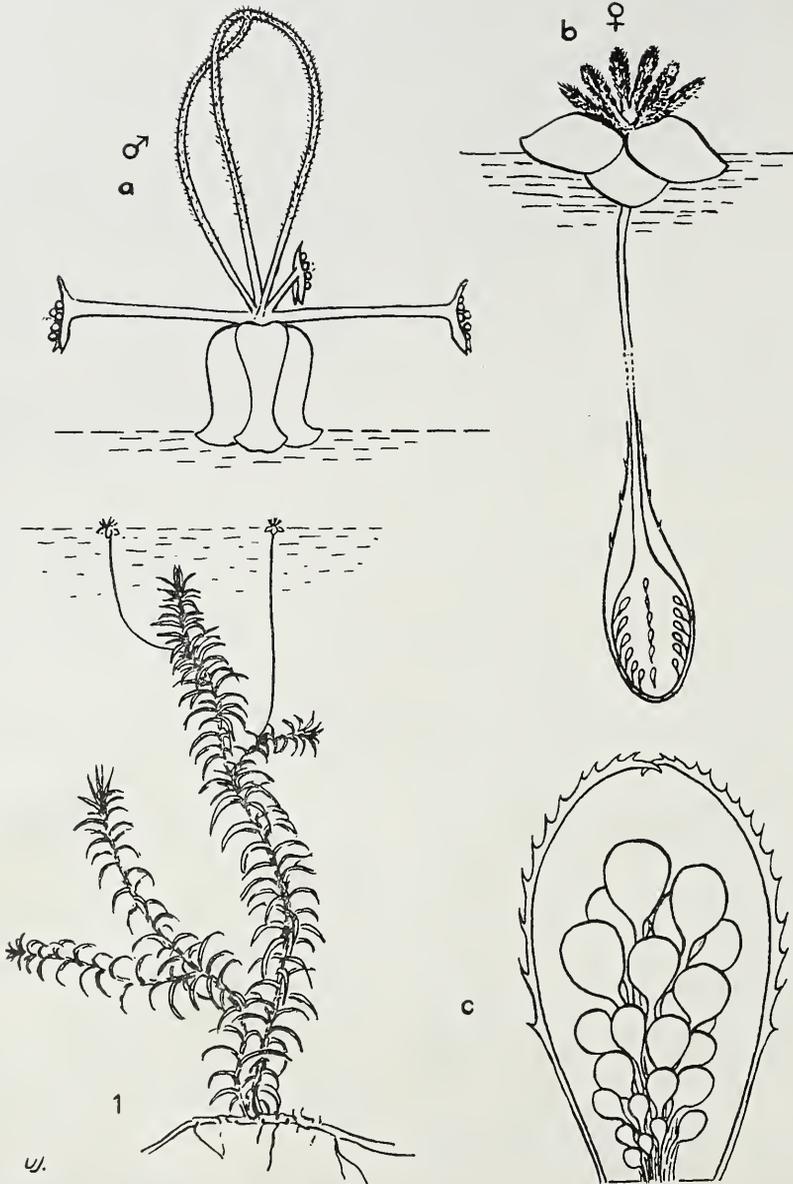


FIG. 31.—1, *Lagarosiphon muscoides*, $\times 1$; a, male floating flower showing reflexed perianth, 3 open stamens and 3 erect papillate staminodes connate at the tip, $\times 12$; b, female flower with the perianth segments and 3 forked papillate styles; floating on the surface of the water, $\times 10$; c, young male flowers inside spathe (diagrammatic), $\times 7$.

