



***Lijndenia udzungwarum* (Melastomataceae—Olisbeoideae): a new, endemic species from the Udzungwa Mountains of southern Tanzania**

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Abstract

Lijndenia udzungwarum R.D. Stone & Q. Luke, a shrub or small tree of Tanzania's Udzungwa Mountains, is described and illustrated. The placement of the new species in *Lijndenia* is indicated by its trinervate, papillose-muricate leaves and persistent bracteoles partially fused to form a cupule immediately subtending each flower. The cordate leaves of *L. udzungwarum* are unique in the genus. From the East African *L. brenanii* (A. Fern. & R. Fern.) Jacq.-Fél. and *L. procteri* (A. Fern. & R. Fern.) Borhidi, the new species is further distinguished by its capitellate inflorescences on long, filiform, axillary peduncles, resembling those of the Sri Lankan *L. capitellata* (Arn.) K. Bremer. Despite its local endemism, *L. udzungwarum* has been assessed as 'Least Concern' according to IUCN criteria, although this assessment is dependent on the continued safeguarding of the Udzungwa Mountains National Park. An identification key is provided for the three currently recognized Tanzanian species of *Lijndenia*.

Introduction

Lijndenia Zoll. & Moritzi in Moritzi (1846: 10) is a small but widespread paleotropical genus with three previously recognized species in tropical Africa, i.e. the western and central African *L. barteri* (J.D. Hooker in Oliver 1871: 462) K. Bremer (1982: 124) as well as the Tanzanian *L. brenanii* (A. Fernandes & R. Fernandes 1960: 71) Jacques-Félix (1985a: 398) and *L. procteri* (A. Fernandes & R. Fernandes 1960: 72) Borhidi (1993: 151). The remaining congeners are in Madagascar (6 spp., Jacques-Félix 1985b) and Sri Lanka (2 spp., Bremer 1988), with the type species *L. laurina* Zoll. & Moritzi in Moritzi (1846: 9) in Malesia, peninsular Thailand and the Philippines (Hughes & Wijedasa 2012). In Borhidi's (1993) treatment there were seven *Lijndenia* species reported for East Africa, but his six new combinations in this genus were made without analysis of taxonomic characters, and five of these species have since been returned to *Warneckea* Gilg (1904: 100) or to *Memecylon* Linnaeus (1753: 349) sensu stricto (cf. Stone & Andreasen 2010, Stone 2014).

In the treatment of Melastomataceae for the *Flora of Tropical East Africa* (Wickens 1975), the species *Lijndenia brenanii* and *L. procteri* were placed in *Memecylon* sensu lato (as *M. brenanii* A. Fern. & R. Fern. and *M. procteri* A. Fern. & R. Fern., respectively). It is clear, however, that these two species do not belong in *Memecylon* sensu stricto (Stone 2014) and are instead properly placed in *Lijndenia* on account of their strongly trinervate to multinervate, papillose-muricate leaves (the distinctive texture owing to the presence of ramiform sclereid idioblasts in the mesophyll). Additional characteristics distinguishing *Lijndenia* from the other memecyloid genera include its inflorescences with a pair of persistent bracteoles fused to form a cupule or "false calyx" immediately subtending each flower; petals unguiculate; ovary strictly unilocular; and embryo curved, with a short hypocotyl and leafy cotyledons, the inner cotyledon bent and rolled around the involute edge of the outer (Zollinger & Moritzi in Moritzi 1846, Jacques-Félix 1977, 1978, 1983, 1985a, 1985b, 1995, Jacques-Félix et al. 1978, Rao & Jacques-Félix 1978, Bremer, 1981, 1982, Rao et al. 1983, Stone 2004). Exclusive monophyly of *Lijndenia* was strongly supported in earlier phylogenetic analyses of the nuclear *GapC* gene (Stone 2006), and is also seen in analyses with denser taxonomic sampling based on sequences of the 5' ETS and ITS regions of nuclear ribosomal DNA (R.D. Stone, unpublished data).

Here we describe a distinctive new *Lijndenia* from the Udzungwa Mountains of southern Tanzania. This species was first collected in the early 1980s and cited by Lovett *et al.* (1988: 882) as “*Memecylon* sp. nov.”, but clearly belongs in *Lijndenia* due to its trinervate, papillose-muricate leaves and persistent, cupulate bracteoles subtending individual flowers. The Udzungwas are part of the Eastern Arc Mountains of Tanzania and Kenya, which have been noted for their high degree of floristic endemism (Rodgers & Homewood 1982a, Iversen 1991, Lovett 1993, Myers *et al.* 2000, Burgess *et al.* 2007).

***Lijndenia udzungwarum* R.D. Stone & Q. Luke, sp. nov. (Fig. 1)**

Type:—TANZANIA. Morogoro region, Kilombero district, Mwanihana Forest Reserve above Sanje village, elev. 1400–1700 m, 10 Oct 1984, D.W. Thomas 3773 (holotype P [P00257930]!, isotypes K!, MO [3298576]!).

