

Chusquea montisylvicola (Poaceae: Bambusoideae), a new species endemic to the Andes of southern Ecuador

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With an estimated 191 species, the Neotropical woody bamboo genus *Chusquea* has centers of species richness in both the Andes and in Brazil. Thirty-one species of *Chusquea* are documented for Ecuador, and of these 11 are considered endemic. We reviewed collections of narrow-leaved species of *Chusquea* from southern Ecuador, and determined that several of these represent a new species morphologically similar to *C. leonardiorum*, another species endemic to this region. We here describe and illustrate *Chusquea montisylvicola*, named for its usual occurrence in montane forests, and compare it to *C. leonardiorum*. *Chusquea montisylvicola* is distinguished based on the combination of a number of vegetative and reproductive features, including: internodes strongly sulcate for the full length; culm leaves basally glabrous and \pm reaching the next node; subsidiary branches 35–80 per node; foliage leaf sheaths with summit extensions 0.2–1 mm on both sides; foliage leaf blades with regularly serrulate margins with teeth 4–6/mm; spikelets with glumes I and II developed; glumes III and IV subulate with a prominent mid-nerve; and glume IV 2/3 to equaling the spikelet length. The new species is classified within *Chusquea* sect. *Chusquea*.

INTRODUCTION

With three publications from 2019 describing new species of the Neotropical woody bamboo *Chusquea* Kunth (Clark & Mason 2019; Fadrique et al. 2019; Guerreiro et al. 2019), the genus comprises an estimated 191 species (including *C. dombeyana* Kunth, from Peru). Clark & Mason (2019) noted the species richness of *Chusquea* in both the Andes and Brazil, and focused in particular on Ecuador, for which 31 species are confirmed, of which 11 are endemic. Although Clark & Mason (2019) indicated that Ecuador shares five species with Peru, the two countries actually share six species (*C. falcata* L.G. Clark, *C. fimbriiligulata* L.G. Clark, *C. exasperata* L.G. Clark, *C. neurophylla* L.G. Clark, *C. scandens* Kunth and *C. tovarii* L.G. Clark) and possibly seven, if *C. uniflora* Steud. is confirmed to occur in Peru. Specimens from southern Ecuador have been annotated as *Chusquea dombeyana* (Clark, pers. obs.), but given the uncertainty in the application of this name, we here exclude it from consideration. It seems likely that *C. polyclados* Pilger, currently known only from northern Peru, will also occur in southern Ecuador, but this remains to be confirmed. *C. serrulata* Pilger is expected in northern Ecuador, but has not been confirmed as occurring outside of Colombia.

As part of ongoing work on a treatment of the bamboos of Ecuador, we reviewed collections of a narrow-leaved

species of *Chusquea* from southern Ecuador resembling *C. leonardiorum* L.G. Clark (Clark, 1996). Although these two species share extravaginal branching, a triangular central bud, a prominent supranodal ridge and many subsidiary branches per node in addition to narrow foliage leaf blades, they differ in a number of other vegetative and reproductive characters. Moreover, whereas *C. leonardiorum* tends to inhabit elfin forests and páramo, the other species is primarily found in somewhat lower elevational communities, including upper montane forests, but occasionally extends into elfin forests or subpáramo. The morphological and ecological differentiation of the montane forest entity is sufficient to warrant recognizing it as a new species, which we here describe and illustrate. With this species, Ecuador is now confirmed to have 32 species of *Chusquea*, 12 of them being endemic.

TAXONOMIC TREATMENT

***Chusquea montisylvicola* L.G. Clark & A.D. Kaul**, sp. nov. TYPE: ECUADOR. Loja: Parque Nacional Podocarpus, Cajanuma, Sendero al Mirador, 04°05'S, 79°10'W, 2900 m, 1 Jun 1992 (fl), L.G. Clark, S. Laegaard & M.J. Stern 1106 (Holotype: QCA! 2 sheets; Isotypes: AAU, ISC).

Diagnosis. *Chusquea montisylvicola* is most similar to *C. leonardiorum* but differs by the following combination of features: internodes strongly sulcate for the full length; supranodal ridge prominent, swollen; culm leaves basally glabrous and \pm reaching the next node; subsidiary buds (20–) 30–60 per node in 1–2 constellate rows; subsidiary branches 35–80 per node; foliage leaf sheaths with summit extensions 0.2–1 mm on both sides; foliage leaf blades 0.2–0.4 (–0.6) cm wide with L:W = (7–) 10–41 (–61) and regularly serrulate margins with teeth 4–6/mm; synflorescences (3.5–) 6–13 (–15) cm long, narrow; spikelets 5–8 mm long with glumes I and II developed [collectively 0.2–1.2 (–2) mm long]; glumes III and IV subulate with a prominent mid-nerve; and glume IV 2/3 to equaling the spikelet length.

