

AUSTRALIAN BIOLOGICAL RESOURCES STUDY, CANBERRA



# SPECIES PLANTARUM

FLORA OF THE WORLD

*Part 2. STANGERIACEAE*

by E.M.A.Steyn, G.F.Smith & K.D.Hill



Department of the Environment and Heritage

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## INTRODUCTION

*Species Plantarum* aims to provide in concise format, and with standardised data fields, basic taxonomic information on the vascular plants of the world, including accepted names and synonyms with bibliographic data, types of names, keys and descriptions from family to varietal levels, geographical distributions, ecological information and other related matters, and to publish it in both hard copy and electronic form.

The format of the *Species Plantarum* is based on that of *Flora of Australia*, with some departures made necessary by the different scale of the project. Initially at least, the series is being edited and published for the Species Plantarum Project and IOPI by the Australian Biological Resources Study (ABRS), producers of *Flora of Australia*.

Treatments are contributed on a voluntary basis. Each part of *Species Plantarum* is intended to provide a complete account of a family, subfamily, large genus or other related taxonomic group. While treatments of small families may be shorter, it is intended that contributions will, in general, cover at least 50 to 100 species. The taxonomy adopted is that of the author, although the family delimitations recommended are initially those of R.K.Brummitt, *Vascular Plant Families and Genera* (1992). The order of taxa within families, genera and species in the *Species Plantarum* is intended to reflect natural relationships, so far as this is possible in a linear sequence.

Maps are provided for each species, or in those cases where infraspecific taxa are recognised, for each of the terminal taxa. Distribution maps are based on those in S.Hollis & R.K.Brummitt, *World Geographical Scheme for Recording Plant Distributions* (1992), and the 'countries' adopted are those of Level 3 and 4 of that work. Description of distribution follows the same work, with a two-digit code for regions and a three-letter code for the 'country'. Upper case letters for the 'country' indicate native distribution; lower case letters indicate that the taxon is only present in that 'country' as an introduced and naturalised plant. If a taxon is extinct in a 'country', this is indicated by a dagger. Distribution of species as cultivated plants is not included.

Misapplied and invalid names are, in general, omitted. Journal titles are abbreviated according to G.D.R.Bridson & E.R.Smith, *Botanico-Periodicum-Huntianum / Supplementum* (1991). Book titles are abbreviated according to F.A.Stafleu & R.S.Cowan, *Taxonomic Literature* (2nd edn) Vols 1–7, and *Supplements* (1976–), except that upper case initial letters are used for proper names and significant words. Authors of plant names are abbreviated according to R.K.Brummitt & C.E.Powell, *Authors of Plant Names* (1992).

A separate part, *Introduction to the Series*, provides a history of the project, a glossary, guide for contributors and key to the conventions used in describing distribution. These resources will also be available on the World Wide Web, initially through the ABRS site (currently <http://www.anbg.gov.au/abrs/flora/spplant/spplant.htm>) with links from the IOPI site (currently <http://life.csu.edu.au/iopi/iopihome>) and others.

Editor

Canberra, 1999



## STANGERIACEAE

*E.M.A.Steyn*<sup>1</sup> & *G.F.Smith*<sup>1</sup> (family; *Stangeria*)  
*K.D.Hill*<sup>2</sup> (*Bowenia*)

*Stangeriaceae* L.A.S.Johnson, *Proc. Linn. Soc. New South Wales* 84: 68 (1959)

Type: *Stangeria* T.Moore

*Boweniaceae* D.W.Stev., *Amer. J. Bot.* 68: 1114 (1981)

Type: *Bowenia* Hook.

Dioecious, superficially fern-like, perennial plants. Stem subterranean, naked (not clothed with old frond bases), branched or unbranched, merging into tuberous main root; apogeotropic coralloid roots present. Cataphylls absent. Fronds 1–30 at or near apex of stems or branches, usually deciduous, very variable in size (25–200 cm long), petiolate, pinnate or bipinnate; petiole as long as or longer than divided blade; ultimate segments (pinnae or pinnules) elongate-lanceolate, acutely acuminate to rounded at apex, entire or toothed to irregularly incised or lobed, glabrous. Cones solitary, terminal, pedunculate or sessile; sporophylls spirally arranged, imbricate, with outer faces in 6–8 almost vertical orthostichies; male cones slender-cylindrical to ovoid; female cones ovoid to globose; megasporophylls peltate, stalked, bearing 2 inverted ovules on lower surface. Seeds broadly ellipsoidal; outer layer fleshy; middle layer stony, encasing embryo embedded in copious primary nutritive tissue.

