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Chusquea sect. *Tenellae* (Bambuseae, Bambusoideae, Poaceae), a taxonomic revision of a new section from South America

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Abstract

The *Chusquea ramosissima* informal group, including four named species, is classified within *Chusquea* subg. *Chusquea* based on morphological characters, but has not been rigorously studied in its entirety. The putative synapomorphies distinguishing the *C. ramosissima* informal group from the remainder of *Chusquea* subg. *Chusquea* are the presence of a pseudopetiolate culm leaf blade that remains green and synflorescences borne on a mix of longer leafy and shorter non-leafy subsidiary branches per node, features unknown in the rest of the subgenus or the genus as a whole. In addition, the species of the *C. ramosissima* informal group share a bud complement with a set of 1–4 laterally compressed, \pm falcate subsidiary buds on each side positioned facing each other, a central bud with parallel sides and a broadly triangular apex, and thin-textured spikelets. Because of this unique combination of characters, including two that are unique within *Chusquea*, and molecular support, we here formally describe *Chusquea* sect. *Tenellae* within *Chusquea* subg. *Chusquea* to accommodate this group. Five species, distributed in Argentina, Brazil, Bolivia, Paraguay and Uruguay, are included in the newly recognized *Chusquea* sect. *Tenellae*: *C. fasciculata*, *C. ramosissima*, *C. tenella*, *C. tenuiglumis*, and the newly described *C. ovatifolia*. This revision includes a comparison of sect. *Tenellae* with the five previously recognized sections of subg. *Chusquea*, detailed descriptions for the five species of sect. *Tenellae*, line illustrations or images for all species, maps of their distributions, and morphological keys for their identification. The names *Chusquea fasciculata*, *C. tenuiglumis*, *C. tenuiglumis* var. *laxiuscula* and *C. tenuiglumis* var. *subcylindrica* are lectotypified.

Key words: Chusqueinae, Euchusquea clade, Neotropical woody bamboos

Introduction

Bambusoideae is one of the 12 subfamilies within the grass family, including over 1600 described species and classified into three tribes: the Bambuseae (tropical woody bamboos), the Arundinarieae (temperate woody bamboos) and the Olyreae (herbaceous bamboos) (Clark *et al.* 2015, Kellogg 2015, Vorontsova *et al.* 2016). The tribe Bambuseae is widely distributed in both the Old World and New World and comprises the Palearctic and Neotropical woody bamboos. Bambuseae includes eleven subtribes, 74 genera, and 910 species (Clark *et al.* 2015, Wong *et al.* 2016, Vorontsova *et al.* 2016) and is characterized by the presence of pachymorph rhizomes (with some also having leptomorph rhizomes and thus amphimorph) and acropetal or bidirectional aerial branch development. Further, molecular evidence strongly supports the monophyly of the Bambuseae (Sungkaew *et al.* 2009, Kelchner *et al.* 2013, Wysocki *et al.* 2015). Neotropical woody bamboos within the Bambuseae form a moderately supported clade, and comprise three well-supported subtribes: Arthrostylidiinae, Chusqueinae, and Guaduinae (Kelchner *et al.* 2013, Clark *et al.* 2015). In addition to strong molecular support, Chusqueinae can be differentiated from other tropical woody bamboo subtribes by the presence of two papillae on each subsidiary cell of the foliar stomatal apparatus and spikelets consisting of four glumes, one fertile floret, and no rachilla extension (Fisher *et al.* 2009, 2014, Clark *et al.* 2015). *Chusquea* Kunth (1822: 151) is the sole genus classified within subtribe Chusqueinae (Clark *et al.* 2015). Currently, there are 176 described species within *Chusquea*, most of which are characteristic of montane forests throughout Mexico, Central and South America, and the Caribbean, with some species occurring in high altitude grasslands and lowland tropical forests or

in temperate forests at higher latitudes (both north and south) (Fisher *et al.* 2009, Clark *et al.* 2015, Vorontsova *et al.* 2016, Mota *et al.* 2017). *Chusquea* also has the broadest elevational range of any bamboo genus, occurring from sea level to 4300 m (Clark *et al.* 2015).