Evergreen shrub or small tree 2–3 m high; internodes (0.6–) 1.9–3.3 (–3.8) cm long; young branchlets terete in cross section. Leaves thinly coriaceous, dark green above, somewhat paler below, granular on both surfaces in dried material; petioles c. 1 mm long (rarely obsolete or up to 2 mm); blades ovate, (2.4–) 3.2–5.2 (–5.9) cm long, (0.9–) 1.8–2.8 (–3.2) cm long, rounded at base and broadly cordate, acuminate at apex; acumen c. 1 cm long, obtuse; midnerve impressed on the upper surface, prominent on the lower but becoming progressively narrower toward the leaf apex; lateral nerves much thinner than the midnerve, those of the principal pair curvilinear in the basal half of the blade but becoming weak and intramarginal in the apical half; secondary pair of lateral nerves faintly visible in the basal portion of the blade, intramarginal; transverse veins ± obscure. Inflorescences condensed to 3-flowered heads 5–8 mm in diameter, borne on filiform peduncles 10–20 (–27) mm long in the leaf axils; paired bracts at base of head distinct, ovate-lanceolate, c. 1 mm long; bracteoles suborbicular, cucullate, fused in pairs to form a cupule immediately subtending each of the flowers; pedicels 0; hypantho-calyx obconic, 2 mm long × 2.5 mm wide, the lobes broadly triangular, 0.5 mm long, obtuse-rounded to acute; corolla well exposed in bud, the petals white, broadly ovate-deltate, 2 mm long × 1.5 mm wide, rounded and abruptly acute at apex, truncate at base above the claw 0.5 mm long; anthers c. 1 mm long, ± keeled dorsally and lacking an oil-gland, the pollen sacs fronto-ventral; style 3.5 mm long; top of ovary smooth (interstaminal partitions absent). Berries blue-purple, globose, c. 7 mm in diameter, lacking a persistent calycinal crown.

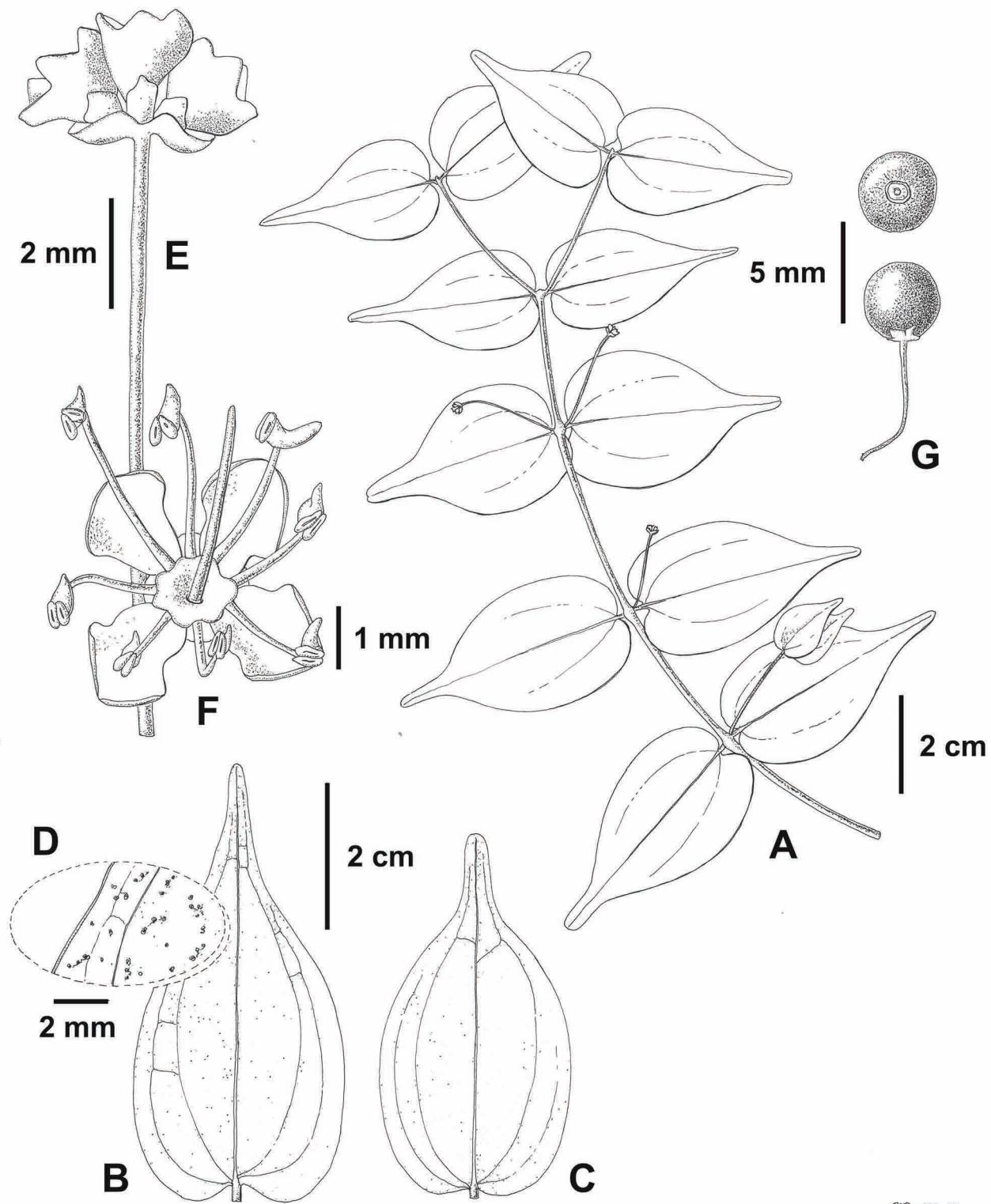
Additional specimens examined (paratypes):—TANZANIA. Udzungwa Mountains National Park, Sonjo–Mwanihana Route, lat. 7°49'S, long. 36°51'E, elev. 1360 m, 8 Nov 1997, Luke 5079 (EA!, K!); Udzungwa Mountains, Nyumbanitu, lat. 7°52'S, long. 36°22'E, elev. 1460 m, 28 Nov 1999, Price & Mhoro WK329 (K!, NHT); Udzungwa Mountains National Park, Mt. Luhombero, lat. 7°47'S, long. 36°32'E, elev. 1350 m, 27 Sep 2000, Luke *et al.* 6700 (BR, CAS!, EA!, K!, NHT); Udzungwa Mountains National Park, lat. 7°48'S, long. 36°49'E, elev. 1600 m, 26 Sep 2001, Luke *et al.* 7839 (CAS!, EA!, K!).