A family of two genera and three species; one genus (*Stangeria*), with one variable species, confined to southern Africa and the other (*Bowenia*), of two species, confined to Queensland, Australia.

The 11 cycad genera form a united and isolated group of obviously ancient gymnosperms, not closely related to conifers. Although the geological record does not provide pertinent evidence on the ancestry of the Cycadales, they are generally believed to have arisen from some of the late Palaeozoic seed ferns, which were a paraphyletic assemblage (S.V.Meyen, *Bot. Rev.* 50: 1–116 (1984)). Opinions vary as to the suprageneric classification of the extant cycad genera. For example, R.K.Brummitt, *Vascular Plant Families and Genera* (1992) recognised two monogeneric families Boweniaceae and Stangeriaceae. Recent cladistic analyses suggest that *Stangeria* is closer to *Bowenia* than has been previously believed and that the two may be sister genera within the Stangeriaceae (D.W.Stevenson, *Brittonia* 44: 220–223 (1992)). This arrangement is followed here.

R.Marloth, Cycadaceae, *Fl. S. Afr.* 1: 97–98, t. 14 (1913); J.Hutchinson & G.Ratray, *Stangeria* T.Moore, in A.W.Hill, *Fl. Cap.* 5, 2 (Suppl.): 24–27 (1933); D.W.Stevenson, Observation on ptyxis, phenology and trichomes in the Cycadales and their systematic implications, *Amer. J. Bot.* 68: 1104–1114 (1981); D.W.Stevenson, A proposed classification of the Cycadales, *Amer. J. Bot.* 72: 971–972 (1985); L.A.S.Johnson & K.L.Wilson, Stangeriaceae, in K.U.Kramer & P.S.Green (eds), *Fam. Gen. Vasc. Pl.* 2: 370–371 (1990); D.W.Stevenson, Morphology and systematics of the Cycadales, *Mem. New York Bot. Gard.* 57: 8–55 (1990); D.W.Stevenson, A formal classification of the extant cycads, *Brittonia* 44: 220–223 (1992); K.D.Hill, 'Gymnosperms' – The paraphyletic stem of seed plants, *Fl. Australia* 48: 505–526 (1998); R.S.Hill, The fossil record of cycads in Australia, *Fl. Australia* 48: 539–544 (1998); K.D.Hill, Stangeriaceae, *Fl. Australia* 48: 636–637 (1998).

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## KEY TO GENERA

- Leaves pinnate; pinnules with prominent compound midrib [South Africa] **1. Stangeria**  
 Leaves bipinnate; pinnules lacking midrib [Queensland, Australia] **2. Bowenia**

## 1. STANGERIA

*Stangeria* T.Moore, *Hooker's J. Bot. Kew Gard. Misc.* 5: 228 (1853)

T: *S. paradoxa* T.Moore

Fronds pinnate; longitudinal ptyxis inflexed; horizontal ptyxis conduplicate. Pinnae flat, with a prominent compound midrib and many dichotomizing lateral veins running parallel to each other; stomata confined to lower surface.  $x = 8$  ( $2n = 16$ ), C.J.Marchant, *Chromosoma* 24: 101 (1968).

A genus comprising a single, variable species, *S. eriopus*, restricted to a narrow coastal strip of south-eastern Africa.

*Stangeria* is readily recognised by its fern-like appearance, the venation of the pinnae (similar only to that of *Chigua*, according to D.W.Stevenson, K.J.Norstog & D.V.Molsen, *Brittonia* 48: 67–74 (1996)), the absence of cataphylls and the presence of stipular hoods at the frond bases (D.W.Stevenson, *Amer. J. Bot.* 68: 1104–1114 (1981)). This cycad was originally regarded as a fern, *Lomaria eriopus* by Kunze (*Linnaea* 10: 506 (1836)). The remarkable differences in vegetative morphological characters between grassland and forest plants led to further confusion among taxonomists and this is reflected in the extensive synonymy. However, careful studies of plants in their natural habitat and in cultivation have indicated that only a single, extremely variable and ecologically adaptable species is involved (R.A.Dyer, *Bothalia* 8: 429–432 (1965); P.Vorster & E.Vorster, *Encephalartos* 2: 8–17 (1985)).