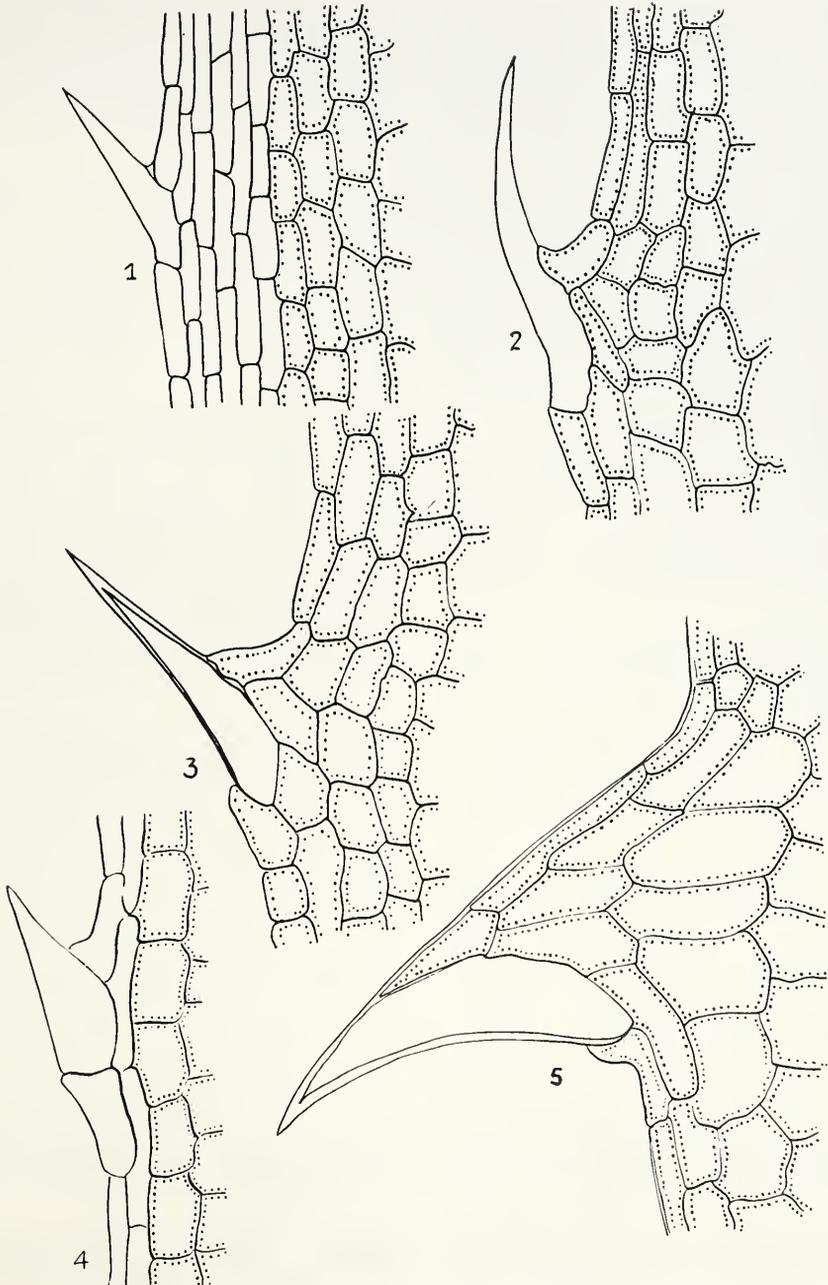


FIG. 32.—Leaf margins of *Lagarosiphon* species showing spines and location of chloroplasts (dotted lines).
 1, *Lagarosiphon muscoides*. 2, *L. verticillifolius*. 3, *L. crispus*. 4, *L. major*. 5, *L. ilicifolius*. $\times 500$.

margin chlorophyllous, teeth many, short, acicular, pointing out- and upwards, emerging from a triangular excrescence; with a few cell-rows beside the midrib slightly larger, lacunar, the outer row with thickened walls. *Male inflorescence* with the spathe-valves lanceolate, convex, 2.5 mm long and 1 mm broad, acute, with a few marginal teeth. *Female inflorescence* with the spathe-valves ovoid below, tubular above, apex bifid, occasionally with a few marginal teeth; perianth white, stigmatic arms long with large papillae; ovary with 9–12 ovules, funicle straight, shorter than the ovule. *Capsule* ovoid, 5 mm long and 2 mm broad, elongated at the apex; seeds 1.5 mm long, narrowly grooved and with some papillae. Fig. 32 : 2.

Recorded from Natal and Transvaal. Also found in Mozambique and Rhodesia.

NATAL.—Hlabisa: Hluhluwe Game Reserve, Ward 2518; 2549 ♂; 2551 ♀. Ubombo: Mkuzi Game Reserve, Tinley 443.

TRANSSVAAL.—Letaba: K.N.P., Shangoni, Mathlambanthlova Pan, *Van der Schijff* 2857. Pilgrims Rest: Kruger National Park, 19 miles N.E. of Skukuza, *Codd* 6069.

