



Dicksonia utteridgei, a new species of hairy tree fern (*Dicksoniaceae* - *Cyatheales*) from New Guinea

M. Lehnert^{1*}, R. Cámara-Leret²

Key words

biogeography
Cyatheales
Dicksonia
endemic
New Guinea
tree ferns

Abstract A new species of hairy tree fern (*Dicksoniaceae* - *Cyatheales*) is described and illustrated: *Dicksonia utteridgei* from stunted ridge forest in central New Guinea. The species is the only one in the genus with a combination of fully pinnate to bipinnate-pinnatifid pinnules and bristly spreading petiole hairs.

Published on 21 September 2018

INTRODUCTION

The tree fern family *Dicksoniaceae* (*Cyatheales*; PPG 1 2018) contains c. 40 species in three genera: *Calochlaena*, *Lophosoria* and *Dicksonia*. Of these, *Dicksonia* is the largest genus in species number (30 spp.) and size, with the tree fern habit being the norm as opposed to the (mostly) prostrate rhizomes of *Calochlaena* (5 spp.) and *Lophosoria* (2–4 spp.). *Dicksonia* has been phylogenetically investigated at the global level (Noben et al. 2017), revealing three major lineages that evolved during the Cenozoic and radiated in the last few million years in the Neotropics, New Caledonia and Malesia.

The taxonomy of *Dicksonia* had been relatively static for more than 50 years. Holttum revised the genus for Flora Malesiana and described two new species (Holttum 1962, 1963). Subsequently, taxonomic changes were restricted to rare reinstatements (Guymer 1982, Jones 1984) and merging of species names (Tryon & Tryon 1982) until Adjie et al. (2012) published *D. timorensis* Adjie, a new species from Timor, Indonesia. In recent years, evidence from herbarium specimens, field observations, digital photographs and molecular data have led to a better understanding of the taxa in *Dicksonia* (Brownsey & Perrie 2014). As preparation towards the phylogeny of the genus by Noben et al. (2017), a revision of all taxa led to the discovery of new species from the western Pacific (Noben & Lehnert 2013) and South America (Noben et al. unpubl. data). The only unresolved area remains eastern Malesia. While western Malesia is botanically relatively well explored and has few species of *Dicksonia* that are distributed mostly parapatrically (Lehnert & Coritico, unpubl. data), the island of New Guinea remains under-sampled because of its remoteness, size and political instability. New Guinea is the centre of diversity for *Dicksonia*, with six endemic species that are poorly understood because of fragmentary collections and the difficulties in revisiting the type localities. Our expeditions on the island and herbarium studies at B, BM and K (acronyms according to Thiers, constantly updated) did not elucidate much of the intraspecific variability of

the recognized species, but rather reinforced doubts about the validity of some New Guinean species, as already expressed by Holttum (1963). Only one collection deposited in K stood out by its unique, strongly divergent morphology, and is here described confidently as new to science.

Dicksonia utteridgei Lehnert & Cámara-Leret, sp. nov. — Fig. 1, Map 1

A newly recognized species of *Dicksonia* with bristly reddish to dark brown hairs on petioles and rachises, and large ovate-lanceolate to triangular pinnules, which are notably stalked and themselves fully pinnate to bipinnate-pinnatifid, with the largest segments clearly stalked. All other known species of *Dicksonia* are at most fully pinnate at the base of the pinnules, and even then the basal segments are sessile. — Type: *P.J. Edwards 4370* with *R.J. Johns, A. Hidayat, P. Rudall, D. Tekege, T.M.A. Utteridge, F.R. Willis* (holo K 18 sheets; iso BO), Indonesia, Papua [Irian Jaya], Freeport Concession Area, ridge next to main road, about 1 km above Tembagapura, 2300 m, 3 Apr. 1999.

Etymology. Named for Timothy M.A. Utteridge, head of Identification and Naming Department at The Royal Botanic Gardens Kew, in recognition of his work to promote botanical knowledge and the floristic exploration of New Guinea.