R.A.Dyer, Stangeriaceae, in L.E.Codd, B. de Winter & H.B.Rycroft, *Fl. Sthn. Afr.* 1: 1–3 (1966); H.Heine, 'Pseudopteridophyta' Deux cas exceptionnels de plantes valablement décrites dans un embranchement impropre du règne végétal, *Adansonia*, n. ser. 8(3): 311–316 (1968); P.Vorster & E.Vorster, *Stangeria eriopus*, *Excelsa* 4: 79–89 (1974); D.L.Jones, Genus *Stangeria*, *Cycads World* 265–268 (1993).

***Stangeria eriopus* (Kunze) Baill., *Hist. Pl.* 12: 68 (1892)**

*Lomaria eriopus* Kunze, *Linnaea* 13: 152 (1839). T: Cape Province: Eastern Cape, *J.F.Drège s.n.*, n.v. [probably formerly LZ, now destroyed].

*Stangeria paradoxa* T.Moore, *Hooker's J. Bot. Kew Gard. Misc.* 5: 228 (1853). T: cult. London, *T.Moore*, ex Natal, *W.Stanger s.n.*; syn: K n.v.

*Stangeria schizodon* W.Bull, *Retail List* 72: 8 (1872); *Stangeria paradoxa* [var.] *schizodon* (W.Bull) Regel, *Cycad. Gen. Spec. Rev.* 13 (1876); *S. paradoxa* f. *schizodon* (W.Bull) J.Schust., in A.Engler & L.Diels, *Pflanzenr.* 4, 1 (Heft 99): 105, fig. 15C, t. 3 (1932); *S. sanderiana* J.Schust., in A.Engler & L.Diels, *Pflanzenr.* 4, 1 (Heft 99): 105 (1932), *nom. nud. pro syn.* T: Hort., possibly from Natal, n.v.; fide E.Regel, *Cycad. Gen. Spec. Rev.* 13 (1876).

*Stangeria katzeri* Regel, *Gartenfl.* 23: 163, t. 798, (1874); *Stangeria paradoxa* var. *katzeri* (Regel) Marloth, *Fl. S. Afr.* 1: 97, fig. 63 (1913). T: Hort., n.v.; fide E.Regel, *Cycad. Gen. Spec. Rev.* 13 (1876).

Illustrations: G.V.Nash, *J. New York Bot. Gard.* 10: t. 62 (1909); R.Marloth, *Fl. S. Afr.* 1: 98, fig. 63 (1913) as *S. paradoxa* T.Moore var. *katzeri*, t. 14 as *S. paradoxa* T.Moore; J.Hutchinson & G.Ratray, in A.W.Hill, *Fl. Cap.* 5, 2 (Suppl.): 27, fig. 3 (1933); C.Giddy, *Cycads S. Afr.*, 2nd edn, 108, t. 29 (1984).

Maps: P.Vorster & E.Vorster, *Stangeria eriopus*, *Excelsa* 4: 82, fig. 10 (1974); C.Giddy, *Cycads S. Afr.*, 2nd edn, 107 (1984); D.L.Jones, *Cycads World* 266 (1993).

Fronds 1 (–4) per stem, 25–200 cm long, pinnate; frond base with stipular hood attached adaxially; hoods seemingly functioning as cataphylls; pinnae in 5–20 pairs, opposite or subopposite, to 40 cm long and 6 cm broad, entire or toothed to irregularly incised or lobed,



## STANGERIACEAE (*I. Stangeria*)

glabrous, with prominent, compound midrib and many dichotomizing lateral veins running parallel to each other. Cones silvery pubescent when young, becoming brownish with age, pedunculate, with outer faces in 6 orthostichies; male cones slender-cylindrical, 10–25 cm long, 3–4 cm wide; microsporophylls with sporangia in sori, 2–6 sporangia per sorus, on lower surface towards base; female cones ovoid, to 18 cm long, 8 cm wide. Seeds to 3.5 cm long, 2.5 cm wide; outer layer dark red, becoming brownish with age. Fig. 1 and front cover.