3. *Lagarosiphon crispus* Rendle in Journ. Linn. Soc. Bot. 30 : 381, t.31 figs. 8–17 (1895); Wright in F.T.A. 7 : 4 (1897); Oberm. in Bothalia 8 : 143 (1964). Type: Tanganyika, between Uyui and coast, *Taylor* (K. holo.).

L. tsotsorogensis Brem. & Oberm., in Ann. Transv. Mus. 14 : 401 (1935). Type: Bechuanaland, Tsotsoroga Pan, *Van Son* in TRV 28853 (PRE, holo.).

Stems filiform, 1–2 mm in diameter. *Leaves* alternate, subopposite to verticillate above, usually densely spaced on the stems, spreading, soft, thin, transparent, linear, average size 14 mm long and 0.5 mm broad, marginal cells chlorophyllous, the many sharp curved teeth pointing upwards, situated on small triangular excrescences; leaf-tips bidentate; central area beside the midrib narrow to very broad, consisting of large lacunar cells without or with very little chlorophyll, usually with distinct transverse veins. *Male inflorescence* with spathe-valves cup-shaped, obovoid, 2 mm long, acute at first, becoming broad and gaping during anthesis, with about 8 teeth on each side. *Female inflorescence* with spathes forming a narrow ovoid tube 2.5 mm long, entire or with some small teeth; perianth white, limb 2 mm in diameter; ovary

with 24–30 ovules, funicles about as long as the ovules; stigmas with short papillae. *Capsule* ovoid, acuminate, 3 mm long, many-seeded; seeds 1 mm long, turbinate, with raised ridges which have transverse septa (when dry). Fig. 32 : 3; 33.

Recorded from South West Africa and the eastern and northern Transvaal. Also found in Bechuanaland, Rhodesia and eastern Africa.

TRANSSVAAL.—Pilgrims Rest: Kruger National Park, Leupan near Tshokwane, *Van der Schijff* 2766; 4198. Soutpansberg: Limpopo River, farm Weipe, *Codd & De Winter* 348; *Verdoorn* 2273.

S.W.A.—Caprivi: Kabuta Village, Chobe River, Munro. Grootfontein: west of Andara, *Merxmüller* 2096. Okavango Native Territory: Okavango River, Niangana, *Dinter* 7246.

4. *Lagarosiphon major* (Ridley) Moss ex *Wager* in Trans. Roy. Soc. S. Afr. 16 : 193 (1928); Mason in New Zeal. Journ. Sci. 30 : 384 (1960); Wild in Kirkia 2 : 39, t.13d (1961); Oberm. in Bothalia 8 : 145 (1964). Syntypes: Cape, Victoria East, Umdizine River, *Cooper* 17 (K, PRE, BOL); Transvaal, Bronkhorstspuit, *Rehmann* 6559 (K, BOL); Bethal, Trigardtsfontein, *Rehmann* 6678 (K).

L. muscoides Harv. var. *major* Ridley in Journ. Linn. Soc. Bot. 22 : 233 (1886); Wright in F.C. 5, 3 : 2 (1912).

Stems about 3 mm in diameter, usually firm. *Leaves* alternate, laxly spaced below, densely so above, lamina spreading-recurred, soft but firm, opaque, linear, average size 16 mm (occasionally up to 3 cm) long and 2 mm broad, apex obtuse or acute to acuminate, margin with the outermost row of cells hyaline, forming minute, blunt, closely spaced teeth; midrib sunk above, prominent below; lamina with small papillose rhomboid cells, those of the midrib slightly longer and larger. *Male inflorescence* with spathe-valves oblong-lanceolate, 5 mm long and 3 mm broad, with about 8 teeth on each side, bearing about 50 flowers consecutively; perianth pinkish. *Female inflorescence* with spathe-valves ovoid, up to 5.5 mm long and 2.5 mm broad, with about 12 teeth on one side and about 6 on the other; perianth pale pink, maximum length 15 cm; ovary flask-shaped, stigmas red, ovules about 12. *Capsule* ovoid, 5 mm long; seeds 2 mm long. Fig. 32 : 4.

