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FOUR NEW SPECIES OF *CYRTANDRA* (GESNERIACEAE) FROM THE LATIMOJONG MOUNTAINS, SOUTH SULAWESI

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Four new species of *Cyrtandra* (Gesneriaceae) from the Latimojong Mountains, South Sulawesi (Sulawesi Selatan) are described and illustrated: *C. floccosa* R.Bone & H.J.Atkins, *C. kjellbergii* R.Bone & H.J.Atkins, *C. purpureofucata* R.Bone & H.J.Atkins, and *C. spectabilis* R.Bone & H.J.Atkins. Conservation recommendations are made for the four species.

Keywords. Cyrtandra, Gesneriaceae, Latimojong Mountains, new species, Sulawesi.

Introduction

There are currently 24 species of *Cyrtandra* J.R.Forst. & G.Forst. (Gesneriaceae–Didymocarpoideae–Cyrtandreae) recorded from Sulawesi (including those newly described here), and more await description. The four species described here all grow in the Latimojong Mountains, South Sulawesi (Fig. 1), in the vicinity of Gunung Rantemario (the highest point on the island; 3478 m a.s.l.), in Montane or Tropalpine habitats (*sensu* Cannon *et al.*, 2007). However, the flora of Sulawesi is poorly known (Mendum & Atkins, 2004) and additional undescribed species may well be found in the future.

South Sulawesi has the highest density of anthropogenic pressure on the island, and both lowland and upland vegetation has been extensively converted or cleared. At higher altitudes (> 1500 m a.s.l.) the Montane and Tropalpine forest types were classed as the least endangered in a recent study by Cannon *et al.* (2007). Even at these altitudes, however, land is in demand for small-scale agricultural plots, which include coffee plantations. Anthropogenic disturbance now extends into the 510 km² Pegunungan Latimojong Protection Forest (IUCN VI) east of Buntu Rantemario (Fig. 1; Thomas *et al.*, 2009).

In addition to the four new species of *Cyrtandra* described here, new species in other plant groups, such as *Begonia*, have been found on recent expeditions to the area (Thomas *et al.*, 2009, 2011). Further exploration of this region could significantly increase our knowledge of the *Cyrtandra* flora of Sulawesi. However, effective

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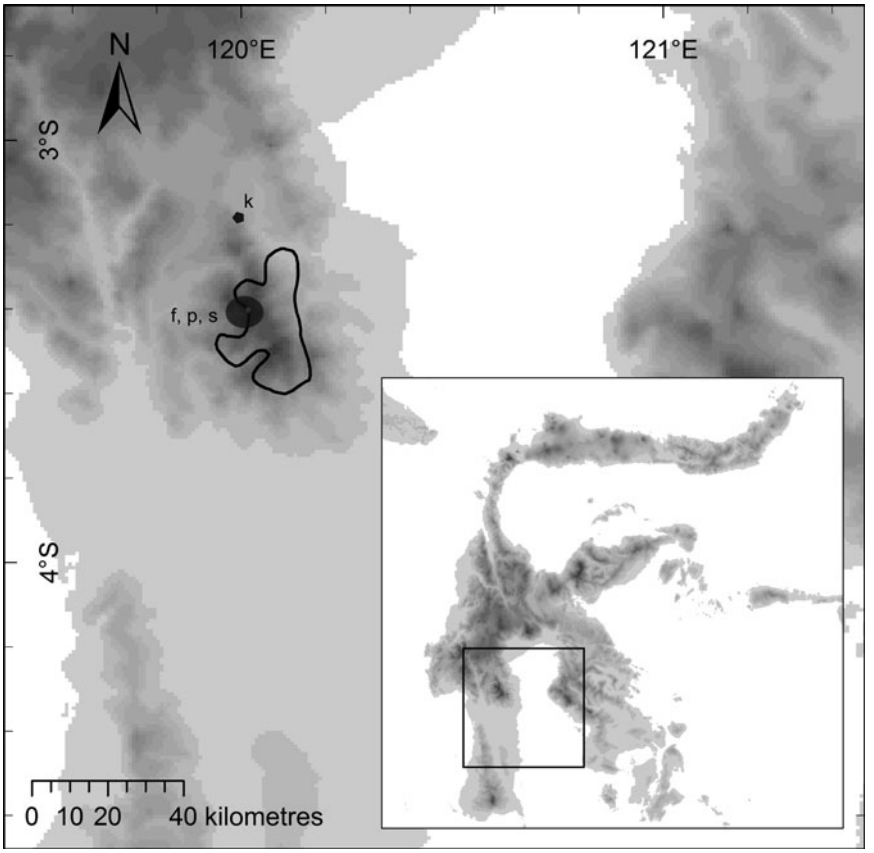


FIG. 1. Distribution map showing collection localities for four new species of *Cyrtandra*. *Cyrtandra floccosa* (f), *C. purpureofucata* (p) and *C. spectabilis* (s) are all known from specimens collected in the vicinity of Gunung Rantemario in the area highlighted by a grey ellipse. *Cyrtandra kjellbergii* (k) is represented by a single specimen from Buntu Poka Pindjang to the north. The boundary of the Pegunungan Latimojong Protection Forest is shown as a continuous black line. Topographical variation is indicated by five shades of grey: 0–500 m (the lightest shade), 500–1000 m, 1000–1500 m, 1500–2000 m, and 2000 m (the darkest shade).

conservation measures are needed if montane vegetation is not to suffer the same fate as that of lower altitudes. High species-level endemism is reported for the Didymocarpoideae (as Cyrtandroideae − Mendum & Atkins, 2004) and, given the altitudinal and topographical barriers to gene flow in Montane and Tropalpine habitats, it is likely that many *Cyrtandra* species will have narrow distributions.