Description. **Culms** (0.6–) 2–4 (–5) m tall, 0.8–2 cm diam., erect at the base and arching or scrambling to scandent above; internodes 4–12 (–19) cm long, \pm deeply sulcate for the full length but often becoming shallower toward the next node, glabrous, with a white waxy band below the node when young. **Culm leaves** (7.8–) 11–17 (–19.5) cm long, \pm reaching the next node, rarely surpassing it, loosely wrapped around the culm, chartaceous to \pm coriaceous, the juncture of the sheath and blade an inverted “V”, abaxially obscure; sheaths 6–13 (–16.7) cm long, (2.4–) 3–6 cm wide, 0.6–4 (–6) times longer than the blade, abaxially retrorsely scabrous but glabrous toward the summit and base, the margins slightly scarios, glabrous, not fused at the base; girdle 0.5–1 mm long, glabrous; inner ligule 0.5–3 mm long, longest in the center, chartaceous, marginally ciliate; blades (2–) 3–8 (–10.8) cm long, erect, persistent, abaxially glabrous, triangular, linear to slightly cordate at the base, no median nerve visible, the margins scarios, apex usually long attenuate. **Nodes** at mid-culm with one triangular central bud subtended by (20–) 30–60 smaller subsidiary buds in 1–2 constellate rows; nodal line nearly horizontal, dipping only slightly below the bud/branch complement; supranodal ridge swollen, prominent. **Branching** extravaginal; central branch often developing but only after the subsidiaries; leafy subsidiary branches 35–80 per node, 0.5–1 mm diam., often geniculate near the base but then straight, spreading, rebranching from the very base but not above, farinose when young. **Foliage leaves** 3–5 per complement; sheaths striate, glabrous, rarely pubescent between the nerves, the summit prolonged on each side for 0.2–1 mm, occasionally asymmetrically so, adnate to the inner ligule, the margins usually glabrous; pseudopetiole 1–2 mm long but indistinct; outer ligule 0.1–0.2 mm long, glabrous; inner ligule 0.5–1 mm long, slightly asymmetrical, apically entire to erose; blades (2–) 4–15.3 cm long, 0.2–0.4 (–0.6) cm wide, L:W = (7–)10–41 (–61), linear, lax (shade) to \pm stiff (sun), adaxially glabrous or scabrous-pubescent along the midrib or scabrous-pubescent for the full length

between the midrib and the narrow-side margin, not tessellate, abaxially glabrous but the nerves with fine prickles along their full length, not tessellate or weakly so, usually somewhat glaucous, the nerves projecting on both surfaces, with the midrib somewhat more prominent than the rest, the base attenuate, the margins regularly serrulate with 4–6 teeth/mm, the apex tapering, subulate. **Synflorescences** (3.5–) 6–13 (–15) cm long, paniculate, narrow, the base retained within the subtending leaf sheath; rachis angular, glabrous; branches angular, glabrous, the basal-most branch subtended (and the rachis encircled) by a glabrous papery bract. **Spikelets** 5–8 mm long, 1.3–1.5 mm wide, laterally compressed; glume I 0.2–0.7 (–1) mm long, glume II (0.4–) 0.7–1.2 (–2) mm long; glumes III and IV subulate, slightly navicular, abaxially glabrous, 3- or 5-nerved, the midnerve prominent; glume III 3.1–5.5 mm long, 1/2–2/3 the spikelet length; glume IV 3.8–5.9 mm long, 2/3 to equaling the spikelet length; lemma 5.2–7.1 mm long, shortly subulate or mucronate, navicular, 7-nerved, the nerves equal, becoming more prominent toward the apex; palea 4.6–6.7 mm long, bimucronate, 4-nerved, the central 2 nerves more prominent, distinctly sulcate toward the apex. Lodicules 3. Stamens 3; anthers ca. 3 mm long. Mature fruit unknown.

Etymology. This species is named for the upper montane forest habitat in which it usually grows.