Widespread in Southern Africa from the eastern Cape to Natal, Orange Free State and Transvaal. Also in Rhodesia. Recorded as an adventive in

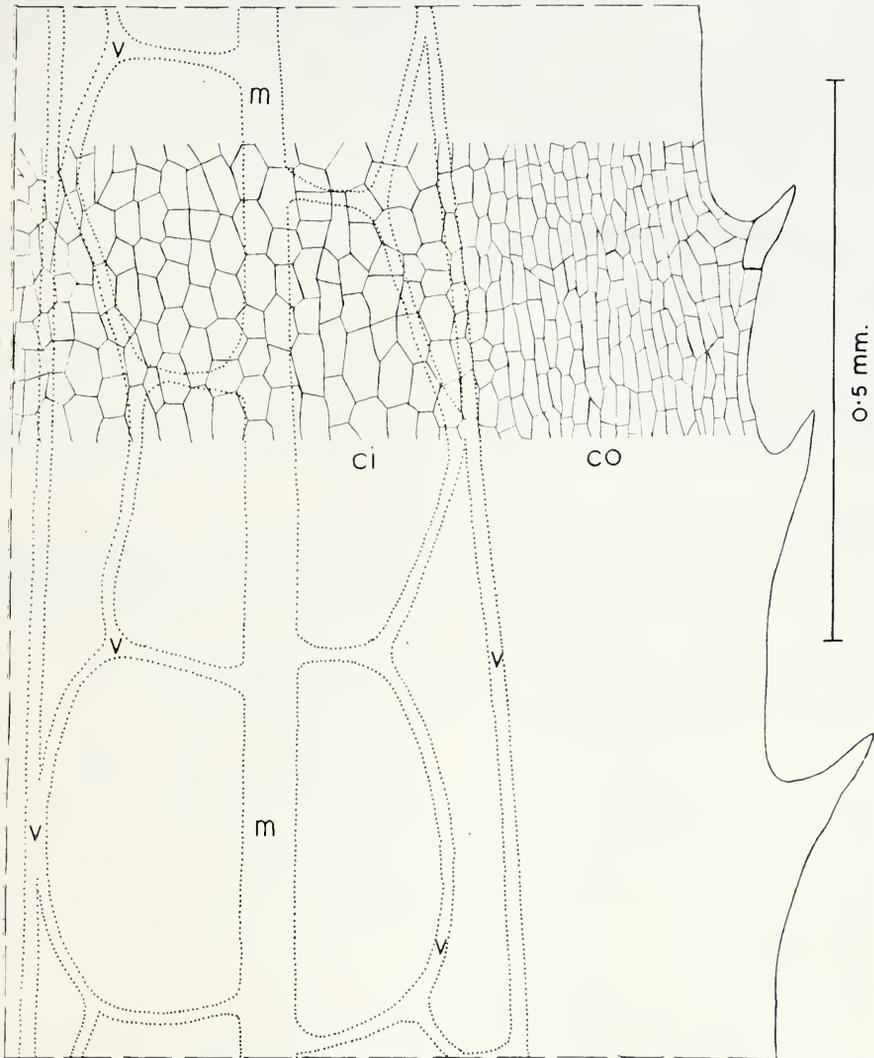


FIG. 33.—*Lagarosiphon crispus*, part of lamina seen from above showing midrib (m) and net-work of veinlets (v); ci, large central cells; co, smaller outer cells, $\times 240$.

Europe and New Zealand. Usually sterile. Becomes a pest at times by choking up dams and rivers.

CAPE.—King William's Town: near King William's Town, *Sim* 1561.

NATAL.—Newcastle: west of Laingsnek—Quaggasnek road, *Edwards* 2369.

O.F.S.—Boshoff: Smitskraal, *Burt Davy* in PRE 10731.

TRANSVAAL.—Belfast: *Wager* in NH49186. Germiston: Birchleigh, *Wager* in NH49187. Piet Retief: *Kleber* s.n. Potchefstroom: Frederikstad, *Louw* 1709. Pretoria: Rietvlei Dam, *Repton* 2001. Standerton: *Schlechter* 3464.

5. *Lagarosiphon ilicifolius* *Oberm.* in *Bothalia* 8 : 145 (1964). Type: Bechuanaland, Bridge at Toteng on the N.E. tip of Lake Ngami, *Story* 4727 (PRE, holo.).