MATERIALS AND METHODS

All available *Cyrtandra* specimens from A, BM, BO, CANB, E, K, L and S were examined. Material was compared using a binocular microscope and flowers were dissected

after boiling (cf. Bridson & Foreman, 2004). In addition, photographs of plants growing in the field were consulted when available. A lack of collecting activity in Sulawesi, compared to other Indonesian islands (Cannon *et al.*, 2007), means that little material is available for comparison. All material cited (as type material and, when available, additional specimens) comprises the extent of our knowledge of these species.

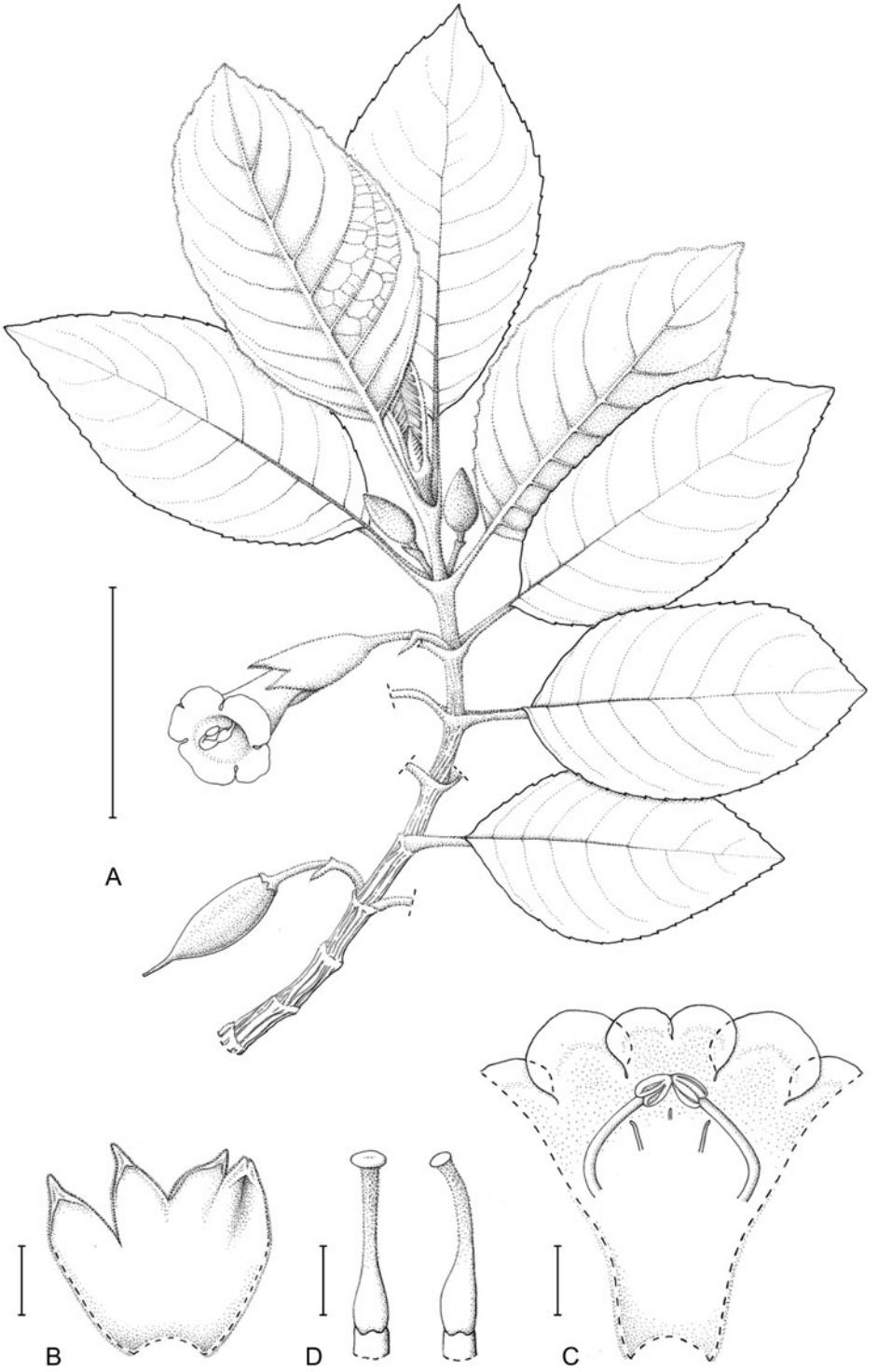
Proposals for IUCN conservation categories were made following the *IUCN Red List Categories and Criteria* (IUCN, 2012). Forest types (Montane and Tropalpine) referred to in these notes follow the definitions stated in Cannon *et al.* (2007). When more than two collection localities were known for a species, precise geographical coordinates of collection localities from specimen labels, or geo-referenced place names, were used to estimate extent of occurrence (EOO) and area of occupancy (AOO; *sensu* IUCN criterion B1) using a 2 km by 2 km grid cell in GeoCAT (Bachman *et al.*, 2011). Because the Latimojong Mountains are underexplored (and these species undersampled) these calculations probably underestimate true EOO and AOO values. However, we feel that their inclusion helps to emphasise the urgent need for more extensive surveying in the region to adequately assess threats to these species.

