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SPECIES PLANTARUM

FLORA OF THE WORLD

Part 3. WELWITSCHIACEAE

by E.M.A.Steyn & G.F.Smith



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

WELWITSCHIACEAE

*E.M.A.Steyn*¹ & *G.F.Smith*¹

Welwitschiaceae Markgr., in A.Engler & K.Prantl, *Nat. Pflanzenfam.* 2nd edn, 13: 419 (1926)

Type: *Welwitschia* Hook.f.

Dioecious perennial xerophytes; stem woody, unbranched, broadly obconical, often split into two lobes, outer covering corky; taproot elongate, usually branching near apex. Leaves 2, opposite, persistent, simple, entire, with continuous basal growth, tearing lengthwise into strips and wearing away at tips, leathery, parallel-veined, isobilateral, amphistomatic. Strobili in dichasial branch systems; ultimate branches terminating in 1 or 3–5 cones; cones small, subquadrate, comprising numerous reproductive, flower-like units ('flowers') subtended by bracts. Units unisexual, single, decussate. Male: bracteoles ('perianth') 4, outer 2 lateral, boat-shaped, inner 2 anterior-posterior, broadly obovate, fused; microsporangiophores 6, in single whorl, eventually exserted, basally fused in a cup-like structure, each bearing 3 fused microsporangia opening with 3 terminal pores; ovule non-functional, with single integument extending upwards into tubulus (micropylar tube) with funnel-shaped disc at apex. Female: bracteoles basically 4, outer 2 often absent, lateral, boat-shaped, inner 2 ('perianth') anterior-posterior, fused from inception, persistent, laterally expanded into conspicuous, fibrous wings; ovule functional, comprising a nucellus and single integument, crassinucellate, eventually containing embryo sac tubes with egg nuclei (archegonia not formed), integument extending upwards into tubulus terminating in fringed, stigma-like apex; tubulus exserted at maturity. Seed with tubulus, enclosed in persistent winged bracteoles; wings papery, fibrous, hygroscopic; embryo small, axile, usually with 2, rarely 3 cotyledons, imbedded in lipid and protein-rich nutritive tissue, attached to long coiled suspensor, developing a feeder at germination.

The family is represented by the single species, *Welwitschia mirabilis*, limited in distribution to the desert or desert margin along the south-west coast of Africa. This land strip, about 1 000 km long, stretches from the Kuiseb River, just south of Walvis Bay in Namibia, to the Nicolau River (approximately 14°S) in Angola (L.E.Kers, *Svensk Bot. Tidskr.* 61: 97–125 (1967)).

Ever since Hooker's illustrated account of *Welwitschia* appeared in *Trans. Linn. Soc. London* 24: 1–48 (1862), conceptions of, especially, the female reproductive structures have been controversial. The interpretation adopted here is mainly based on the exhaustive ontogenic studies of P.Martens, *Cellule* 60: 171–286, t. 1–13 (1959). We further followed K.Kubitzki, in K.U.Kramer & P.S.Green (eds), *Fam. Gen. Vasc. Pl.* 2: 378–391 (1990), who pointed out the inappropriateness of using angiosperm-orientated terminology with regard to the Gnetales – neither the derivation of the group nor their relationship with angiosperms is fully understood. The gnetalean genera, *Welwitschia*, *Ephedra* and *Gnetum*, have been regarded as the closest living relatives of flowering plants on the one hand and the extinct Bennettitales on the other (P.R.Crane, *Ann. Missouri Bot. Gard.* 72: 716–793 (1985); K.Kubitzki (1990)). The three obviously very old and rather bizarre genera share a mixture of gymnospermous and angiospermous characters. They are nevertheless considered as so distinct and isolated from one another that views about intergeneric relationships have been extremely controversial (Kubitzki (1990), and references cited therein). However, most authors regard *Welwitschia* and *Gnetum* as more closely related to each other than to *Ephedra*.

J.D.Hooker, On *Welwitschia*, a new genus of the Gnetaceae, *Trans. Linn. Soc. London* 24: 1–48, t. 1–14 (1863); I.C.Verdoorn, *Welwitschiaceae*, in L.E.Codd, B. de Winter &

¹National Botanical Institute, Private Bag X101, Pretoria, South Africa, 0001.