Distribution and habitat:—*Lijndenia udzungwarum* is endemic to the northern part of the Udzungwa Mountains in southern Tanzania (Fig. 2). According to data provided on specimen labels, the habitat of this species is in montane forest at 1350–1700 m elevation.

Of the five collections cited for *L. udzungwarum*, four are from within the boundaries of the Udzungwa Mountains National Park. This protected area, gazetted in 1992, covers almost 2000 km² in the northern Udzungwas and encompasses all of the Mwanihana forest as well as large parts of the Luhombero and Matundu forests.

Three of the collections cited are from the Mwanihana forest, situated along the steep, east-facing escarpment of the northern Udzungwas. This area of approx. 180 km², first gazetted as a Forest Reserve in 1958, includes an estimated 59 km² of forest spanning a wide elevational range (from 300 to 2080 m) and subdivided into lowland, transitional (submontane), montane and upper montane forest types (Rodgers & Homewood 1982b, Lovett *et al.* 1988, Lovett & Pócs 1993a). The label of the type collection (Thomas 3773) clearly states the locality as being in the Mwanihana forest at 1400–1700 m elevation, but the geographic coordinates given (lat. 7°50'S, long. 36°55'E) are incorrect as they would place it at c. 290 m elevation in the Msolwa River valley, east of the Mikumi–Ifakara road. In the Tropicos (2015) specimens database, the coordinates of Thomas 3773 have been revised to lat. 7°47'S, long. 36°52'E.

The fourth collection of *L. udzungwarum* (i.e. Luke *et al.* 6700) is from the Luhombero massif, a remote highland plateau that includes the highest peak in the Udzungwas (elev. 2576 m). This area was previously included in the West Kilombero Scarp Forest Reserve, first gazetted in 1957 and comprising 1953 km² until the northern portion (910 km² including Luhombero) was excised into the Udzungwa Mountains National Park. Vegetation in the area has been generally described as “moist and dry montane and upper montane forest with extensive areas of bamboo and upland grassland with forest patches” (Lovett & Pócs 1993b). The area of natural forest was reported by Rodgers & Homewood (1982b) as 25 km², but this would seem to be an underestimate.



S. Burrows

FIGURE 1. *Lijndenia udzungwarum*. **A.** Flowering branch. **B–C.** Leaves. **D.** Detail of lower leaf surface. **E.** Inflorescence. **F.** Open flower (top view). **G.** Fruit, side & top views (A, C from Luke et al. 6700, CAS; B, D–G from Thomas 3773, K, MO, P). Drawing by Sandie Burrows.

The fifth collection of *L. udzungwarum* (i.e. Price & Mhoro WK329) is from the Nyumbanitu forest, situated in the remaining part of the West Kilombero Scarp Forest Reserve (area 1043 km²) bordering the Udzungwa Mountains National Park on the west. The total forest cover within this reserve is reportedly 305 km², of which 135 km² is found at elevations of 1040–2480 m (Frontier Tanzania 2001). Additional localities for *L. udzungwarum* may yet be found in the Ndundulu and Ukami forests, representing the other two large fragments of montane forest in the reserve.

Phenology:—Flowers in late September to early October. Fruits in October.