Species Descriptions

Cyrtandra floccosa R.Bone & H.J.Atkins, **sp. nov. Fig. 2.**

Differs from other species in South Sulawesi by the presence of a 'rusty' floccose indumentum, the large fleshy yellow flowers borne on a distinct peduncle, and the leaves drying black. − Type: Sulawesi, Gunung Rantemario, 2940 m, 26 iv 2009, *D.C. Thomas & W.H. Ardi* 09-90 (holo E; iso BO, L).

Shrub or tree 2−4 m. *Stems* strongly fenestrated, often with conspicuous swollen nodes, glabrescent, densely orange-floccose, rusty coloured when young. *Leaves* isophyllous; petiole 12–25 mm, orange-floccose; lamina somewhat coriaceous, usually drying dark brown or black, elliptic to ovate, 6.5–13 × 3–6 cm, apex acute, base acute or rounded, 7−9 pairs of secondary veins, margin crenate to serrate, apex of teeth acute or obtuse, primary and secondary veins of upper and lower surface sparsely to densely orange-floccose, lower surface orange-floccose between veins, juvenile leaves more densely hairy, venation of lower leaf surface conspicuous. *Inflorescences* in leaf axils, 1-flowered; bracts 3–5(−7) mm, at junction of peduncle and pedicel, triangular to ligulate, leafy (with midrib); peduncle c.6–11 mm; pedicels 7–20 mm, densely orange-floccose. *Calyx* olive green, coriaceous, tubular, bilabiate, 19–34 mm, densely orange-floccose outside, dividing into lobes at apex, the two lateral lobes splitting on ventral side of corolla at c.1/3 to 1/2 of length of the calyx; lobes c.8–16 mm, acute, the three dorsal lobes united ± to apex forming what appears to be one large dorsal sepal with a tri-dentate apex (sometimes obscure). *Corolla* 26–45 mm, lemon yellow, fleshy, orange-floccose to glabrescent outside, becoming sparsely hairy distally at ends of lobes, glabrous inside at base becoming glandular-hairy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distally; tube narrow at base, widening and becoming slightly pouched at c.1/3 of length, limb 5-lobed; lobes reflexed, two small dorsal lobes c.5 mm long, two large lateral lobes c.12 mm long, one ventral lobe c.7 mm long. *Stamens* 2, borne c.20 mm from base of corolla tube; filaments glabrous?, 9–10 mm long; anther thecae cohering at tips before and during dehiscence, becoming free, 3–4 mm long (when dehiscing), dehiscing longitudinally; staminodes 3. *Disk* c.4 mm, cupular, undulate with 5 shallow lobes. *Gynoecium* c.29 mm; ovary glabrous; style sparsely glandular-hairy at base, becoming dense distally; stigma large, c.3 mm wide, peltate, surface densely papillose; stigma and stamens visible beyond corolla mouth. *Fruit* green, drying black, 15–25 × 6–8 mm, elliptic, glabrous; calyx usually not persistent in fruit.

Distribution. Indonesia: Sulawesi Selatan: Gunung Rantemario and Latimojong Mountains, above 2500 m.

Habitat and ecology. On steep, mossy slope, Tropalpine forest with ferns, tree ferns, Ericaceae (including *Rhododendron* spp.), *Podocarpus* spp.

Etymology. The specific epithet refers to the floccose indumentum that characterises this species. It is particularly dense on juvenile leaves and shoots.

Proposed IUCN conservation category. Least Concern (LC). *Cyrtandra floccosa* has been collected on three different botanical expeditions in the Latimojong Mountains (in 1929, 1969 and 2009). It occurs in the same habitat type and altitudinal range as *Cyrtandra purpureofucata* (Tropalpine vegetation at > 2500 m a.s.l.) in and around the western boundary of the Pegunungan Latimojong Protection Forest. Because this habitat type is in good condition and not considered at risk (Cannon *et al.*, 2007; D. C. Thomas, pers. comm., 2012), and due to the natural protection afforded to this area by the steep and inaccessible terrain, we consider it unlikely that this species is in decline.

Based solely on the EOO and AOO this species would be in the Endangered Category (based on 2 km × 2 km grid cell size) under the B criteria. However, threats to the survival of the species cannot be identified, thereby not fulfilling the criteria needed for any of the threat categories. Further survey work in the region is required to assess population size and health for this species and enable more accurate application of the IUCN criteria.

Additional specimens examined. INDONESIA. **South Sulawesi**: Gunung Rantemario, 2788 m, 26 iv 2009, *D.C. Thomas & W.H. Ardi* 09-89 (BO, E, L); B. Rante Mario, 3000 m, 1929, *Kjellberg* 4046 (BO, S); Latimojong Mts south of Ninimori, 2950 m, 23 x 1969, *Sands* 296 (E, K); ibid., *Sands* 344 (K).