A recent molecular phylogenetic study provides evidence for four major clades within *Chusquea*: (i) subg. *Magnifoliae* Clark & A.E. Fisher in Fisher *et al.* (2014: 841), (ii) subg. *Platonina* Nees (1835: 486), (iii) subg. *Rettbergia* (Raddi 1823: 17) Clark (1997: 41) and (iv) the *Euchusquea* clade, which comprises subg. *Chusquea* and subg. *Swallenochloa* (McClure 1973: 106) Clark (1997: 42), and includes ca. 75% of the species diversity in the genus. Neither subgenus nor any of the currently recognized sections within either subgenus is supported as monophyletic, and overall resolution and support values within the *Euchusquea* clade are weak or non-existent. However, five minor clades are well-supported even though their relationships are still ambiguous due to conflicting morphological and molecular evidence (Fisher *et al.* 2014). One of these is the *Chusquea ramosissima* Lindm. (1900: 14) clade, which consists of three sampled species [*C. ramosissima*, *C. tenella* Nees (1835: 492), and *C. longispiculata* Clark (2004: 34)] currently placed in two informal morphological groups. The *C. ramosissima* informal group as per Fisher *et al.* (2009) comprises *C. ramosissima*, *C. tenella* and *C. tenuiglumis* Döll (1880: 199) plus the newly described *C. ovatifolia*, all of which share a pseudopetiolate culm leaf blade that remains green and synflorescences borne on a mix of both longer leafy and shorter non-leafy subsidiary branches per node, features not otherwise known in *Chusquea* (Fisher *et al.* 2014). Recent examination of the limited material available for *C. fasciculata* Döll (1880: 202) allowed us to include it in this informal group rather than its previous placement as *Incertae Sedis* within *Chusquea* subg. *Chusquea* (Judziewicz *et al.* 1999, Fisher *et al.* 2009). The *C. meyeriana* Rupr. ex Döll (1880: 203) informal group, on the other hand, includes *C. longispiculata* and *C. meyeriana* plus several other species, and is distinguished on the basis of reflexed lower inflorescence branches and the usual presence of one or more spathe bracts subtending the inflorescence (Fisher *et al.* 2014). The members of both groups are distributed across southern South America in Argentina, Brazil, Bolivia, Paraguay and Uruguay.

Based on molecular support and a unique combination of morphological features, we here formally describe *Chusquea* sect. *Tenellae* to accommodate the *C. ramosissima* informal group and compare it with the five previously described sections within *Chusquea* subg. *Chusquea*. We present updated morphological descriptions for the species of sect. *Tenellae*, including the newly described species from Bolivia. Morphological keys to the five species of sect. *Tenellae* are included, the species are illustrated with line drawings or images to show their diagnostic characters, and the known distributions for all species are mapped. The names *Chusquea fasciculata*, *C. tenuiglumis*, *C. tenuiglumis* var. *laxiuscula* and *C. tenuiglumis* var. *subcylindrica* are lectotypified.

Materials and methods

Field observations and collections of all sect. *Tenellae* species except for *C. fasciculata* (known only from two collections from 1854) and the new species were made by LGC in Brazil, and the new species was observed and collected by AFF in Bolivia. LA and LGC prepared the descriptions and AFF contributed data to the description of *C. ovatifolia*. LA and LGC wrote the text and supervised preparation of the illustrations.

Standard collection procedures for bamboos were followed and therefore complete specimens were collected, including branch complements, culm leaves, culm nodes, and internodes whenever possible (Soderstrom & Young 1983). We followed McClure (1973) and Clark (1989) for definitions of structures and morphological terminology, with a few modifications. The morphological descriptions are based on detailed study of the collected specimens and direct examination of herbarium specimens (BAA, C, FCQ, G, HUEFS, ISC, K, LIL, LPB, MB, MBM, MO, NY, S, SI, SP, US, VIC, W and WIS) (Thiers 2016). Morphological comparison and measurement of the structures were performed using a Leica S6D (Leica Microsystems Inc., Buffalo Grove, Illinois) or a Bausch & Lomb stereoscopic microscope. Culm leaf sheaths and blades were measured separately. Foliage leaf length was measured from the base of the pseudopetiole to the tip of the blade and leaf width was measured at the widest point. Spikelets were dissected in Pohl's solution (Pohl 1965). Spikelet length was measured from the base of glume I to the very tip of the longest part of the spikelet and proportional extension of the glumes was measured according to Clark (1989). For all measurements for which a mean (in parentheses) is reported following the range (e.g., internode length, culm leaf sheath length, foliage leaf blade length, width), 10 or more measurements were taken per species (across available collections) and averaged.