Conservation status:—Despite the evident restriction of *L. udzungwarum* to three fragments of montane forest in the northern Udzungwas, the IUCN (2013) has assessed it (as *Lijndenia sp. nov.*) as being of “Least Concern,” citing an absence of documented or observed threats. It was noted however that this assessment is contingent on the continued effectiveness of conservation measures (safeguarding of the Udzungwa Mountains National Park). No new status is proposed in the present work, i.e. the IUCN (2013) assessment of “Least Concern” for *L. udzungwarum* is confirmed.

Etymology:—The species epithet *udzungwarum* is a feminine, plural noun (Declension I) in the genitive case. It is used to indicate geographical origin, i.e. to emphasize that the new species is a local endemic of Tanzania’s Udzungwa Mountains.

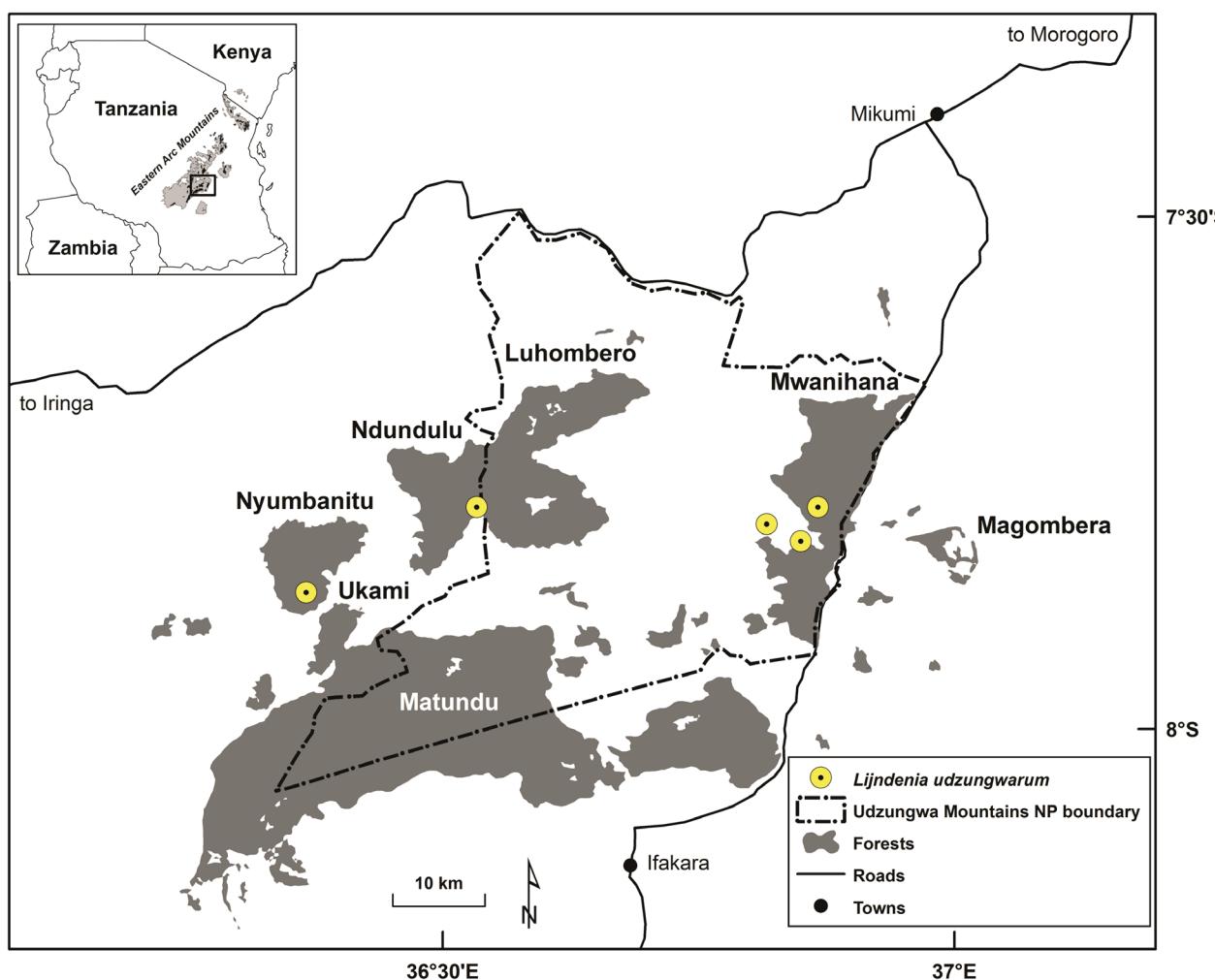


FIGURE 2. Map of the northern Udzungwa Mountains showing known localities for *Lijndenia udzungwarum*. Major forests are named. The inset at upper left shows the location of the Udzungwa Mountains within the Eastern Arc Mountains (in grey, with forest patches shown in black) of Tanzania and Kenya. The Udzungwa Mountains National Park boundary is from the World Database on Protected Areas (IUCN & UNEP-WCMC 2015). Limits of forested areas in the northern Udzungwas are according to a land-use classification by the GIS Services branch of the International Livestock Research Institute (2002). Limits of the Eastern Arc Mountains (inset) are from Platts *et al.* (2011a, 2011b).