FIG. 2. *Cyrtandra floccosa* R.Bone & H.J.Atkins. A, habit; B, calyx; C, corolla showing positions of the stamens and staminodes; D, gynoecium and disk. Scale bars: A = 5 cm; B–D = 1 cm. Drawn by Claire Banks.

Cyrtandra kjellbergii R.Bone & H.J.Atkins, **sp. nov. Fig. 3.**

Similar to *Cyrtandra engleri* Koorders from the north of Sulawesi in both being shrubs with strongly anisophyllous leaves and densely hairy calyces, corollas and fruits but differs in corolla colour (white in *C. engleri* vs. yellow in *C. kjellbergii*) and leaf margin (subentire to serrulate in *C. engleri* vs. deeply incised in *C. kjellbergii*). − Type: Sulawesi, B. Poka Pindjang, 2300 m, river bank, 27 v 1929, *Kjellberg* 1459 (holo BO; iso S).

Shrub. *Stems* terete, glabrescent, densely tomentose when young. *Leaves* subequal to markedly anisophyllous; petiole 4–6 mm, sparsely whitish orange hairy; larger leaf lamina herbaceous, elliptic to obovate, 4–6 × 1.9–3 cm, base cuneate, 4−5 pairs of secondary veins, margin deeply incised with c.3–7 lobes along each margin, glabrous to sparsely ciliate, upper surface very sparsely pilose, lower surface sparsely hairy on primary and secondary veins, glabrescent between veins, hairs whitish. *Inflorescences* in leaf axils, 1-flowered; bracts c.2 mm, often caducous, elliptic to ligulate, hairy; peduncle absent; pedicels 5–10 mm, sparsely hairy. *Calyx* bilabiate, c.6–11 mm, pilose; lobes connate at base, c.2–5 mm, caudate. *Corolla* 28 mm, sulphur yellow, pilose outside, glabrous inside; tube narrow, ± parallel-sided, widening slightly towards mouth, limb 5-lobed; upper lobes c.5 × 3 mm, the two adjacent dorsal lobes orbicular, c.5 mm × 4.5 mm, the two ventral lobes connate along central axis, c.5 × 3 mm. *Stamens* 2, borne c.17 mm from base of corolla; filaments glabrous, 9–10 mm long; anther thecae free at maturity (when dehiscing), 1–1.5 mm long; staminodes 3, one highly reduced, glabrous. *Disk* c.1 mm, cupular, undulate, glabrous outside. *Gynoecium* 16–20 mm long; ovary densely long whitish orange villous; style glabrescent to sparsely hairy, hairs glandular; stigma capitate, 1 mm wide, surface papillose. *Fruit* 12–13 × 4–5 mm, conical, narrowing to tip formed by persistent style, indumentum sparse, orange; calyx usually persistent.

Distribution. Indonesia: South Sulawesi: Subdivision Enrekang, c.3°30′S, 120°00′E. Known only from the type.

Habitat and ecology. Recorded from a river bank at 2300 m.

Etymology. This species is named after Gunnar Konstantin Kjellberg (1885–1943), who made an important botanical investigation of Sulawesi in 1929.

Proposed IUCN conservation category. Near Threatened (NT). *Cyrtandra kjellbergii* is known only from the type material, collected in 1929 at 2300 m a.s.l. The collection locality is not in a protected area or national park (Fig. 1) and little is known about the habitat of this species (only 'river bank' was recorded on the specimen label). The altitude suggests that it grows in the Montane forest type (1500−2500 m) although nothing is known of the associated vegetation. Cannon *et al.* (2007) rank Montane forests as being at low risk. However, Thomas *et al.* (2011) report 'moderate to strong anthropogenic disturbance' in primary forest between 1300 m and 2200 m a.s.l., with some species persisting in primary forest remnants rather than occurring in extensive forested areas.

A lack of specimens of *Cyrtandra kjellbergii* precludes estimations of EOO and AOO. Until more intensive botanical exploration can be made of this area it is assumed that this species is restricted to the type locality. If the threats to the area are real (specifically forest clearance for agriculture) then the only known population of this species could be at risk of decline or extinction in the near future. However, for the time being, we cannot comment on latent threats to the population with any certainty. We recommend that this species is categorised as Near Threatened (NT), but again emphasise the importance of carrying out further survey work in this region.