H.B.Rycroft (eds), *Fl. S. Afr.* 1: 48–51 (1966); C.H.Bornman, *Welwitschia*, paradox of a parched paradise (1978); E. van Jaarsveld, The cultivation and care of *Welwitschia mirabilis*, the extraordinary caudiciform from the Namib desert, *Aloe* 27: 69–82 (1990); K.Kubitzki, in K.U.Kramer & P.S.Green (eds), *Fam. Gen. Vasc. Pl.* 2: 378–391 (1990); Hasebe, M., Ito, M., Kofuji, R., Iwatsuki, K. & Ueda, K., Phylogenetic relationships in Gnetophyta deduced from rbcL gene sequences, *Bot. Mag. (Tokyo)* 105: 385–391 (1992).

WELWITSCHIA

Welwitschia Hook.f., *Gard. Chron.* 1862: 71 (1862), *nom. cons.*

Type: *W. mirabilis* Hook.f.

Tumboa Welw., *Gard. Chron.* 1861: 75 (1861). T: *Welwitschia mirabilis* Hook.f.

A monotypic genus, confined to western Africa.

Welwitschia mirabilis Hook.f., *Gard. Chron.* 1862: 71 (1862)

T: Specimen not cited. Angola: Cabo Negro, *F. Welwitsch s.n.*; syn: K, photo PRE.

Tumboa bainesii Hook.f., *Gard. Chron.* 1861: 1008 (1861), *nom. prov.*; *Welwitschia bainesii* Carr., *Traité Gén. Conif.*, 2nd edn, 783 (1867), *nom. prov.*

Tumboa strobilifera Welw. ex Hook.f., *Gard. Chron.* 1862: 71 (1862), *nom. nud. pro syn.*

Illustrations: *Trans. Linn. Soc. London* 24: 6, t. 1–14 (1863); K.R.Sporne, *Morphol. Gymnosp.*, 181, fig. 40A–D; 182, fig. 41A–D (1971), as *W. bainesii*; K.Kubitzki, in K.U.Kramer & P.S.Green (eds), *Fam. Gen. Vasc. Pl.* 2: 388 (1990); Anon., *Linnean* 13(3): 20 (1997).

Maps: L.E.Kers, *Svensk Bot. Tidskr.* 61: 116, fig. 5 (1967); E. van Jaarsveld, *Aloe* 27: 71 (1990).

Trunk mainly subterranean, with up to 200 cm emergent. Leaves with basal growth, eroding at tips, to 900 cm long, 200 cm wide. Male strobili 1–4 cm long, 5–7 mm wide, on a pedicel 2–5 mm long; bracteoles 1–3 mm long; microsporangiphore cup to 3.5 mm long; free stalks 0.5–1.5 mm long; microsporangia 0.2 mm wide. Female strobili 3.5–8 cm long, 2–3 cm wide; outer bracteoles 5 mm long; inner bracteoles 8 mm long; micropylar tube with bulbous base 4 mm long and narrow tube 5 mm long; ovule 4 mm long. Seed white to creamish white, including persistent bracteoles and micropyle c. 3.5 cm long, c. 3 cm wide. Figs 1–3, and cover.

Coastal strip from Nicolau River, Angola (c. 14°S) to just south of Walvis Bay, Namibia (c. 24°S). 26: ANG. 27: NAM. Deserts and desert margins. Map 1.

26. ANGOLA: Cabo Negro, 1863, *J.J.Monteiro s.n.* (K); near main road across desert between Moçamedes [Namibe] and Porto Alexandre, *R.J.Poynton s.n.* (PRE); 32 km S of Mosamedes [Namibe], *R.J.Rodin 9354* (PRE). 27. NAMIBIA: Damaraland, *T.Baines s.n.* (K, photo PRE); 31 km W of Khorichas on Twyfelfontein road, *D.S.Hardy 7184* (PRE); 1.5 km W from Howeb and 0.5 km N of Kuiseb river bed, *W.Geiss 9540* (PRE).