Results and discussion

Distribution and habitat:—The species of sect. *Tenellae* are distributed across South America in Argentina, Bolivia, Brazil, Paraguay and Uruguay (Figs. 1, 2). Both *C. ramosissima* and *C. tenella* are distributed in Argentina, Brazil and Uruguay, but *C. ramosissima* also occurs in eastern Bolivia and Paraguay, whereas *C. ovatifolia* is restricted to western Bolivia and *C. fasciculata* and *C. tenuiglumis* are restricted to Brazil. Thus, of these five species, *C. ramosissima* has the broadest distribution, but it also has the greatest latitudinal distribution of any species of *Chusquea* documented to date (Judziewicz *et al.* 1999, Vorontsova *et al.* 2016), extending from nearly 4°S in the state of Ceará, Brazil, to nearly 33°S in the department of Treinta y Tres, Uruguay. Collectively, the species of sect. *Tenellae* range from sea level to 1200 m in elevation, with *C. ovatifolia* having the highest range and *C. ramosissima* the lowest (Table 1).

As is true for most of *Chusquea*, the species of sect. *Tenellae* are associated with forests (Judziewicz *et al.* 1999). *Chusquea ovatifolia* grows in semi-deciduous to deciduous gallery forests and dry forests with short trees, and less frequently in disturbed forests (Fuentes *et al.* 2004). *Chusquea ramosissima* occupies Atlantic forests, growing near streams, in the understory and along forest edges, but is also common and even weedy in secondary habitats (Schmidt & Longhi-Wagner 2009, Montti *et al.* 2011, 2014, Lizarazu 2013). While *C. tenuiglumis* inhabits disturbed Atlantic forests and forest remnants, *C. tenella* occupies relatively undisturbed Atlantic forests along rivers and by waterfalls, but is also an aggressive colonizer in disturbed semideciduous Atlantic forests (Schmidt & Longhi-Wagner 2009, Montti *et al.* 2014). Although *C. fasciculata* was collected in the region of Caldas in Minas Gerais state in Brazil, no indication of habitat was provided on the labels and we have not been able to identify the original localities with any degree of confidence.

Morphology:—The major defining morphological characters of the five species of sect. *Tenellae* are compared and summarized in Table 1, although *C. fasciculata* is incompletely known. The major features that characterize the section, or that need to be further studied, are discussed here and summarized in Table 2, with reference to other published observations and illustrations included in this revision.

TABLE 1. Comparative table of morphological characters for the species of sect. *Tenellae*. “?” indicates unknown state.

Character	<i>C. fasciculata</i>	<i>C. ovatifolia</i>	<i>C. ramosissima</i>	<i>C. tenella</i>	<i>C. tenuiglumis</i>
Habitat	?	semi-deciduous, deciduous and gallery forests, less commonly disturbed forests	Atlantic forests, ± dry transitional Atlantic forests, forest remnants and secondary habitats along rivers and streams	relatively undisturbed Atlantic forests along rivers and by waterfalls	Atlantic forests and disturbed forest and forest remnants
Distribution	Brazil	Bolivia	Argentina, Bolivia, Brazil, Paraguay, Uruguay	Argentina, Brazil, Uruguay	Brazil
Elevation (m)	?	760–1200	0–720	100–910	(100–) 530–1180
Vegetative characters					
Nodal line position relative to bud complement	dipping very slightly	dipping slightly	dipping markedly	dipping slightly	dipping slightly
Culm leaf sheath abaxial surface	appressed hispid-pubescent at the apex and the summit on both sides	shortly pubescent	glabrous or pubescent at the base and finely appressed-pubescent above	pubescent-hirsute	glabrous or sparsely appressed-hispid
Culm leaf sheath apex shape	symmetrically concave	symmetrically concave	symmetrically concave	symmetrically concave	more or less horizontal
Culm leaf sheath summit extension length (mm)	1.5–2	?	0.9–3.2	1.2–10	0.6–5
Culm leaf pseudopetiole abaxial surface	?	shortly pubescent	ciliate along the midrib	strongly ciliate	strongly ciliate

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TABLE 1. (Continued)