Tree fern, terrestrial. *Trunks* 1.4 m tall; vascular tissue solenostelic; 8–10 cm diam, covered in old, blackish petiole bases, these sticking out between the brown hairs and adventitious roots, without skirt of old fronds; adventitious buds presumably regular, type plant with three separate crowns departing from main trunk at 0.8 m above ground. *Fronds* to c. 360 cm long, with ascending petioles and arching to distally drooping blades. *Petioles* 60–90 cm long, dark brown to black, covered with setiform, reddish to dark brown hairs to 2.5 cm long, stiffly spreading, hairs dense at base but thinning in most parts of the petiole, persistent at bases, cinnamon-brown undercoat of matted tortuous, at least partially catenate hairs, extending from petiole base through all frond axes, soon worn off in exposed parts. *Laminae* to c. 270 by 150 cm, coriaceous, glossy dark green adaxially, subglossy olive-green abaxially, tripinnate-pinnatifid to quadripinnate-pinnatifid, elliptic, gradually reduced apically, widest pinnae at the middle, the basal pinnae c. 1/3 the length of the longest pinnae, not reflexed; weakly dimorphic, fertile parts with slightly reduced green tissue, occurring patchily in central and lower parts. *Leaf axes*

¹ Nees-Institut für Biodiversität der Pflanzen, Rheinische-Friedrich-Wilhelms Universität Bonn, Meckenheimer Allee 170, D-53115 Bonn, Germany; corresponding author e-mail: mlehnert@uni-bonn.de.

² Royal Botanic Gardens Kew, Richmond, Surrey, TW9 3AE, UK.

(rachises, costae and costules) with easily worn-off coat of matted hairs like on the petiole, remaining longest in the axils of pinnae and pinnules, epidermis shiny blackish brown where exposed, scabrous to verrucose with bases of abraded larger hairs. *Pinnae* to 77 by 36 cm, subsessile to short-stalked 1.0–1.5 cm, oblong-lanceolate with attenuate tips, with basal basiscopic pinnules much reduced, c. 10 pinna pairs per frond. *Largest pinnules* to 19.0 by 9.5 cm, stalked to 1.4 cm, ovate-lanceolate to triangular, basally \pm truncate to weakly cordate with segments weakly reflexed, apically long-acute to attenuate. *Segments* to 45 by 15 mm, free and short stalked to 2 mm except for pinnule tip, oblong to elongate with obtuse to rounded tips, pinnatifid to (almost) pinnate basally, free lobes patent, adnate lobes oblique; *sterile segments* with weakly revolute crenate margins, lobes appearing subentire or entire; *fertile segments* more deeply incised between the sori, the lobe tips often more deeply crenate than those of sterile segments. *Veins* prominent on both sides, midveins of segments and lobes ridged adaxially, veins glabrous except for segment midveins, adaxially with antrorsely curved, dark reddish hairs to 1.0 mm long, abaxially hairs softer, originally denser but also more ephemeral, antrorsely curved to matted, to 1.5 mm long. *Sori* 1.5–2.0 mm wide, 1 or 2 (or 3) pairs per lobe, kidney-shaped when closed, \pm round when opened, at the end of unbranched lateral veins; indusia bivalved, outer one greenish to brownish, with dark brown cartilaginous margin, inner one dark brown with slightly erose margins and some hyaline cells; paraphyses longer than sporangia, catenate, tortuous, whitish, hyaline, with a red clavate tip. *Spores* white to pale yellow, with reticulate perispore; ultrastructure not investigated.

Distribution — Only known from the type locality in central New Guinea (Prov. Papua, Indonesia).

Habitat & Ecology — Only known from stunted ridge top forests at 2300 m.

Vernacular name — ‘Utteridge’s rough tree fern’, suggested herewith.

Notes — The type of this new species contains a section of the trunk, which shows unmistakably vascular tissue arranged in a solenostele, putatively amphiphloic (= siphonostele). The same type is documented for the non-aborescent *Dicksoniaceae* genera *Calochlaena* and *Lophosoria*, but not for *Dicksonia*. Here the vascular tissue is generally described as corrugated dictyostele (Bower 1926, Kramer 1990), based mainly on observations on the Australo-American clade sensu