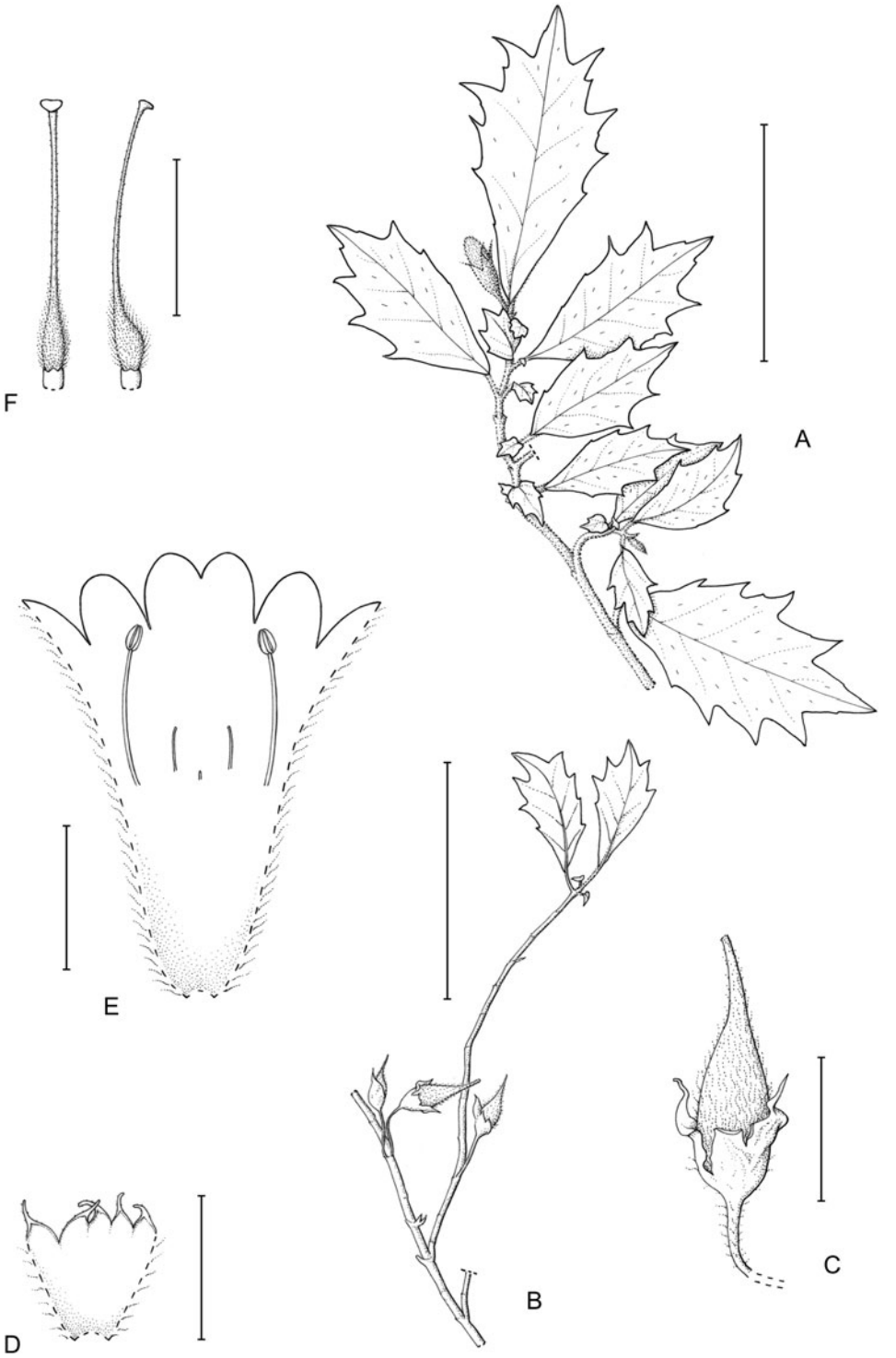
Cyrtandra purpureofucata R.Bone & H.J.Atkins, **sp. nov. Fig. 4.**

Differs from other species in Sulawesi by its unusual urceolate, villous corolla with strongly reflexed purple lobes. − Type: Sulawesi Selatan, Gunung Rantemario, 2788 m, on mossy steep slope Tropalpine forest with ferns, tree ferns, Ericaceae, 26 iv 2009, *D.C. Thomas & W.H. Ardi* 09-88 (holo E; iso BO, L).

Herb or shrub 1−4 m. *Stems* woody, terete, warty, orange-pilose, densely so when young. *Leaves* subequal to markedly anisophyllous or pseudo-alternate; petiole 6–10 mm, orange-brown pilose; larger leaf lamina herbaceous, drying olive-green to grey, elliptic to somewhat obovate, 4.5–10 × 1.5–3 cm, apex attenuate to acuminate, base cuneate, margin serrate, upper surface glabrous, lower surface with appressed pilose hairs on primary and secondary veins, glabrescent between veins, juvenile leaves more densely hairy. *Inflorescences* in leaf axils, 1-flowered, pendulous; bracts 2–5 mm long, sometimes caducous?, triangular to linear-attenuate; peduncle absent; pedicels 5–19 mm, densely orange-silky. *Calyx* green, coriaceous, 11–15 mm, hairy with orange villous silky hairs shorter than those on corolla tube, ± evenly 5-lobed but with the division on the ventral side being deeper than all other divisions, connate at base; lobes 4–10 mm, apex narrowly caudate to linear. *Corolla* 25–37 mm, deep pink externally, pale pink internally with dark purple lobes, densely villous outside becoming sparsely glandular-hairy on lobes; tube narrow in basal half becoming wider and pouched in apical half, narrowing again at mouth, limb 5-lobed; lobes strongly reflexed, the three dorsal lobes being slightly larger than the ventral two, c.4 × 4 mm. *Stamens* 2, borne c.20 mm from base of corolla; filaments glabrous, or with tuft of hairs at point of fusion with corolla tube, 9–11 mm long; anther thecae facing one another and cohering at tips before dehiscence, free at maturity, 1–2 mm long; staminodes 3, one reduced. *Disk* c.2 mm, cupular, undulate with broad rounded lobes, lobes long-ciliate with non-glandular hairs, glabrous outside. *Gynoecium* 25–32 mm; ovary and style densely hairy, hairs non-glandular; stigma capitate to flattened. *Fruit* c.35 × 6 mm wide, narrowly ovate, asymmetric, narrowing to tip formed by persistent style, pilose, thick-walled, many seeded; seeds c.0.4 × 0.25 mm, brown, elliptic.