Distribution and Habitat. *Chusquea montisylvicola* is endemic to southern Ecuador in the provinces of Loja and Zamora-Chinchipe at elevations from 2600 to 3125 m usually in upper montane forests but sometimes also elfin forests and subpáramo, including in disturbed areas on paths, roads and exposed ridges.

Phenology. Seven flowering collections have been examined from the years 1985, 1990, 1992, 1996, and 1998. There were two collections each in 1985 and 1992 and there were also vegetative collections in each of these years except for 1992. Flowering collections from the Cajanuma sector of Podocarpus National Park were made in 1990, 1992 and 1998, whereas flowering collections from the Yangana-Cerro Toledo sector were made in 1985 and 1996. Like many other *Chusquea*, *C. montisylvicola* is likely to be a gregarious and cyclical bloomer, but even with multiple flowering collections from the same populations, the overall pattern is unclear although a short cycle is possible. Given the lack of information about the extent of flowering for some of these collections, it is also possible that some sporadic flowering may occur.

Comments. Although sharing extravaginal branching, a prominent supranodal ridge, numerous subsidiary branches per node and relatively narrow foliage leaf blades with *C. leonardiorum*, *C. montisylvicola* is easily distinguished (Table 1). It has strongly sulcate internodes (vs. internodes deeply sulcate only immediately above the bud/branch