South Africa, along the coastal strip between Bathurst (Eastern Cape Province) and the southern border of Mozambique. Also, according to archival reports, once in the Mpumalanga (Golela area) adjacent to the Swaziland and KwaZulu-Natal borders. 27. CPP, NAT. On grassy slopes, forest margins or in forests. Map 1.

27. CAPE PROVINCE: Grassy slopes near Kei Mouth, *H.G.Flanagan 1118* (PRE); 2 km from forest station on way to Mboyti, *F.Venter 903* (PRE). NATAL: 2 miles [3.2 km] N of Nkwaleni Post Office, *L.E.Codd 1846* (PRE); Makowe store road near Hluhluwe Reserve, *M.J.Wells 2141* (PRE). Mpumalanga, in the Golela area, adjacent to the KwaZulu-Natal and Swaziland borders, *vide* archival correspondence, PRE ref. NOS/rtc (PRE).

## 2. BOWENIA

*Bowenia* Hook. ex Hook.f., *Bot. Mag.* 89, t. 5398 (1863)

Type: *B. spectabilis* Hook. ex Hook.f.

Leaves bipinnate; longitudinal ptyxis circinate; horizontal ptyxis involute. Pinnae with circinate ptyxis and often a true terminal leaflet. Pinnules flat, lacking a midrib, with numerous subparallel longitudinal veins and stomata on both surfaces; individual ptyxis flat.  $2n = 18$ , K.Sax & J.M.Beale, *J. Arnold Arbor.* 15: 255–262 (1934).

The underground stem contains pockets of a cyanobacterium (*Anabaena* sp.), believed to be present in a symbiotic relationship.

A genus of two species, both confined to Queensland, Australia.

- |   |                          |
|---|--------------------------|
| 1 Pinnules entire or a few irregularly lacerate                                 | 1. <i>B. spectabilis</i> |
| 1: Pinnules regularly serrate   |                          |
| 2 Stem with 5–20 leaf-bearing branches; largest leaves with more than 12 pinnae | 2. <i>B. serrulata</i>   |
| 2: Stem with 1–5 leaf-bearing branches; largest leaves with less than 11 pinnae | 1. <i>B. spectabilis</i> |

### 1. *Bowenia spectabilis* Hook. ex Hook.f., *Bot. Mag.* 89, t. 5398 (1863)

T: the plate, *Bot. Mag.* t. 5398 (1863); illustrated from a cultivated plant.

Illustration: J.D.Hooker, *Bot. Mag.* 89, sub t. 5398 (1863).

Stem elongate, to 10 cm diam., with an elongate tuberous tap root, and 1–5 short, slender, leaf- and cone-bearing branches. Leaves 1–7 in the crown, erect, with 4–10 spreading branches (pinnae), 100–200 cm long, to 100 cm broad; petiole to 100 cm long. Pinnules 7–30 on each pinna, obliquely lanceolate, decurrent at base, 7–15 cm long, 1.5–4 cm broad, entire or a few with occasional coarse lacerations, rarely regularly shortly serrate. Pollen cones stalked, ovoid, to 5 cm long, 2.5 cm diam.; sporophylls broadly cuneate, distally dilated and truncate. Female cones sessile, ovoid to globose, to 10 cm long, 10 cm diam.; sporophylls in about 8 ranks; expanded ends  $\pm$ hexagonal, 30–55 mm wide, c. 15 mm tall. Seeds to 32 mm long, 18 mm wide. Fig. 2F–H.

Australia, in north-eastern Queensland, on the coast and ranges from Cardwell to Cooktown, with an outlying occurrence in the McIlwraith Range. 50. QLD. Scattered in open situations in and around rainforest. Map 2.