Distribution. Indonesia: South Sulawesi: Tinabang.

Habitat and ecology. On mossy, steep slopes in Tropalpine forest at 2500–3000 m.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Etymology. The epithet *purpureofucata*, meaning painted purple, refers to the reflexed corolla lobes.

Proposed IUCN conservation category. Least Concern (LC). *Cyrtandra purpureofucata* has been collected on botanical expeditions to montane areas of South Sulawesi in 1929, 1937 and more recently in 2000 and 2009. All four specimens were collected in Tropalpine vegetation at 2500–3000 m a.s.l., including one collecting locality within the Pegunungan Latimojong Protection Forest (Fig. 1). The type locality lies just outside the western boundary of this National Park and is described as steep sloping ground with Tropalpine vegetation of ferns and Ericaceae forming 'pristine primary forest', where the only anthropogenic disturbances are hiking and camping groups who clear vegetation along the single hiking trail to the summit of Gunung Rantemario (D. C. Thomas, pers. comm., 2012). In addition, Tropalpine and Montane forests were ranked as the least endangered habitats of Sulawesi by Cannon *et al.* (2007), with a high proportion of Tropalpine forest classed as 'Great to Good' in quality.

Based solely on the EOO and AOO this species would be within the Endangered Category (EOO < 5000 km^2; AOO < 500 km^2) under the B criteria. However, the lack of identifiable threats or evidence of decline precludes application of any of the IUCN threat categories. However, surveys should urgently be carried out in the region to determine the size and health of the population so that the criteria can be applied more rigorously.

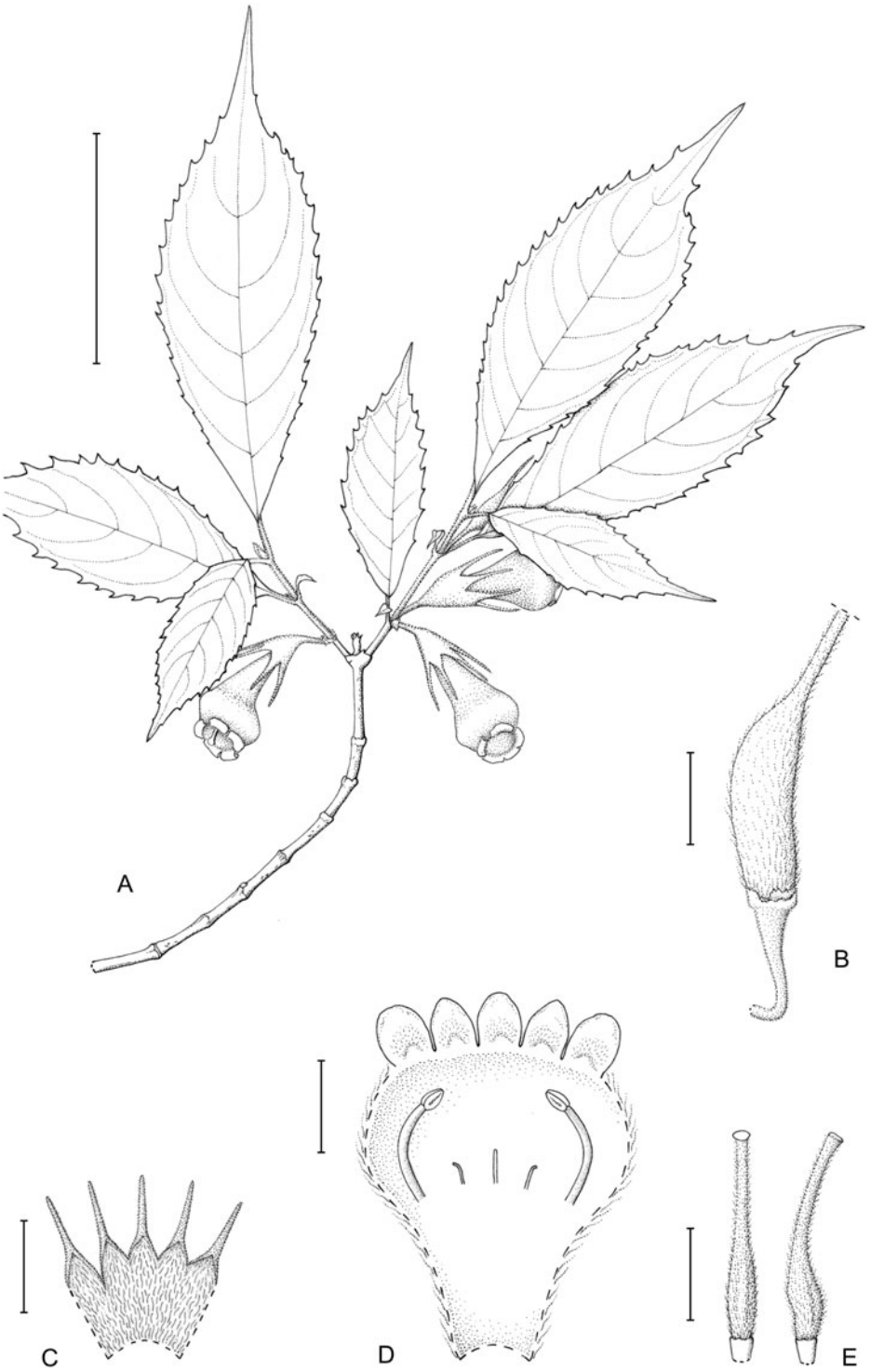
Additional specimens examined. INDONESIA. **South Sulawesi**: Tinabang, West side of the Rante Mario, 3000 m, 17 vi 1937, *Eyma* 696 (A, BO, K, L); Rantemario, above Rantelemo, 2800 m, 6 iii 2000, *Mendum, Argent & Hendrian* 00252 (BO, E, K, L); B. Rante Mario [Buntu Rantemario], 2500 m, vi 1929, *Kjellberg* 4039 (BO, S).