Discussion:—From its congeners, *L. udzungwarum* is immediately distinguished by its cordate leaves (vs. leaf-bases cuneate to attenuate or rounded in other *Lijndenia* spp.). The new species further differs from the East African *L. brenanii* and *L. procteri* by its 3-flowered, capitellate inflorescences borne on slender peduncles 10–20 (–27) mm long (vs. inflorescences with up to 11 or more distinctly pedicellate flowers borne on thicker, quadrangular peduncles to 11 mm long and with secondary inflorescence axes to 9 mm long). The inflorescence features of *L. udzungwarum* are most similar to those of the Sri Lankan species, *L. capitellata* (Arnott 1836: 17) K. Bremer (1982: 123), although this would seem to represent a case of morphological convergence as these two species are not believed to be sisters in a phylogenetic sense or even very closely related.

When *L. brenanii* and *L. procteri* were first described under *Memecylon* sensu lato (Fernandes & Fernandes 1960), each species was known from a single collection, the former from Sangarawe in Tanzania's East Usambara Mountains (*Greenway* 3680, holotype EA!, isotype K!, fragment P!), the latter from the Shagayu forest in the West Usambaras (*Procter* 208, holotype EA!, isotypes K!, TFD!). In his key to the species of *Memecylon* sensu lato for the *Flora of Tropical East Africa*, Wickens (1975) contrasted the characters of the inflorescence between these two species (i.e. inflorescence compound in *L. brenanii* vs. simple in *L. procteri*), but the original diagnoses (Fernandes & Fernandes 1960) also noted differences in habit and leaf size, i.e. *L. brenanii* a tree to 18 m high with larger leaves to 7.5 cm long × 4 cm wide, vs. *L. procteri* a shrub to 1.2 m high with smaller leaves to 4.5 cm long × 3 cm wide. Wickens (1975) has suggested that *L. procteri* might only be a shrubby form of *L. brenanii*, but this does not seem to be the case as the two taxa occupy distinct geographic ranges and are diagnosably different (see below for a key to the currently recognized Tanzanian species of *Lijndenia*).

Lijndenia brenanii is evidently an extremely rare species that has been recollected only twice in the Kwamkoro forest near the type locality (*Mgaza* 437, EA!, K!, TFD!; *Ruffo & Mmari* 2213, TFD!). In January 2002, the first author could not relocate *L. brenanii* in spite of several days searching in the East Usambaras, although in the Shume forest (West Usambaras) he did succeed in finding a new *Lijndenia* population currently determined as *L. aff. brenanii* (*Stone et al.* 2438, CAS!, DSM, K!, MO!, NU!, TFD, UPS). These are trees to 15 m high.

Lijndenia procteri has been recollected several times in the Shagayu forest, its only known locality in the West Usambaras (*Mgaza* 616, BR!, EA!, K!, TFD!; *Borhidi et al.* 84-850, MO!, UPS! & 86-040, UPS!; *Iversen* 85-767, UPS!; *Stone et al.* 2440, BR, CAS!, DSM, EA, G, K!, MO!, NU!, P!, PRE, TFD, UC, UPS, US). These are shrubs to 5 m high. In addition, a new population of *L. procteri* has been discovered in the nearby South Pare Mountains (Chome Forest Reserve, *Mwangoka et al.* 1868, CAS!, MO!).

Lijndenia udzungwarum is not the only *Lijndenia* species that has been found in the mountains of southern Tanzania. Several collections from this region have cuneate leaf-bases and relatively large leaves matching those of *L. brenanii* (e.g. *Rodgers* 390, DSM, K!; *Thomas* 3760 & 3916, MO!; *Luke* 5077, K!; *Luke et al.* 9200, EA!, K!; *Ndangalasi* 405, K!; *Abeid et al.* 2438, EA!; *Luke* 12793, EA!, K!; *Marshall et al.* 2072, K!). Other material has smaller leaves resembling those of *L. procteri* (*Kisena & Mmari* 1715, K!; *Luke et al.* 7938, CAS!, EA!, K!; *Luke* 10474, DSM, EA!, K!, MO, NHT; *Luke et al.* 11345, EA!, K!, MO, NHT). The first author has obtained nrDNA spacer sequences from some of these southern Tanzanian populations indicating they represent a distinct evolutionary lineage in comparison to the populations further north in the Usambaras (R.D. Stone, unpublished data). Additional collections and further study are needed to discover any morphological differences that might be used to diagnose the southern populations in comparison with typical *L. brenanii* or *L. procteri*, and also to determine if the larger-leaved and smaller-leaved plants all belong to the same species. There is an indication that the larger-leaved plants in the Udzungwas are found in the understory of submontane or montane forest (700–1800 m elevation) while the smaller-leaved plants occupy ridgetop sites at 1750–1900 m.