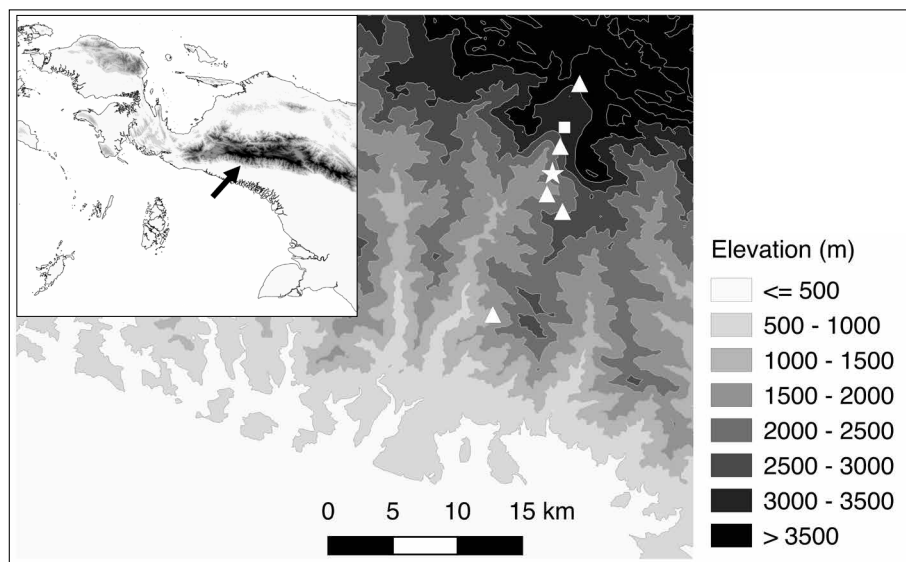
Noben et al. (2017), e.g., *D. sellowiana* Hook. (Tryon & Tryon 1982) and *D. antarctica* Labill., which is traded for horticulture as cut trunks (Hoshizaki & Moran 2001). This corrugated dictyostele can be interpreted as solenostele with more tightly packed leaf traces: *D. antarctica* has fronds in distinct whorls in short distance whereas *D. utteridgei* supposedly has them in a wider spiral around the trunk, as observed in most New Guinean taxa. A complete survey of trunk sections may reveal a phylogenetic signal in the development of the stele type.

Among the New Guinean *Dicksonia*, *D. utteridgei* is regarded a close ally of *D. archboldii* Copel. based on the dark axes, the stiff, brittle red petiole hairs and the thick cinnamon brown undercoat. Petiole material alone would be indistinguishable but *D. utteridgei* has a unique laminar dissection (Fig. 1); much more strongly divided (tripinnate-pinnatifid to quadripinnate-pinnatifid vs bipinnate-pinnatifid to tripinnate) and with blunter ultimate segments (vs tips acute, in fertile segments coarsely serrate).

Dicksonia utteridgei is currently only known from the Mt Jaya region, where it grows near two species that are more widespread on the island, the already mentioned *D. archboldii* as well as *D. lanigera* Holttum (Map 1). At Mt Jaya, *D. archboldii* grows between 2175–3800 m, from mid-montane forests to subalpine shrubbery, and *D. lanigera* grows on vertical limestone cliffs at c. 3100 m (Johns 10721, K) but can also be found in forest clearings. *Dicksonia lanigera* cannot be confused with *D. utteridgei* as it differs in all diagnostic characters, having only soft, usually matted reddish hair, basally tapering blades, sessile pinnae and pinnules, green to brown but never notably darkened frond axes, and smaller sori (c. 1 mm wide).

The other New Guinean species with dark axes are easily separated from *D. utteridgei* (as well as from *D. archboldii*) either by size and shape of the fronds (e.g., fronds < 200 cm long, pinnae strongly tapering basally, petiole short in *D. hieronymi* Brause) or by the absence of stiff spreading hairs (e.g., only soft matted cinnamon brown hairs in *D. grandis* Rosenst.).

From the lamina colour, texture and dissection of the penultimate segments, *D. utteridgei* is very similar to *D. arborescens* L’Hér. from St. Helena Island; smaller pinnules of *D. arborescens* may look very much like larger tertiary segments of *D. utteridgei*. This similarity is particularly interesting considering the fact that in the latest phylogeny (Noben et al. 2017), all hitherto described New Guinean *Dicksonia* species are resolved as crown group in a clade to which *D. arborescens* and the endemics from Juan



Map 1 Distribution of *Dicksonia archboldii* Copel. (△), *D. lanigera* Holttum (□) and *D. utteridgei* Lehnert & Cámara-Leret (☆) in the Mt Jaya region, Papua province, Indonesia.