In phylogenetic analysis of ITS sequences, *Cyrtandra purpureofucata* was resolved in a moderately supported clade (bootstrap 85%) with *C. roseiflora* H.J.Atkins from Sulawesi and several unidentified *Cyrtandra* spp. from southern and northern Sulawesi, Papua, West Papua and the northern Philippines. This suggests an eastern affinity for this species (as opposed to a Malaysia-Borneo affinity; Bone, 2003).

Cyrtandra spectabilis R.Bone & H.J.Atkins, **sp. nov. Fig. 5.**

Differs from other species in Sulawesi by its pendulous flowers, borne either in cauliflorous clusters or solitary in the axils, delicate maroon calyx and yellow corolla. − Type: Sulawesi, Subdivision Enrekang District, Latimojong Mountains, c.1.5 km to the north of Bunte Tjejeng, 1900 m, 1 xi 1969, *Sands* 331 (holo E; iso K).

FIG. 3. *Cyrtandra kjellbergii* R.Bone & H.J.Atkins. A, habit; B, fruits on stem; C, fruit; D, calyx; E, corolla showing positions of the stamens and staminodes; F, gynoecium and disk. Scale bars: A, B = 5 cm; C−F = 1 cm. Drawn by Claire Banks.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Erect, spreading shrub to 2.5 m. *Stems* terete, glabrescent or with short brown hairs. *Leaves* anisophyllous or pseudo-alternate; petiole 4–10 mm, woolly, hairs whitish to brown; larger leaf lamina herbaceous, 8−11 × 2−3.2 cm, narrowly elliptic to narrowly obovate, apex acute, base cuneate, 5−7 pairs of secondary veins, margin serrate, serrations irregularly and distantly spaced (c.5–24 mm apart), apex of teeth acute to acuminate, with small tufts of hair at apex, upper surface glabrous, lower surface with pilose woolly indumentum on primary and secondary veins, hairs whitish to pale brown, glabrescent to pilose between veins, juvenile leaves more densely hairy. *Inflorescences* in leaf axils, 1-flowered, or cauliflorous fascicles of up to 7 pendulous flowers; bracts c.2–3 mm, linear to oblanceolate, woolly, indumentum whitish-orange, leafy (with midrib); peduncle short, 2–4 mm, woolly, indumentum whitish-orange; pedicel 30–40 mm, slender, glabrescent to sparsely woolly, indumentum whitish-orange. *Calyx* maroon, drying dark purplish brown, membranaceous, bilabiate, 20–25 mm, split on ventral side c.1/4 to 1/2 the length of the calyx, dorsal sepals fused to at least 3/4 length of calyx, free distally, glabrescent or sparsely pilose, indumentum whitish; lobes c.4–7 mm (in immature flowers the calyx is not so deeply divided on the ventral side and the calyx is more obscurely bilabiate), apex broad acuminate. *Corolla* 30–40 mm, very pale lemon yellow to cream, glabrous inside, pilose to villous or cobwebbed externally, indumentum whitish-orange; tube narrow at base, gradually widening to mouth, lobes c.7 × 6 mm. *Stamens* 2, cream, borne c.24 mm from base; filaments glabrous, 11 mm long; anther thecae cohering at tips becoming free (on?) after anthesis, 1.5 mm long; staminodes 3, one highly reduced, glabrous. *Disk* c.1.2 mm, cupular, undulate with irregular broad, shallow lobes, glabrous. *Gynoecium* c.30 mm; ovary densely long villous, indumentum whitish, non-glandular; style white, sparsely glandular-hairy, indumentum orange; stigma c.0.8 mm wide, light green, peltate, stigma and stamens reaching corolla mouth but not protruding beyond it in specimen seen. *Fruits* not seen.