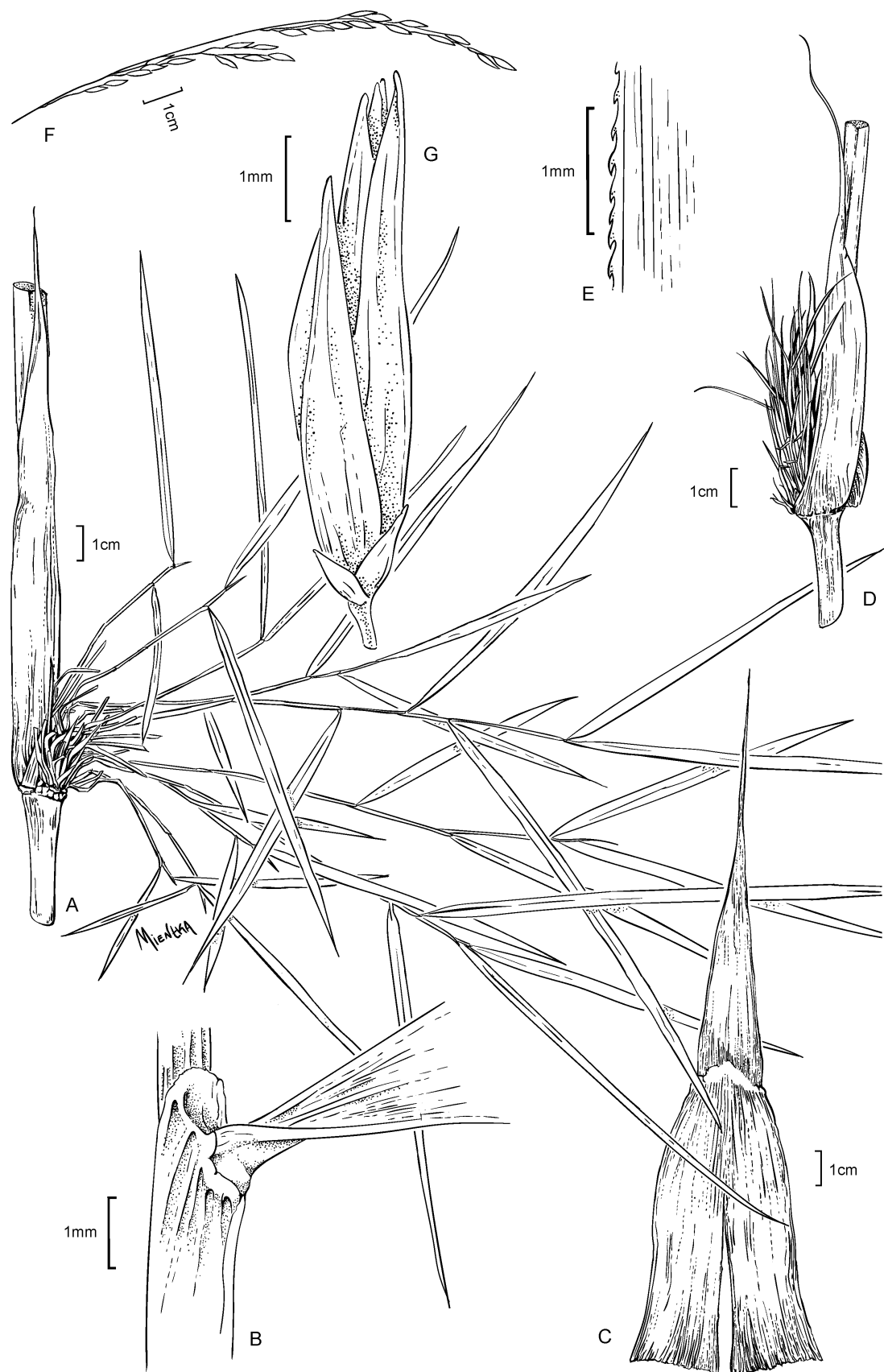


Figure 1. *Chusquea montisylvicola*. A. Branch complement with culm leaf *in situ*. B. Ligular region of a foliage leaf showing the sheath summit extension. C. Culm leaf, adaxial view. D. Extravaginal branching. E. Margin of the foliage leaf blade. F. Synflorescence. G. Spikelet. (A-B. Clark & Asimbaya 1410b; C. Clark & Asimbaya 1423; D. Laegaard et al. 19080; E. Clark et al. 1106; F-G. Clark & Asimbaya 1418) Illustration by S. Mientka.

complement in *C. leonardiorum*); basally glabrous, chartaceous to ± coriaceous culm leaves extending approximately to the next higher node (vs. basally densely hirsute, brittle and often extending for 2 internode lengths); (20–) 30–60 subsidiary buds per node in 1–2 rows (vs. 18–32 per node in usually 3 rows); 35–80 subsidiary branches per node (vs. 80–150); foliage leaf sheaths with summit extensions 0.2–1 mm on each side (vs. usually to 1 mm on one side and 3–4 (–7) mm on the other); foliage leaf blades 0.2–0.4 (–0.6) cm wide with L:W = (7–) 10–41 (–61) and regularly serrulate margins with 4–6 teeth/mm [vs. (0.15–) 0.2–0.3 cm wide with L:W = 43–83 (–104) and irregularly serrulate margins with 0–3 teeth/mm, see Figure 2]; spikelets with glumes I and II developed [collectively 0.2–1.2 (–2) mm long] (vs. up to ca. 0.2 mm long or appearing to be absent); and glume IV 2/3 to equaling the spikelet length (vs. 1/2–2/3 the spikelet length). Given its non-pseudopetiolate and erect culm leaf blades, extravaginal branching, triangular central bud, numerous subsidiary buds in 1–2 constellate rows, linear foliage leaf blades, laterally compressed spikelets and subequal glumes I and II, *C. montisylvicola* is unambiguously classified within *Chusquea* sect. *Chusquea* (Fisher et al. 2009; Attigala et al. 2017).

In general, culm leaf characters, especially the proportion of the sheath to the blade, are taxonomically very useful in distinguishing species of *Chusquea* (e.g., Clark 1989), and may even be useful at the sectional level (Attigala et al. 2017). Although every effort was made to use data from only mid-culm culm leaves for the description of *C. montisylvicola*, the values still exhibit a larger range than would normally be expected. The most consistent characters were the loose wrapping of the sheath around the culm, the abaxial indument, and the length of the culm leaf relative to its internode. Although this species typically inhabits upper montane forests, with more shaded

conditions, it can be found in more exposed elfin forests or even fully exposed in subpáramo or on ridges above the treeline. Sun vs. shade can affect bamboo morphology (March & Clark 2011), and is the likely explanation for this variation in culm leaves, as noted for the texture of the foliage leaf blades in the description above.

While they are morphologically similar, the distribution of *C. montisylvicola* only overlaps with that of *C. leonardiorum* in the province of Loja. They are not known to co-occur in Azuay or Morona-Santiago where *C. leonardiorum* extends, nor in Zamora-Chinchipe where *C. montisylvicola* grows further east than *C. leonardiorum* has been found. Where they co-occur, they are separated somewhat by elevation (Table 1), with *C. montisylvicola* growing at somewhat lower elevations than *C. leonardiorum*, usually in upper montane forest and subpáramo, whereas *C. leonardiorum* is found at somewhat higher elevations in elfin forests and páramo.