Memecylon cogniauxii Gilg (1898: 44) is another Eastern Arc endemic that superficially resembles *L. udzungwarum* in having cordate leaves and axillary inflorescences on long slender peduncles. However, *M. cogniauxii* has apparently uninervate (not trinervate) leaves and clearly belongs in *Memecylon* sensu stricto (see Stone 2014). Furthermore, *M. cogniauxii* is known only from the East Usambara, West Usambara, South Pare, Nguru, and Uluguru mountains; it is not known to occur in or near the Udzungwas.

Key to the species of *Lijndenia* in Tanzania

The identification key provided below includes the new species *L. udzungwarum* described in the present work, as well as the two other currently recognized Tanzanian species of *Lijndenia*. In the *Flora of Tropical East Africa* (Wickens 1975), the latter two species were treated in *Memecylon* sensu lato (see Introduction). Plants resembling *L. brenanii* and *L. procteri* from southern Tanzania (including the Udzungwa Mountains) are not yet fully described (see Discussion), so they are not included in this key.

1. Leaf bases cordate; inflorescences 3-flowered; peduncles slender, 10–20 (–27) mm long; secondary inflorescence axes and pedicels absent. Udzungwa Mountains *L. udzungwarum*
- Leaf bases cuneate to rounded (not cordate); inflorescences with up to 11 or more flowers; peduncles quadrangular, to 11 mm long; secondary inflorescence axes to 9 mm long; pedicels distinct, to 4 mm long 2
2. Habit arboreal (to 18 m high); leaves up to 7.5 cm long × 4 cm wide; cymes once or twice branched, 3–11-flowered, up to 3 cm long; peduncles 5–11 mm long. East Usambara Mountains *L. brenanii*
- Habit fruticose (to 5 m high); leaves up to 4.5 cm long × 3 cm wide; cymes simple (occasionally with an additional axis 1–2 mm long above the peduncle), 1–3-flowered, up to 1.5 cm long; peduncles 2–7 mm long. West Usambara and South Pare mountains.. *L. procteri*

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References

- Arnott, G.A.W. (1836) *Pugillus plantarum indiae orientalis*. Reprinted (possibly preprinted) from *Nova Acta Academia Caesareae Leopoldino-Carolinae Naturae Curiosorum* 18 (1): 319–356.
- Borhidi, A. (1993) *Warneckea hedbergorum* sp. n. (Memecylaceae) and a short review of the East-African *Memecylon* s.l. *Opera Botanica* 121: 149–151.
- Bremer, K. (1981) Seeds and embryos in Sri Lanka (Ceylonese) species of *Memecylon*, with notes on *Spathandra* (Melastomataceae). *Nordic Journal of Botany* 1: 62–65.
<http://dx.doi.org/10.1111/j.1756-1051.1981.tb01036.x>
- Bremer, K. (1982) *Lijndenia*, a re-established paleotropical genus of the Melastomataceae – Memecyleae. *Nordic Journal of Botany* 2: 121–124.
<http://dx.doi.org/10.1111/j.1756-1051.1982.tb01171.x>
- Bremer, K. (1988) Melastomataceae. In: Dassanayake, M.D. (Ed.) *A revised handbook to the flora of Ceylon*, vol. 6. A.A. Balkema, Rotterdam, pp. 157–240.
- Burgess, N.D., Butynski, T.M., Cordeiro, N.J., Doggart, N.H., Fjeldså, J., Howell, K.M., Kilahama, F.B., Loader, S.P., Lovett, J.C., Mbilinyi, B., Menegon, M., Moyer, D.C., Nashanda, E., Perkin, A., Rovero, F., Stanley, W.T. & Stuart S.N. (2007) The biological importance of the Eastern Arc Mountains of Tanzania and Kenya. *Biological Conservation* 134: 209–231.
<http://dx.doi.org/10.1016/j.biocon.2006.08.015>
- Fernandes, A. & Fernandes, R. (1960) Melastomataceae africanae novae vel minus cognitae—IV. *Boletim da Sociedade Broteriana*, sér. 2 34: 59–89 + 26 plates.
- Frontier Tanzania (2001) West Kilombero Scarp Forest Reserve – Botanical and Forest Use Report. In: Doody, K., Howell, K.M. & Fanning, E. (Eds.) *Technical report prepared for the Udzungwa Mountains Forest Management and Biodiversity Conservation Project, MEMA, Iringa, Tanzania*. Available from: <http://www.frontier-publications.co.uk/reports/Tanzania/Forest/Udzungwa1999-2001/>