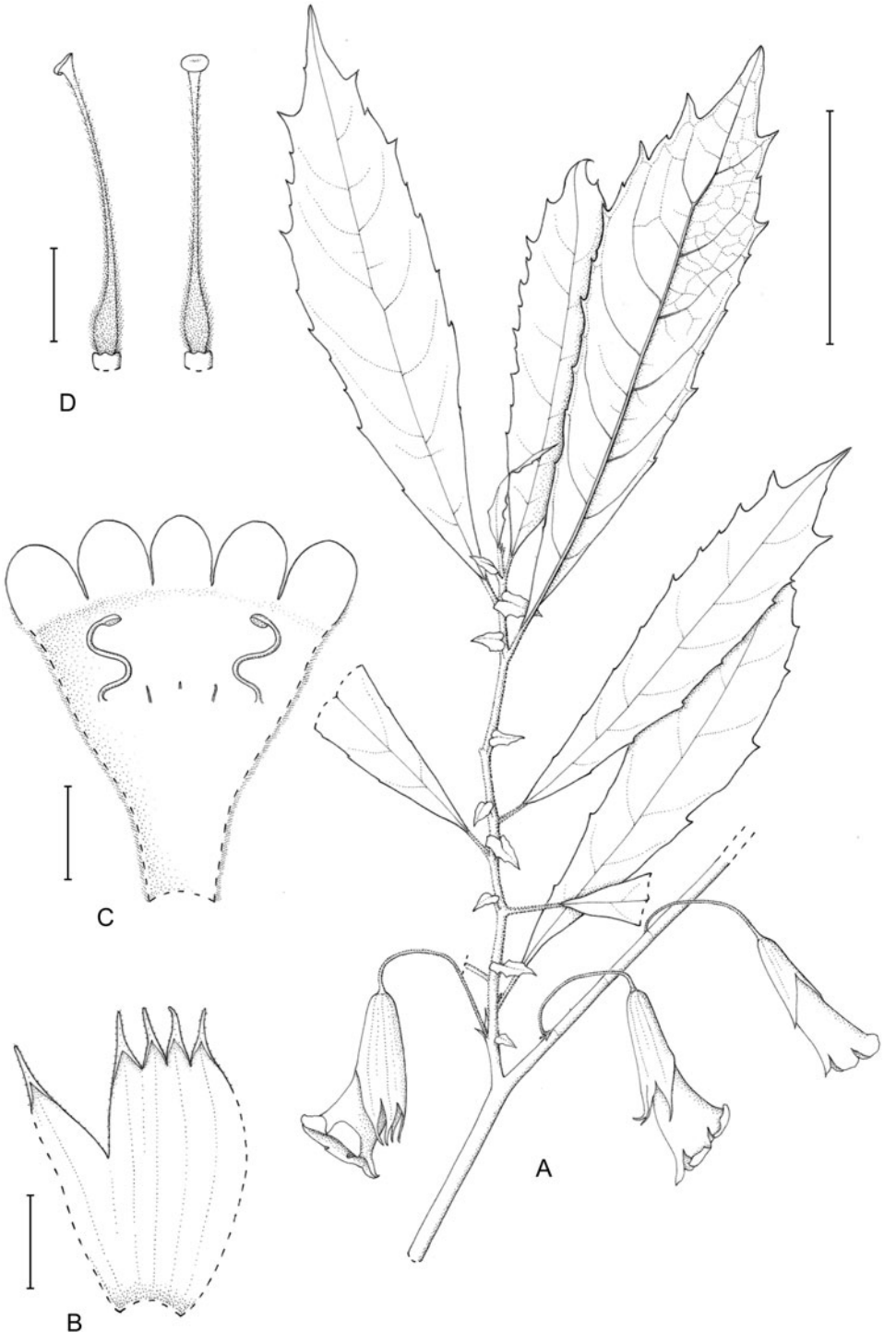
Distribution. Indonesia: South Sulawesi: Latimojong Mountains, c.1.5 km to the north of Bunte Tjejeng. Known only from the type.

Habitat and ecology. Reported from a valley of mixed oak–*Podocarpus* montane forest on a steep landslide above a stream in deep shade on heavy loam and stone.

Etymology. The specific epithet, *spectabilis*, meaning attractive, is used here to describe the striking pendulous flower with yellow corolla and maroon membranaceous calyx.

Proposed IUCN conservation category. Near Threatened (NT). *Cyrtandra spectabilis* is known only from the type material, collected in 1969, to the west of the Pegunungan Latimojong Protection Forest boundary (Fig. 1). Information on the specimen label suggests good quality vegetation at that time (mixed oak–*Podocarpus* montane forest).

FIG. 4. *Cyrtandra purpureofucata* R.Bone & H.J.Atkins. A, habit; B, fruit; C, calyx; D, corolla showing positions of the stamens and staminodes; E, gynoecium and disk. Scale bars: A = 5 cm; B−E = 1 cm. Drawn by Claire Banks.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Although Cannon *et al.* (2007) rank the threats to Montane forests as low, 'moderate to strong anthropogenic disturbance' has been reported in primary forest in the Latimojong Mountains at between 1300 m and 2200 m a.s.l. (Thomas *et al.*, 2011).

A lack of specimens of *Cyrtandra spectabilis* precludes estimations of EOO and AOO. As with all other species described in this paper, more intensive botanical exploration is needed in the region before thorough conservation assessments can be made. Like *Cyrtandra kjellbergii*, it is assumed that *C. spectabilis* is restricted to the type locality but a lack of information means that specific threats to this species cannot be accurately assessed. Given the reported anthropogenic disturbances in this habitat type (Thomas *et al.*, 2011), however, we consider this species to be at risk due to habitat destruction. We therefore suggest that this species is categorised as Near Threatened (NT).

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Fig. 5. *Cyrtandra spectabilis* R.Bone & H.J.Atkins. A, habit; B, calyx; C, corolla showing positions of the stamens and staminodes; D, gynoecium and disk. Scale bars: A = 5 cm; B–D = 1 cm. Drawn by Claire Banks.

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