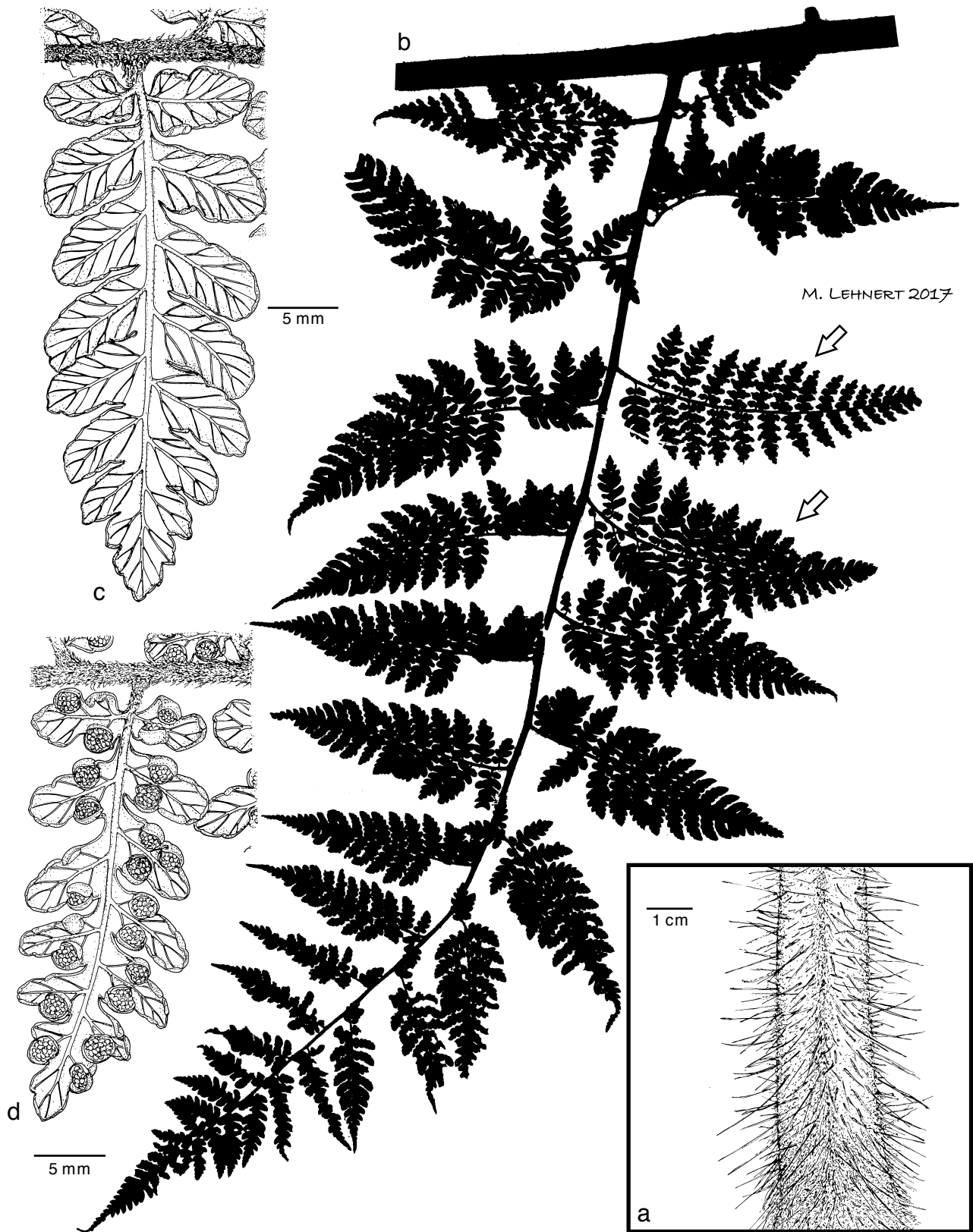


Fig. 1 *Dicksonia utteridgei* Lehnert & Cámara-Leret. a. Petiole; b. medial pinna (c. 56 cm long), mostly sterile, arrows indicate pinnules that are partially fertile; c. sterile tertiary segment abaxially; d. fertile tertiary segment abaxially (*P.J. Edwards 4370* (holo), K). — Drawing by M. Lehnert (BONN), 2017.