12. QUEENSLAND: 2 km past Tinaroo Dam, *K.D.Hill 3770 & L.Stanberg* (NSW); above Beatrice R., 12.6 km from Millaa Millaa towards Innisfail, *K.D.Hill 3781 & L.Stanberg* (NSW); 15 km along Cairns Regional Electricity Board track from Bloomfield, *P.Hind 4604, K.D.Hill & D.Healey* (BRI, NSW); Bartle Frere Rd, 2.6 km E of Topaz Rd junction, near Lamins Hill, *P.W.Weston 813, P.Hind, D.Healey & G.Sankowsky* (NSW).

Occasionally cultivated as an ornamental. Individuals with serrate pinnae occur occasionally in most populations throughout the range of this species.

Hooker stated that he was describing and illustrating this plant from a live specimen sent to him by W.Hill from Queensland. It is therefore appropriate to consider the plate to be the Type. There are also two sheets preserved in Kew, inscribed 'Rockingham Bay, 1863, *W.Hill 167*'. These should possibly be considered as syntypes, but they have not been critically assessed by the present author.

## 2. *Bowenia serrulata* (W.Bull) Chamb., *Bot. Gaz.* 54: 419 (1912)

*Bowenia spectabilis* var. *serrulata* W.Bull, *Retail List* 143: 4 (1878). T: the plate, W.Bull, *Retail List* 143: v (1878); illustrated from a cultivated plant.

*Bowenia spectabilis* var. *serrata* F.M.Bailey, *Syn. Queensland Fl.* 501 (1883). T: [Queensland]: Toowoomba, not located. Possible Type: Queensland: Maryvale, Broad Sound, *A.Thozet* (K).

Illustrations: W.Bull, *Retail List* 143: v (1878); E.Andre, *Ill. Hort.* 26: t. 364 (1879); C.J.Chamberlain, *Bot. Gaz.* 54: 421, 422 (1912).

Stem elongate, to 25 cm diam., with an elongate tuberous tap root, and 5–20 short, slender leaf- and cone-bearing branches. Leaves 5–30 in the crown, erect, with 6–16 spreading branches (pinnae), 100–200 cm long, to 100 cm broad; petiole to 100 cm long. Pinnules 7–30 on each pinna, obliquely lanceolate, decurrent at base, sharply and regularly serrate, a few sometimes coarsely lacerate, 7–15 cm long, 1.5–4 cm broad. Pollen cones stalked, ovoid, to 5 cm long, 2.5 cm diam.; sporophylls broadly cuneate, distally dilated and truncate. Female cones sessile, ovoid to globose, to 10 cm long, 10 cm diam.; sporophylls in about 8 ranks; expanded ends  $\pm$ hexagonal, 30–55 mm wide, c. 15 mm tall. Seeds to 32 mm long, 18 mm wide. Fig. 2A–E.