Stems about 3 mm in diameter (those of the fertile plants usually more slender), firm. *Leaves* alternate, occasionally subopposite, regularly spaced below with the internodes 3–6 mm long, reflexed or recurved, fairly firm, opaque, lanceolate, average size 8 mm long

and 5 mm broad (smaller in fertile plants), apex acute, margin with the outer row of cells hyaline, with the patent strong teeth situated on broad triangular excrescences, closely spaced, leaf-tip bidentate; all cells of the epidermis small, squared and sometimes papillose, midrib faint, depressed, prominent below, purplish in dried state, its cells somewhat longer and narrower. *Male inflorescence* unknown. *Female inflorescence* with spathe-valves narrow-ovate, 4 mm long, toothed or entire, acute, pale wine-red; perianth pale lilac; ovary ovoid, attenuate, ovules about 9, funicle erect, short. *Capsule* ovoid, tapered above, 5–7 mm long; seeds 2 mm long. Fig. 32 : 5.

Recorded from northern South West Africa. Also present in northern Bechuanaland, Rhodesia and Zambia (Zambesi River).

S.W.A.—Okavango Native Territory: Okavango River, Kapako Camp near Mupini Mission, *de Winter & Marais* 4516; Runtu, *Merxmüller* 1890; Niagana, *Dinter* 7202a.

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3. OTTELIA

Ottelia Pers., Synops. Pl. 1 : 400 (1805); Benth. & Hook.f., Gen. Pl. 3 : 453 (1883); Aschers. & Guerke in Pflanzenfam. 2, 1 : 257 (1889); Wright in F.T.A. 7 : 6 (1897); Dandy in Journ. Bot. Lond. 72 : 132 (1934); Phill., Gen. ed. 2 : 58 (1951); Dandy in Hutch., Fam. Flow. Pl. ed. 2, 2 : 541 (1959); den Hartog in Fl. Males. 1, 5 : 396 (1957). Type species: *O. alismoides* (L.) Pers.

Stratiotes L., Sp. Pl. 535 (1753); Gen. Pl. ed. 5 : 238 (1754), pro parte, quoad sp. 2.

Damasonium Schreb. in Linn. Gen. Pl. ed. 8, 1 : 242 (1789), non *Damasonium* Mill. (1754).

Boottia Wall., Pl. As. Rar. 1 : 51 (1830); Benth. & Hook.f., Gen. Pl. 3 : 453 (1883); Aschers. & Guerke, l.c. 255 (1889); Wright, l.c. 7 (1897); Dandy, l.c. 137 (1934); non *Boottia* Bigel (1824).

Aquatic, rooted, acaulescent, armed or unarmed annuals in South Africa (rarely caulescent perennials elsewhere). *Roots* many, simple. *Leaves* rosulate submerged or in some species also with floating blades; lamina of submerged leaves ribbon-like, linear to lanceolate, the floating blade ovate to cordate; nerves 3–11, distinct, connected by cross-veins, sessile or petioled, sheathing at the base. *Inflorescence* pedunculate, dioecious or monoecious and bisexual; spathes saccate, containing many male flowers but the female and the bisexual flowers usually solitary in African species; spathes firm, with prominent sometimes muricate ribs or wings or occasionally smooth; perianth white or yellow in South African species, tubular, with the 3 outer segments persistent, sepaloïd and the 3 inner larger, petaloïd, just exerted above the surface of the water at anthesis, ephemeral, pollination entomophilous (or flowers often cleistogamous); usually 1–3 male flowers exerted at a time the pedicels lengthening rapidly at anthesis. *Male flowers* with 6–15 stamens, anthers bilocular, basifixed. pollen globular, tuberculate, gynoeceium rudimentary. *Female flowers* with a flask-shaped ovary with 3–6 parietal placentas intruded towards the centre, styles 3–15, each divided into 2 stigmatic arms, ovules numerous, amphitropous, staminodes present or absent. *Fruit* ripening inside the accrescent spathe, the lower part of the perianth-tube forming its beak. *Seeds* small, fusiform, tomentose or glabrous.

About 40 species found in the Palaeotropics with one in Brazil. Four tropical and subtropical species, endemic in Africa, extending southwards to the northern and eastern parts of Southern Africa; in permanent or temporary pools and rivers.