Fernández form the sister taxon, with the remaining Australian (i.e., *D. herberti* W.Hill, *D. youngiae* C.Moore ex Baker) and western Malesian taxa (i.e., *D. blumei* (Kunze) T.Moore, *D. mollis* Holttum, etc.) are resolved as paraphylum between them. The addition of *D. utteridgei* to the phylogeny could change the ancestral area reconstruction if it does not group with the other New Guinean species but instead more closely to *D. arborescens*. If both were resolved as sister species, as morphology suggests, it would imply a relatively recent long distance dispersal between New Guinea and St Helena over several thousand kilometres without settling in other areas of suitable vegetation found in between. Currently, it seems most plausible to postulate an ancestral trans-Antarctic distribution of this group (the Malesian clade sensu Noben et al. 2017), which got fragmented by the glaciation of Antarctica that started by the end of the Eocene (c. 35 Mya) and was complete by the mid-Miocene (c. 15 Mya). The Australian population would have given rise to the remainder of the Malesian species, while the South American population would have spread to the neighbouring oceanic islands (age 15–5 My) before going extinct on the mainland (Noben et al. 2017). In the same timeframe falls the split between Old World and New World taxa of the Australo-American clade (Noben et al. 2017).

Acknowledgements We thank the staff at the herbarium K, especially Sally Dawson, as well as the corps of volunteers. Financial support for ML's fieldtrips to New Guinea by the German Research Foundation (DFG grants to Lehnert LE 1826/3 and Quandt QU 153/7) and the Swiss National Fund (SNF grants to Kessler 31003A_125468/1 and 310030L_14906/1) is greatly acknowledged. Herbarium research at Kew was supported by a SYNTHESYS grant (GB-TAF-6305) <http://www.synthesys.info/>, which was financed by the European Community Research Infrastructure Action under the FP7 'Capacities' Program.

REFERENCES

- Adjie B, Kurniawan A, Sahashi N, et al. 2012. *Dicksonia timorensis* (Dicksoniaceae), a hemi-epiphytic new species of tree fern endemic on Timor Island, Indonesia. *Reinwardtia* 13: 357–362.
- Bower FO. 1926. The ferns (Filicales). Cambridge University Press.
- Brownsey PJ, Perrie LR. 2014. Taxonomic notes on the New Zealand flora: recognition of two subspecies in *Dicksonia lanata*. *New Zealand Journal of Botany* 52: 343–351.
- Guymer GP. 1982. *Dicksonia herbertii* W.Hill: an earlier name for *D. youngiae* C.Moore ex Baker. *Australian Systematic Botany Society Newsletter* 32: 13.
- Holttum RE. 1962. New species of tree ferns (*Cyathea* Sm. and *Dicksonia* L'Hérit.). *Kew Bulletin* 16 (1): 51–64.
- Holttum RE. 1963. Cyatheaceae. *Flora Malesiana*, Ser. II, 2: 65–176.
- Hoshizaki BJ, Moran RC. 2001. Fern grower's manual (revised and expanded edition). Timber Press, Portland, Oregon.
- Jones DL. 1984. *Dicksonia herbertii* W.Hill and *D. youngiae* C.Moore ex Baker are different species. *Australian Systematic Botany Society Newsletter* 39: 20–21.
- Kramer KU. 1990. Dicksoniaceae. In: Kramer KU, Green PS (vol. eds), *Pteridophytes and Gymnosperms*. In: Kubitzki K (ed), *The families and genera of vascular plants*. Springer, Berlin & New York.
- Noben S, Kessler M, Quandt D, et al. 2017. Biogeography of the Gondwanan tree fern family Dicksoniaceae – A tale of vicariance, dispersal and extinction. *Journal of Biogeography* 44 (11): 2648–2659.
- Noben S, Lehnert M. 2013. The genus *Dicksonia* (Dicksoniaceae) in the western Pacific. *Phytotaxa* 155: 23–34.
- PPG I. 2016. A community-derived classification for extant ferns. *Journal of Systematics and Evolution* 54: 561–705.
- Thiers B. continuously updated. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/> (acc. 27 Sept. 2017).
- Tryon RM, Tryon AF. 1982. *Ferns and allied plants*. Springer, Berlin.