WELWITSCHIACEAE (*Welwitschia*)



Figure 1. *Welwitschia mirabilis*. Female plant at beginning of reproductive season. Crater-like apical part of trunk about 17 cm wide. Drawn by M.Steyn from a plant cultivated in the nurseries of the Pretoria National Botanical Garden.

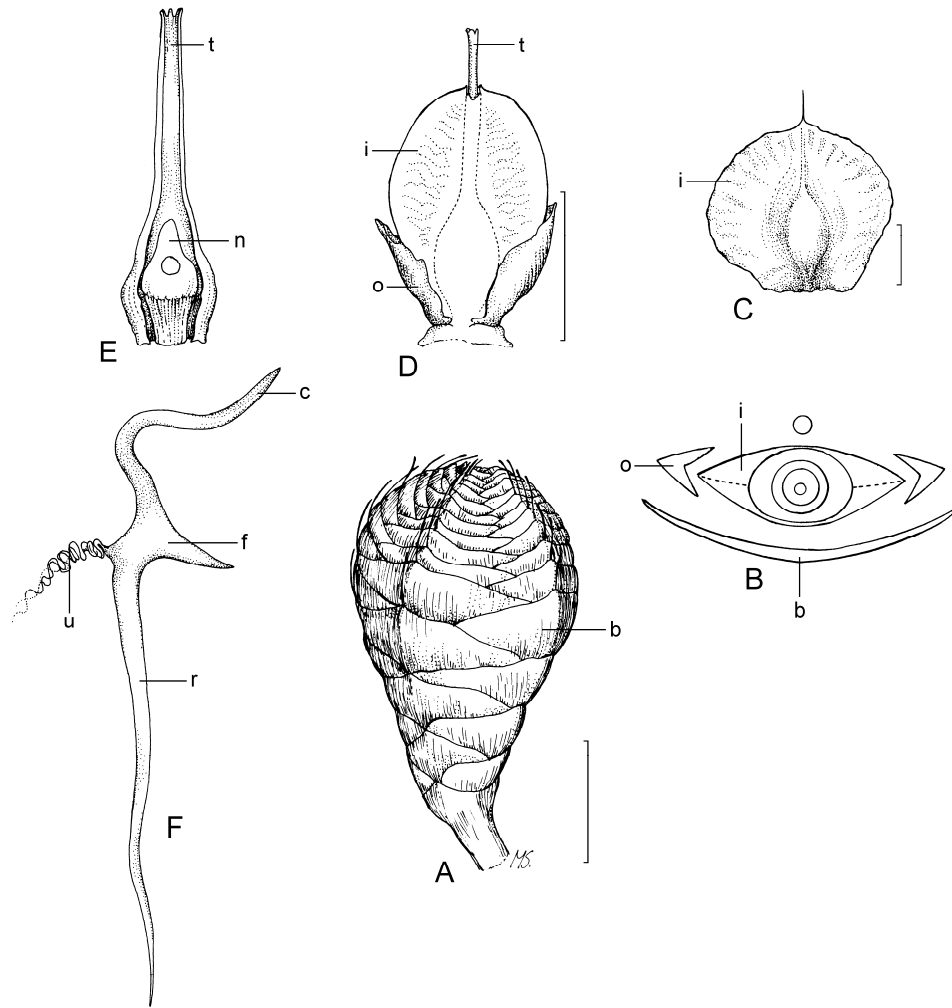


Figure 2. *Welwitschia mirabilis*. **A**, female cone; **B**, diagram of female reproductive unit; **C**, mature seed; **D**, young female reproductive unit with subtending bract removed; **E**, young functional ovule; **F**, germinating seed. Abbreviations: b, subtending bract; c, cotyledons; f, feeder; i, inner bracteole; n, nucellus; o, outer bracteole; r, radicle; t, micropylar tube; u, suspensor. (**A**, **C**, **D**, Hort., Kirstenbosch National Botanical Garden; **E**, redrawn from Hooker t. 9, fig. 12 (1863); **F**, adapted from Bornman, p. 41, fig. 22 (1978)). Scale bars represent 10 mm (**A**, **C**) or 5 mm (**D**). Drawn by M.Steyn.