- Leaves with an ovate to cordate, floating lamina; plants dioecious.....1. *O. exserta*
- Leaves all submerged:
 - Leaves lanceolate, tapered at the base, margin entire, undulate; unarmed plants (rarely with a few minute prickles); plants monoecious, flowers bisexual.....2. *O. ulvifolia*
 - Leaves linear, the margin and also the peduncle minutely toothed; spathe narrow, its wings and ribs prickly; plants dioecious.....3. *O. kunenensis*
 - Leaves triangular in cross-section, armed with coarse prickles, which are also present on the peduncle and spathe; plants dioecious.....4. *O. muricata*

1. *Ottelia exserta* (Ridley) Dandy in Journ. Bot. Lond. 72 : 137 (1934). Syntypes: Mozambique, Shire River near Shamo, *Kirk*; Shupanga, *Kirk*; Madagascar, *Forbes* (BM).

Boottia exserta Ridley in Journ. Linn. Soc. Bot. 22 : 240, t.13 (1886); Wright in F.T.A. 7 : 8 (1897). *B. schinziana* Aschers. & Guerke in Pflanzenfam. 2, 1 : 256 (1889), in obs. Type: South West Africa, Olukonda, *Schinz* (B⁺, Z, BM, PRE, photo). *B. rautanenii* Guerke in Festschrift, Aschers., 538 (1904). Syntypes: South West Africa, Ovamboland, between Olukonda and Unkuambi, *Rautanen* 49; 50; 97 (Z, PRE, photo).

Ottelia schinziana (Aschers. & Guerke) Dandy in Journ. Bot. Lond. 72 : 138 (1934).

Dioecious. *Leaves*: primary leaves fugacious, submerged, linear to lanceolate, undulate; later leaves with a petiole which is triangular in cross-section and a floating, coriaceous, ovate lamina up to 12.5 cm long and 5.5 cm broad, cordate, obtuse or attenuate at the base, apex, rounded, 5–7 nerved. *Male inflorescence* with a flattened scape; spathe compressed, smooth, broadly ovate, 4 cm long and 2.5 cm broad, narrowly winged; flowers about 60, distichously and centrifugally arranged, maturing consecutively with about 1–3 appearing simultaneously; perianth-tube narrowly cylindrical, exserted for about 3 cm, outer segments narrowly lanceolate, 17 × 7 mm, inner widely obovate, forming a wide cup, 3 × 3 cm, white with a yellowish throat, stamens 12, filaments flattened, scabrid, anthers 15 mm long, narrow, pistillodes 3, yellow. *Female inflorescence* with an angled scape; spathe ovate, 5.5 cm long and 2.5 cm broad, fleshy, grooved; flower solitary, with a green perianth-tube, short at first, lengthening in fruit, outer segments green, firm, linear-lanceolate, 17 mm long and 5 mm broad, inner obovate, 4 cm long, white, staminodes 3, filiform, styles 3 short, with the stigmatic arms longer than the style, flattened, with the edges densely glandular-fimbriate,

with a globular gland at the base. *Fruit* narrowly ovoid, 4–5 cm long, beaked. Fig. 34 : 1.

Recorded from eastern Transvaal and northern Natal. Also occurs in Madagascar, Malawi, Rhodesia and Mozambique.

TRANSVAAL.—Pilgrims Rest: Kruger National Park, pan 19 miles N.E. of Skukuza, *Codd* 6070; Leeupan near Tshokwane, *Codd* 6136. Sibasa: Wambia, pan, *Van der Schijff* 3805.

NATAL.—Ubombo: Mkuzi Game Reserve, *Tinley* 616; *Ward* 3071.

Measurements given apply to plants seen from southern Africa; specimens collected in Mozambique and Malawi are far larger in all respects.

2. *Ottelia ulvifolia* (Planch.) Walp., Ann. 3 : 510 (1852–3); Hutch. & Dalz., F.W.T.A. 2 : 301, fig. 279 (1931); Dandy in J. Bot. Lond. 72 : 138 (1934); Oberm., Schweick. & Verdoorn in Bothalia 3 : 225 (1937); Wild in Rhod. Agric. Journ. 49 : 118 (1952); *Kirkia* 2 : 34, t.12b (1961). Syntypes: Madagascar, *Lyall* 149; *Bojer* (K).

Damasonium ulvaeifolium Planch. in Ann. Sci. Nat. ser. 3, 11 : 81 (1849).