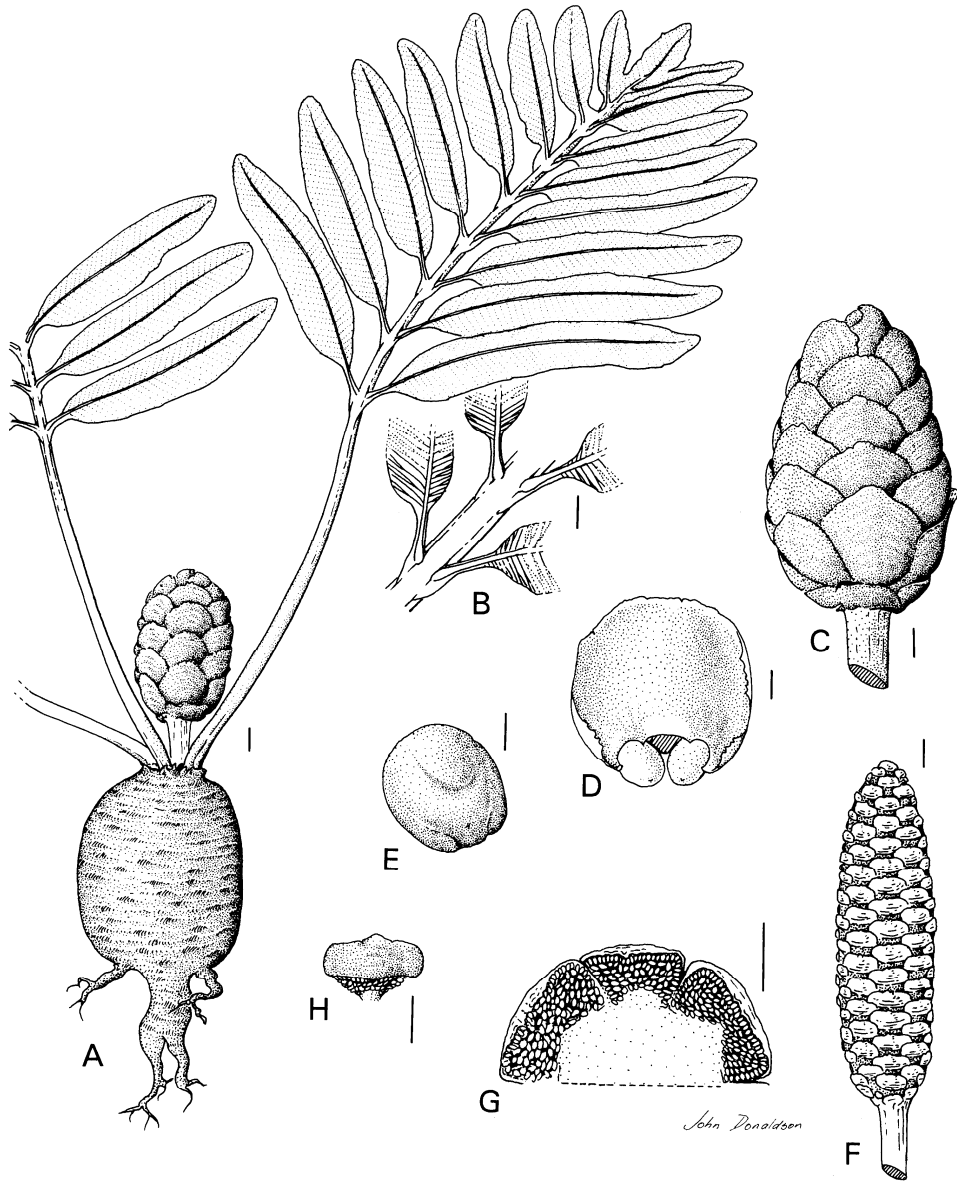
Australia, in central-eastern Queensland, in the vicinity of Byfield, NE of Rockhampton. 50. QLD. Scattered and locally abundant in dry sclerophyll eucalypt forests. Map 3.