WELWITSCHIACEAE (*Welwitschia*)

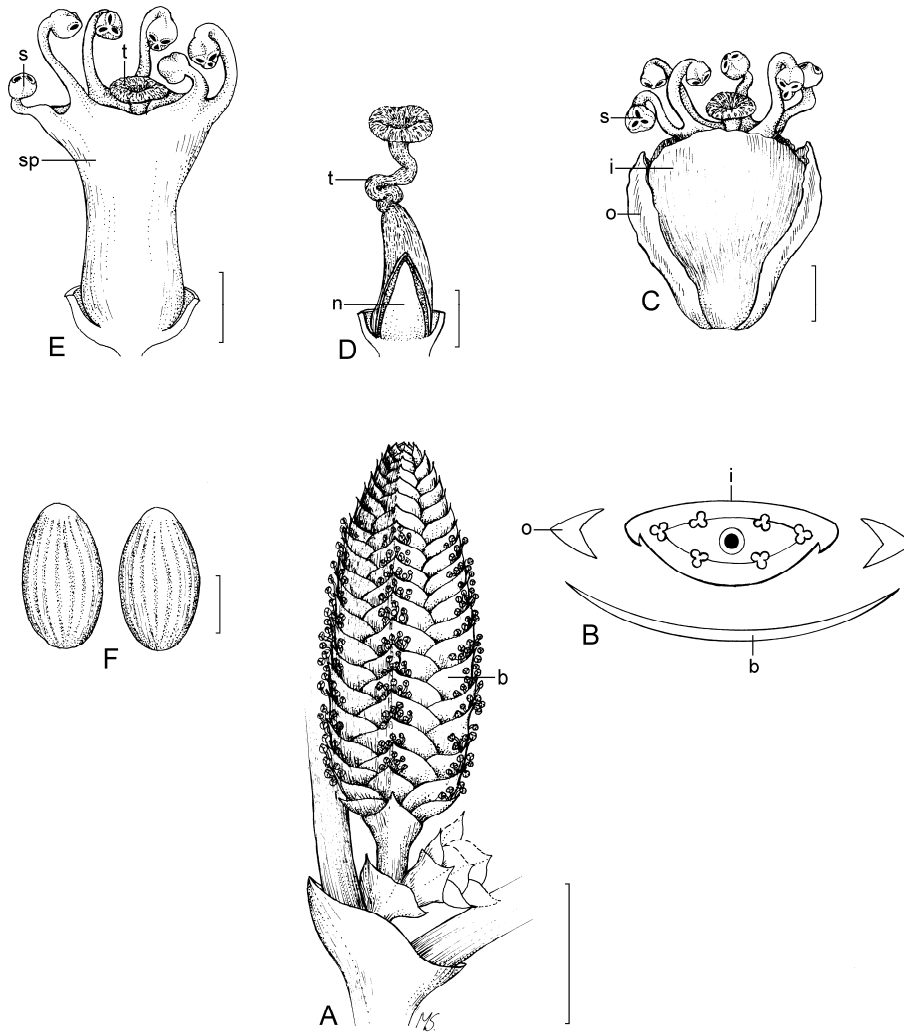


Figure 3. *Welwitschia mirabilis*. **A**, male cone; **B**, diagram of male reproductive unit; **C**, male reproductive unit in anterior view, subtending bract removed; **D**, sterile ovule; **E**, microsporangiophores and exserted micropylar tube; **F**, Pollen grains. Abbreviations: b, subtending bract; i, inner bracteole; n, nucellus; o, outer bracteole; s, fused sporangia; sp, sporangiophore bases; t, micropylar tube. (A, C, D, E, F, *W. Giess 9158*, PRE). Scale bars represent 5 mm (A), 0.5 mm (C, D, E) or 25 μ m (F). Drawn by M. Steyn.

MAPS

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

WELWITSCHIACEAE (*Welwitschia*)



1. *Welwitschia mirabilis* (2)

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Accepted names are in roman, synonyms and doubtful names in *italic*.

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Welwitschiaceae **1**