Ottelia lancifolia Rich., Tent. Fl. Abyss. 2 : 280, t.95 (1851); Wright in F.T.A. 7 : 7 (1897). Type: Ethiopia, Shire, *Quartin Dillon*. *O. plantaginea* Welw. ex Rendle in Journ. Linn. Soc. Bot. 22 : 238 (1886); Wright in F.T.A. 7 : 7 (1897). Type: Angola, *Welwitsch* 6469 (BM, holo.). *O. vesiculata* Ridley in Journ. Linn. Soc. Bot. 22 : 237 (1886); Wright in F.T.A. 7 : 7 (1897). Type: Angola, *Welwitsch* 6497 (BM, holo.). *O. crassifolia* (Ridley) Welw. ex Rendle in Cat. Afr. Pl. Welw. 2, 1 : 2 (1899). *O. baumii* Guerke in Baum, *Kunene-Sambesi* Exp. 171 (1903). Type: Angola, *Baum* 858 (B, holo., M, PRE, photo.). *O. benguellensis* Guerke in Baum, *Kunene-Sambesi* Exp. 172 (1903). Type: Angola, Lion pan, *Baum* 120 (B, holo.?). “*O. sp. cf. O. ulvaeifolia* (Planch.) Walp.”, Wager in Trans. Roy. Soc. S. Afr. 16 : 201, t.22 (1928). *O. australis* Brem. in Ann. Transv. Mus. 15 : 235 (1933). Type: Transvaal, Pietersburg district, *Vivo vlei*, *Bremekamp* & *Schweickerdt* 203 (PRE, holo.). *O. macrantha* (Wright) Dandy in Journ. Bot. Lond. 72 : 138 (1934). *O. vernayi* Brem. & Oberm. in



FIG. 34.—1, *Ottella exserta*, male, $\times \frac{1}{3}$; 1a, female flower showing spathe, one outer perianth segment, one inner perianth segment (cut off), one staminode with basal gland and one forked style, $\times 1$; 1b, male in florescence; 2, *O. kunenensis*, female, $\times \frac{1}{3}$.

Ann. Transv. Mus. 16: 401 (1935). Type: Bechuanaland, Chobe River, Maun, *Van Son* in TRV 28852 (PRE, holo.).

Boottia abyssinica Ridley in Journ. Linn. Soc. Bot. 22: 239 (1886); Wright in F.T.A. 7: 9 (1897). Type: Ethiopia, *Schimper* 1452 (BM, holo.). *B. crassifolia* Ridley in Journ. Linn. Soc. Bot. 22: 239 (1886); Wright in F.T.A. 7: 9 (1897). Type: Angola, Mumpulla River and at Lopollo, *Welwitsch* 6470 (BM, holo.; M, PRE, photo.). *B. rohrbachiana* Aschers. & Guerke in Pflanzenfam. 2, 1: 256 (1889). Type: Central Africa. *B. macrantha* Wright in F.T.A. 7: 9 (1897). Type: Mozambique, *Scott* (K, holo.).

Monocious. *Leaves* all submerged, in rosettes, crowded, radical or on petioles, thin but firm, variable in size and shape, linear-lanceolate to ovate-lanceolate, up to 23 cm long and 5 cm broad, attenuate above and below, margin wavy, entire or sparsely denticulate. *Inflorescence* on a peduncle which is triangular in cross-section, up to 23 cm long and 3 mm in diam.; spathe saccate, compressed, narrow-ovate in outline, becoming much broader in fruit, up to 4 cm long and 2 cm broad, green with brownish nerves, narrowly winged, orifice with a few irregular small teeth; flowers bisexual; perianth-tube just exerted from spathe, outer segments linear-oblong, 8 mm long and 2 mm broad, green, inner obovate, 25 mm long and 9 mm broad, yellow or cream, with a small gland at the base; stamens 6, filaments flattened, 4 mm long, anthers small; ovary 17 mm long and 4 mm broad, placentas 6, unequal, styles 6 with 2 short stigmatic arms. *Fruit* enclosed in the spathe, seeds small, cylindrical, covered with fine white hairs. Fig. 35: 1.

Recorded from the warmer parts of the Transvaal and northern South West Africa. Widespread in subtropical and tropical Africa.