12. QUEENSLAND: 4.7 km N of Byfield, *K.D.Hill 3795 & L.Stanberg* (NSW); Waterpark Ck, Byfield, *P.Hind 2593* (NSW).

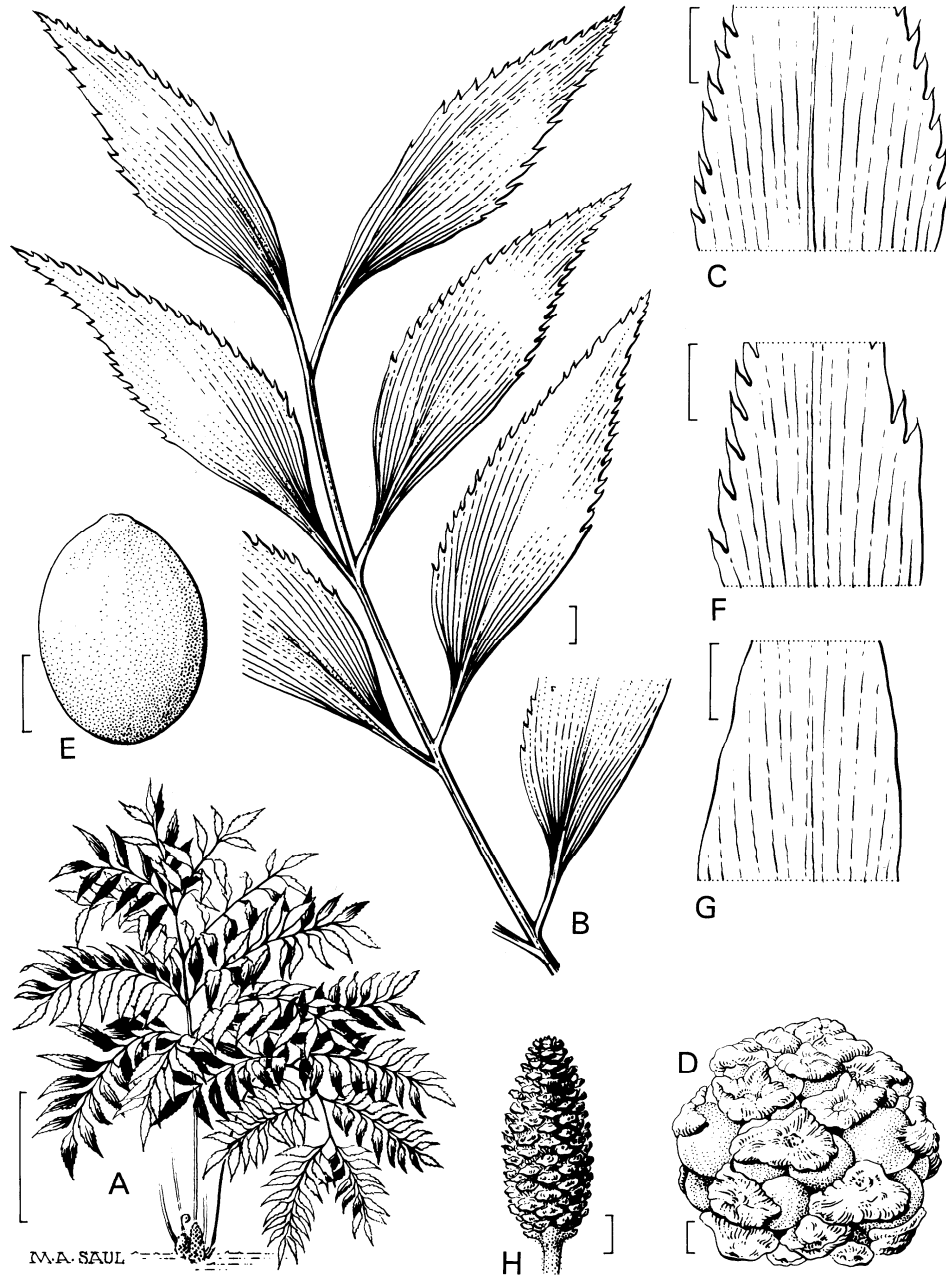
Occasionally cultivated as an ornamental, and popular as ornamental foliage in the florist trade.

It appears that in using the name *S. spectabilis* var. *serrata* Bailey was in fact coining a new name, not using an orthographic variant of *S. spectabilis* var. *serrulata* W.Bull.

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**Figure 1.** *Stangeria eriopus*. **A**, mature female plant; **B**, part of rachis showing bases of pinnules and venation; **C**, female cone; **D**, megasporophyll with ovules on lower surface; **E**, mature seed; **F**, mature male cone; **G**, part of male cone in transverse section showing attachment of microsporophylls to axis and abaxial sporangia; **H**, microsporophyll seen from the front with microsporangia on lower surface. Scale bars represent 10 mm (**A**, **C**, **F**, **G**, **H**) or 5 mm (**B**, **D**, **E**). Drawn by J.S.Donaldson from male and female plants growing in grassland near East London, South Africa.



**Figure 2.** *Bowenia*. *B. serrulata*. **A**, habit (from live material); **B**, part of apex of frond; **C**, mid section of pinnule (**B–C**, *V.K.Moriarty 1348*, BRI); **D**, female cone (from live material); **E**, seed (*Forestry Dept, AQ142006*, BRI). *B. spectabilis*. **F–G**, midsection of pinnules (**F**, *J.Hunter 4252*, BRI; **G**, *E.W.Bick AQ142013*, BRI); **H**, male cone (*L.S.Smith 11513*, BRI). Scale bars represent 50 cm (**A**) or 1 cm (**B–H**). Drawn by Margaret Saul.

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**MAPS**

Number in brackets refers to page on which the taxon is described.



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