- FTERWKSFRBotReport1.PDF (accessed 29 May 2015)
- Gilg, E. (1898) Melastomataceae. In: Engler, A. (Ed.) *Monographieen afrikanischer Pflanzen-familien und -gattungen*. Vol. 2. Wilhelm Engelmann, Leipzig. Available from: <http://biodiversitylibrary.org/page/36878512> (accessed 31 August 2015)
- Gilg, E. (1904) Drei interessante Melastomataceae aus Deutsch-Ostafrika. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 34: 99–102. Available from: <http://www.biodiversitylibrary.org/item/697#page/107/mode/1up> (accessed 31 August 2015)
- Hooker, J.D. (1871) Melastomaceae. In: Oliver, D. (Ed.) *Flora of Tropical Africa*, vol. 2. L. Reeve & Co., London, pp. 439–464. Available from: <http://www.biodiversitylibrary.org/item/124#page/445/mode/1up> (accessed 31 August 2015)
- Hughes, M. & Wijedasa, L.S. (2012) *Memecylaceae of Thailand and Peninsular Malaysia*. Available from: <http://elmer.rbge.org.uk/memecylaceae/> (accessed 22 November 2013)
- International Livestock Research Institute, GIS Services (2002) Tanzania landuse. Available from: <http://192.156.137.110/gis/search.asp?id=543> (accessed 25 January 2015)
- IUCN SSC East African Plants Red List Authority (2013) *Lijndenia* sp. nov. The IUCN Red List of Threatened Species, version 2014.3. Available from: www.iucnredlist.org (accessed 20 March 2015)
- IUCN & UNEP-WCMC (2015) *World database on protected areas* (WDPA), version 9 March 2015. United Nations Environment Programme, World Conservation Monitoring Centre, Cambridge, U.K. Available from: www.protectedplanet.net (accessed 31 March 2015)
- Iversen, S.T. (1991) The Usambara Mountains, NE Tanzania: phytogeography of the vascular plant flora. Ph.D. dissertation, Uppsala University, Sweden. *Acta Universitatis Upsalienses, Symbolae Botanicae Upsalienses* 29: 3.
- Jacques-Félix, H. (1977) La graine et l'embryon chez les *Memecylon* (Mélastomatacées) africains. *Adansonia*, sér. 2 17: 193–200. Available from: http://www.bhl-europe.eu/static/a0prr52q/a0prr52q_full_pdf.pdf (accessed 31 August 2015)
- Jacques-Félix, H. (1978) Les genres de Memecyleae (Melastomataceae) en Afrique, Madagascar et Mascareignes. *Adansonia*, sér. 2 18: 221–235. Available from: http://www.bhl-europe.eu/static/a0rfj6vj/a0rfj6vj_full_pdf.pdf (accessed 31 August 2015)
- Jacques-Félix, H. (1983) Mélastomatacées. In: Satabié, B. & Leroy, J.-F. (Eds.) *Flore du Cameroun*. Vol. 24. Délégation Générale à la Recherche Scientifique et Technique, Yaoundé.
- Jacques-Félix, H. (1985a) Les Memecyleae (Melastomataceae) de Madagascar (1^{re} partie). *Bulletin du Muséum national d'Histoire naturelle (Paris)*, 4^e sér., sect. B (*Adansonia*) 6: 383–451. Available from: <http://www.biodiversitylibrary.org/item/49419#page/400/mode/1up> (accessed 31 August 2015)
- Jacques-Félix, H. (1985b) Les Memecyleae (Melastomataceae) de Madagascar (2^e partie). *Bulletin du Muséum national d'Histoire naturelle (Paris)*, 4^e sér., sect. B (*Adansonia*) 7: 3–58. Available from: <http://www.biodiversitylibrary.org/item/49405#page/5/mode/1up> (accessed 31 August 2015)
- Jacques-Félix, H. (1995) Histoire des Melastomataceae d'Afrique. *Bulletin du Muséum national d'Histoire naturelle (Paris)*, 4^e sér., sect. B (*Adansonia*) 16: 235–311. Available from: <http://www.biodiversitylibrary.org/item/49406#page/403/mode/1up> (accessed 31 August 2015)
- Jacques-Félix, H., Mouton, J.A. & Chalopin, M. (1978) Nervation et types foliares chez les *Memecylon* (Melast.) africains. *Adansonia*, sér. 2 18: 67–81. Available from: http://www.bhl-europe.eu/static/a01vhpx/a01vhpx_full_pdf.pdf (accessed 31 August 2015)
- Linnaeus, C. (1753) *Species plantarum*. Laurentius Salvius, Stockholm.
<http://dx.doi.org/10.5962/bhl.title.669>
- Lovett, J.C. (1993) Eastern Arc moist forest flora. In: Lovett, J.C. & Wasser, S.K. (Eds.) *Biogeography and ecology of the rain forests of eastern Africa*. Cambridge University Press, pp. 33–55.
<http://dx.doi.org/10.1017/cbo9780511895692.004>
- Lovett, J.C., Bridson, D.M. & Thomas, D.W. (1988) A preliminary list of the moist forest angiosperm flora of Mwanihana Forest Reserve, Tanzania. *Annals of the Missouri Botanical Garden* 75: 874–885.
<http://dx.doi.org/10.2307/2399376>
- Lovett, J.C. & Pócs, T. (1993a) *Assessment of the condition of the Catchment Forest Reserves, a botanical appraisal*. Morogoro Region. Technical report prepared for the Catchment Forestry Project (under the Forestry and Beekeeping Division of the Ministry of Tourism, Natural Resources and Environment, Tanzania). Available from: <http://celp.org.uk/webpages/projects/ecology/forest%20reserves/pdf/moro.pdf> (accessed 3 September 2015)
- Lovett, J.C. & Pócs, T. (1993b) *Assessment of the condition of the Catchment Forest Reserves, a botanical appraisal*. Iringa Region. Technical report prepared for the Catchment Forestry Project (under the Forestry and Beekeeping Division of the Ministry of Tourism, Natural Resources and Environment, Tanzania). Available from: <http://celp.org.uk/webpages/projects/ecology/forest%20reserves/pdf/Iringa.pdf> (accessed 3 September 2015)
- Moritz, A. (1846) *Systematisches Verzeichniss der von H. Zollinger in den Jahren 1842 – 1844 auf Java gesammelten Pflanzen*. Verfassers, Solothurn. Available from: http://reader.digitale-sammlungen.de/de/fs1/object/display/bsb10302557_00005.html (accessed 31 August 2015)

- Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B. & Kent, J. (2000) Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
<http://dx.doi.org/10.1038/35002501>
- Platts, P.J., Burgess, N.D., Gereau, R.E., Lovett, J.C., Marshall, A.R., McClean, C.J., Pellikka, P.K.E., Swetnam, R.D. & Marchant, R. (2011a) Delimiting tropical mountain ecoregions for conservation. *Environmental Conservation* 38: 312–324.
<http://dx.doi.org/10.1017/S0376892911000191>
- Platts, P.J., Burgess, N.D., Gereau, R.E., Lovett, J.C., Marshall, A.R., McClean, C.J., Pellikka, P.K.E., Swetnam, R.D. & Marchant, R. (2011b) Shapefiles for the Eastern Arc Mountains in Tanzania and Kenya. *Environmental Conservation* 38 (3): 312–324.
<http://dx.doi.org/10.5061/dryad.c5310>
- Rao, T.A. & Jacques-Félix, H. (1978) Les types de sclérates foliaires et la classification des *Memecylon* africains. *Adansonia, sér. 2* 18: 59–66. Available from: http://www.bhl-europe.eu/static/a05mkm09/a05mkm09_full_pdf.pdf (accessed 31 August 2015)
- Rao, T.A., Bremer, K. & Naidu, T.R.B. (1983) Foliar sclereids in *Memecylon* and *Lijndenia* (Melastomataceae) from Borneo, Java, Malaya and Sumatra. *Nordic Journal of Botany* 3: 343–345.
<http://dx.doi.org/10.1111/j.1756-1051.1983.tb01947.x>
- Rodgers, W.A. & Homewood, K.M. (1982a) Species richness and endemism in the Usambara mountain forests, Tanzania. *Biological Journal of the Linnean Society* 18: 192–242.
<http://dx.doi.org/10.1111/j.1095-8312.1982.tb02037.x>
- Rodgers, W.A. & Homewood, K.M. (1982b) Biological values and conservation prospects for the forests and primate populations of the Uzungwa Mountains, Tanzania. *Biological Conservation* 24: 285–304.
[http://dx.doi.org/10.1016/0006-3207\(82\)90016-7](http://dx.doi.org/10.1016/0006-3207(82)90016-7)
- Stone, R.D. (2004) *Phylogenetic systematics of Melastomataceae, subfamily Olisbeoideae*. Ph.D. dissertation, University of California, Berkeley.
- Stone, R.D. (2006) Phylogeny of major lineages in Melastomataceae, subfamily Olisbeoideae: utility of nuclear glyceraldehyde 3-phosphate dehydrogenase (*GapC*) gene sequences. *Systematic Botany* 31: 107–121.
<http://dx.doi.org/10.1600/036364406775971741>
- Stone, R.D. (2014) The species-rich, paleotropical genus *Memecylon* (Melastomataceae): molecular phylogenetics and revised infrageneric classification of the African species. *Taxon* 63: 539–561.
<http://dx.doi.org/10.12705/633.10>
- Stone, R.D. & Andreasen, K. (2010) The Afro-Madagascan genus *Warneckea* (Melastomataceae): molecular systematics and revised infrageneric classification. *Taxon* 59: 83–92.
- Tropicos (2015) Missouri Botanical Garden, Saint Louis, USA. Available from: <http://www.tropicos.org> (accessed 20 Aug. 2015)
- Wickens, G.E. (1975) Melastomataceae. In: Polhill, R.M. (Ed.) *Flora of Tropical East Africa*. Crown Agents for Oversea Governments and Administrations, London.