TRANSVAAL.—Letaba: Gravelotte, Blackhills, *Wager*; Kruger National Park, Mahlambanhlou Pan, *Vau der Schijff* 2847. Pietersburg: Vivo vlei, *Bremekamp* & *Schweickerdt* 203. Pretoria: near Petronella, *Dyer*, *Verdoorn* & *Mauve* 4267. Soutpansberg: Duvenagespan near Amisfort, *Schweickerdt* & *Verdoorn* 623. Waterberg: near Naboomspruit, Nyl River, *Mauve* 4260.

S.W.A.—Caprivi: near Andara, Okavango River, *Merxmüller* 2095. Okavango: near Runtu, Omuramba Omatako, *De Winter* & *Marais* 5045; Kanovle, *Dinter* 7191.

3. *Ottelia kunenensis* (*Guerke*) *Dandy* in Journ. Bot. Lond. 72: 137 (1934). Type: Angola, Kunene River, between Kiteve and Humbe, *Baum* 962 (B† holo., Z, PRE, photo.).

Boottia kunenensis *Guerke* in *Baum*, *Kunene-Sambesi Exped.* 172 (1903).

Dioecious. *Leaves* submerged, ribbon-like, linear, up to 50 cm long and 2 cm broad, indistinctly 5–7 nerved, often with purple blotches, margin denticulate, undulate, midrib dorsally denticulate. *Inflorescence* on a slender scape, triangular in cross-section, serrulate or smooth, in the female tightly coiled in fruit; male flower with spathe ovoid, up to 3 cm long and 1 cm broad, with 9–12 narrow denticulate ribs, orifice split into 3–9 teeth, outer segments linear, 14 mm long and 2 mm broad, inner obovate, about 25 mm long, white or yellow, stamens 12–15 of various lengths, rudimentary ovary glandular, 3-lobed; female spathe cylindrical, 2.5 cm long, perianth-tube as long as the spathe, segments resembling those of the male, the 6 styles divided nearly to the base with the stigmatic arms about 15 mm long. Fig. 34: 2.

Recorded from South West Africa. Also in Angola.

S.W.A.—Okavango Native Territory: Okavango River at Runtu, *De Winter* & *Marais* 4909; *Merxmüller* 1882; Niangana, *Dinter* 7250. Caprivi: Kabuta Village, Chobe River, *Muuro* ML3.

4. *Ottelia muricata* (*Wright*) *Dandy* in Journ. Bot. Lond. 72: 138 (1934). Syntypes: Bechuanaland, Botletle River, *Lugard* 13; Chobe River, *McCabe* 32 (K).

Boottia muricata *Wright* in F.T.A. 7: 569 (1898); *Hook.*, *lc. Pl.* t.3101 (1933), partly, excl. fig. 1. *B. aschersoniana* *Guerke* in *Baum*, *Kunene-Sambesi Exped.* 173 (1903); *Dandy* in Journ. Bot. Lond. 72: 138 (1934). Type: Angola, Kuito depression between Kutui and Sobi, *Baum* 772 (B).

Dioecious, perennial, armed (the conical projections soft in the living state). *Leaves* submerged, filiform, with a dorsal prominent rib, to triangular with short coarse teeth on the ribs, lamina up to 2 m long and 5–15 mm wide. *Inflorescence* with the spinous scape terete to triangular in cross-section, resembling the leaves; male flower with spathe fusiform, about 35 mm long and 10 mm broad, leathery, with 7–10 spiny ribs, orifice bilobed, perianth-tube exerted for 14–30 mm, outer segments linear-lanceolate, 14 mm long, inner 2–3 cm long, obovate, white with an orange throat, minutely papillate outside, stamens 12, of various lengths; female flower with spathe cylindrical, 45 mm long and 4 mm broad, with about 7 spiny ribs, perianth-tube

exserted for about 7 mm from the spathe, styles 3, short, each with 2 stigmatic arms 12 mm long; staminodes 6, three with long papillate filaments, 3 small, scale-like. Fig. 35: 2.

Found in the northern part of South West Africa. Also in Angola, Zambia, Rhodesia and Bechuanaland, where it is frequent in the Okavango, Chobe, Zambesi and Quito Rivers and their tributaries.

S.W.A.—Okavango Native Territory: Okavango River at Runtu, Maguire 1607.



FIG. 35.—1, *Ottelia ulvifolia*, $\times \frac{1}{2}$. 2, *O. muricata*, male $\times \frac{1}{2}$; 2a, female flower.

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* An asterisk signifies an exotic genus or species; synonyms are in italics.

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