Chusquea montisylvicola also overlaps in range and elevation with *C. falcata* L.G. Clark (1993) in both Loja and Zamora-Chinchipe. However, these two species are easily distinguished by the same features that are outlined in Clark (1996) for distinguishing between *C. leonardiorum* and *C. falcata*. *Chusquea falcata* has terete internodes (vs. strongly sulcate in *C. montisylvicola*), a circular central bud (vs. triangular), infravaginal branching (vs. extravaginal), foliage leaf blades 0.4–0.85 cm wide [vs. 0.2–0.4 (–0.6) cm], and falcate spikelets (vs. straight).

Additional specimens examined: ECUADOR. Loja: Parque Nacional Podocarpus, Cajanuma, Sendero Bosque Nublado, 04°05'S, 79°10'W, 2800 m, 1 Jun 1992, *Clark et al. 1102* (ISC, QCA); Parque Nacional Podocarpus, Cajanuma, Sendero al Mirador, 04°05'S, 79°10'W, 2900 m, 1 Jun 1992, *Clark et al. 1104* (ISC, QCA); Parque Nacional Podocarpus, Cajanuma, Sendero al Mirador,

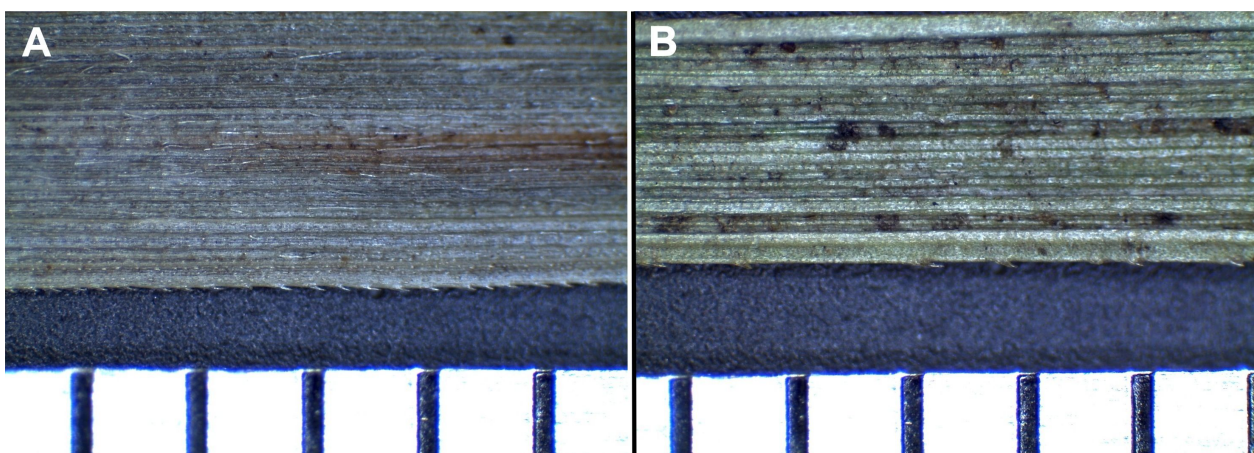


Figure 2. Foliage leaf blade margins in *C. montisylvicola* and *C. leonardiorum*, showing density of the teeth in the mid-portion of the blade. A. Regularly serrulate margin of *C. montisylvicola* (*Clark et al. 1106*). B. Irregularly serrulate margin of *C. leonardiorum* (*Clark & Asimbaya 1404*). Ruler segments 1mm. Images by L.G. Clark.

Character	<i>C. montisylvicola</i>	<i>C. leonardiorum</i>
Internode	Sulcate node to node	Deeply sulcate above the bud/branch complement, becoming shallowly sulcate to flattened above
Culm leaf to internode relative length	Extending to ca. 1 internode length	Extending for >1 internode length, often up to 2 internode lengths
Culm leaf abaxial pubescence	Glabrous	Hirsute base and apex
Culm leaf sheath: blade	0.6–4 (–6)	3–10 (–22)
Number of subsidiary buds per complement	(20–) 30–60	18–32
Number of rows of subsidiary buds per complement	1–2	Usually 3
Number of subsidiary branches per complement	35–80	80–150
Foliage leaf sheath indument	Glabrous, rarely pubescent between the nerves	Pubescent between the nerves
Foliage leaf sheath summit extension	0.2–1 mm, rounded, glabrous	To ca. 1 mm on one side and 3–4 (–7) mm on the other, ciliate
Foliage leaf blade margin	Regularly serrulate, 4–5 teeth/mm	Irregularly serrulate, 0–2 teeth/mm
Foliage leaf blade width (cm)	0.2–0.4 (–0.6)	(0.15–) 0.2–0.3
Foliage leaf blade L:W	(7–) 10–41 (–61)	43–82 (–104)
Glumes 1&2	Developed, 0.2–1.2 (–2) mm	Minute, ca. 0.2 mm to apparently absent
Glume IV relative length	2/3–1	1/2–2/3
Distribution (by province)	Loja, Zamora-Chinchipe	Azuay, Loja, Morona-Santiago
Elevation	2600–3125 m	(2850–) 3050–3500 m

Table 1. Morphological comparison of *C. montisylvicola* and *C. leonardiorum*.

04°05'S, 79°10'W, 3000 m, 1 Jun 1992, *Clark et al. 1107* (ISC, QCA); Parque Nacional Podocarpus, Cajanuma, trail to Mirador above casa de Predesur, 04°05'S, 79°10'W, 2800–2850 m, 9 Feb 1996, *Clark & Asimbaya 1410A, B0* (ISC, QCA); Parque Nacional Podocarpus, entrando por Loja, desde el “Centro de Información” de Cajanuma, subiendo por el camino de las Lagunas del Compadre, después de la segunda quebrada, 04°05'S, 79°12'W, 2810 m, 3 Oct 1995, *Garmendia & Paredes 470* (QCA); Parque Nacional Podocarpus, Cajanuma, at Casa de Predesur, 2850 m, 21 Feb 1985, *Laegaard 53605* (AAU); Along road Yangana – Cerro Toledo, 2900 m, 26 Feb 1985 (fl), *Laegaard 53687* (AAU, QCA); Road Vilcabamba –

Valladolid, at pass on exposed ridge, 2800–2900 m, 28 Feb 1985 (fl), *Laegaard 53755* (AAU); along road Yangana - Cerro Toledo, 04°23'S, 79°07'W, 2850 m, 4 Sep 1985 (fl), *Laegaard 55194* (AAU, QCA); Cajanuma, along trail to El Mirador, 2900 m, 27 Sep 1998 (fl), *Laegaard & Bjerrum 19212* (LOJA, QCA); 17.3 km S of Loja at Parque Nacional Podocarpus Headquarters, growing on loop trail above the headquarters, 04°05'S, 79°10'W, 2830–3100 m, 26 Apr 1990 (fl), *Peterson et al. 8927* (QCA, US); páramo al sur del nudo de Sabanilla, UTM 17 95069000/705500, 3100 m, 15 Sep 1995, *RBu & SL s.n.* (QCA). **Loja/Zamora-Chinchipe:** Parque Nacional Podocarpus, Cerro Toledo, 12.9 km E of Yangana, 4°23'S, 79°08'W,

3050 m, 11 Feb 1996 (fl), *Clark & Asimbaya 1418* (ISC, QCA); Parque Nacional Podocarpus, Cerro Toledo, 13 km E of Yangana, 4°23'S, 79°08'W, 3125 m, 11 Feb 1996, *Clark 1423* (ISC, QCA). **Zamora-Chinchipe:** Road Yangana – Valladolid, 21 km S of Yangana, <1 km S of pass, 4°28'S, 79°09'W, 2800 m, 11 Feb 1996, *Clark & Asimbaya 1431* (ISC, QCA); above Valladolid on road to Yangana, montane rain forest, 04°03'S, 79°07'W, 2700 m, 2 Feb 1985 (fl), *Harling & Andersson 21474* (QCA); road Vilcabamba – Valladolid, km 5 S of provincial border, 04°29'S, 79°09'W, 2400 m, 28 Feb 1985 (fl), *Laegaard 53746* (AAU, QCA); 8 km E of pass on Jimbura – Zumbura road, 04°47'S, 79°24'W, 2940 m, 21 Mar 1998, *Laegaard et al. 18584* (LOJA, QCA); along old Loja – Zamora road ca. 0.5–1 km E of pass, 03°59'S, 79°09'W, 2750 m, 26 Apr 1998, *Laegaard 18742* (LOJA, QCA); Yangana – Valladolid, 5–10 km S of Nudo de Sabanilla, 04°29'S, 79°08'W, 2600 m, 1 Sept 1998, *Laegaard et al. 19080* (AAU, QCA); Cantón Palanda, Reserva Tapichalaca, a lo largo del sendero de los Pericos, bosque siempreverde montano del Sur de la Cordillera Oriental, 04°29'43"S, 79°07'55"W, 2470–2600 m, 20 June 2014 (fl), *Pérez et al. 7132* (QCA).

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