Character	<i>C. fasciculata</i>	<i>C. ovatifolia</i>	<i>C. ramosissima</i>	<i>C. tenella</i>	<i>C. tenuiglumis</i>
Culm leaf blade position	?	erect	reflexed	reflexed	slightly spreading or reflexed
Size and number of the subsidiary buds	?	± subequal, (5–) 7–9	2 sizes, 20–37	2 sizes, 5–9	2 sizes, 5–8
Number of leaves per complement	4–7	4–5 (–7)	5–9	6–15	(3–) 5–7 (–8)
Foliage leaf sheath indument	shortly pubescent toward the overlapping margin	slightly pubescent	puberulent	slightly puberulent	glabrous
Foliage leaf sheath margin indument	ciliate throughout	ciliate only at the summit	ciliate toward the apex	ciliate throughout	glabrous or ciliate
Foliage leaf sheath summit extension development	only one side	only one side	only one side	both sides, strongly unequal	both sides, strongly unequal
Foliage leaf sheath summit extension length (mm)	0.1–0.4	0.4–1.5	0.5–2	1–7	4–30
Foliage leaf sheath summit extension indument	ciliate	ciliate	glabrous or less commonly ciliate	densely ciliate	glabrous
Foliage leaf outer ligule	ciliolate, 0.1–0.3 mm	ciliolate or ciliate, 0.3–5 mm	usually ciliolate or ciliate, 0.1–1.5 mm	ciliate, ca. 0.5 mm	glabrous or ciliolate, 0.5–5 mm
Foliage leaf inner ligule length (mm)	0.2–0.3	0.5–2	0.4–1.5	1–7	3.5–40
Foliage leaf inner ligule shape	truncate	truncate to obtuse	truncate	obtuse to asymmetrical	asymmetrical
Foliage leaf pseudopetiole length (mm)	0.5–1	0.5–1.5	1–2	1–7	2–6
Foliage leaf length (cm)	2.4–5.8	(3–) 4–8.2	4–9.4 (–12)	4.9–22.8	6.6–24.5
Foliage leaf width (cm)	0.5–0.8 (–1.4)	0.8–2.5	0.5–1.5 (–1.8)	0.6–4.1	1–5.6
Foliage leaf blade shape	lanceolate to ovate-lanceolate	ovate to ovate-lanceolate	lanceolate	ovate-lanceolate	ovate-lanceolate
Foliage leaf blade abaxial surface	glabrous	sparsely pubescent or glabrous and ciliate at the base	glabrous with a few sparse cilia near midrib at the base	glabrous, pubescent at the base on both sides of the midrib	glabrous
Foliage leaf blade apex	acuminate to apiculate	acute	acuminate	acuminate	acuminate
<u>Reproductive characters</u>					
Synflorescence branching	racemose or paniculate	racemose	paniculate	racemose or weakly paniculate	paniculate
Synflorescence length (cm)	(1.5–) 2–4	1.5–2.8	2–6.5	2.5–5.1	5–10
Glume III: spikelet length ratio	2/5–1/2	1/3–1/2	2/5–2/3	1/3–3/5	1/2–3/5 (–2/3)
Glume IV: spikelet length ratio	2/5–1/2	1/2	1/2–2/3	1/2–3/5	3/5–2/3 (–7/10)

Rhizomes and Habit—Rhizomes are not well characterized for this group of species. Lizarazu (2013) described the rhizomes of *C. ramosissima* as leptomorph, but did not describe them for *C. tenella*; in contrast, Schmidt & Longhi-Wagner (2009) described the rhizomes of both species as pachymorph and short. A few specimens of *C. ramosissima* include leptomorph rhizome pieces, but one or two specimens show pachymorph segments. This suggests that *C. ramosissima* is amphimorph, which is consistent with the diffuse colonies that it typically forms and its aggressive colonizing behavior in disturbed areas (Montti *et al.* 2011, Clark pers. obs.). *Chusquea ovatifolia*, *C. tenella* and *C. tenuiglumis* also form diffuse colonies (Fig. 4C), so we infer that all produce leptomorph rhizomes at a minimum and that they are probably all amphimorph. These four species initially have erect culms that more or less quickly become

trailing (seen in *C. ramosissima*) or scandent, clambering or hanging above (Schmidt & Longhi-Wagner 2009, Montti *et al.* 2011, Lizarazu 2013). No information on the rhizomes of *C. fasciculata* is available.

Culms—Culms are usually solid, the general condition in *Chusquea*, with terete and usually glabrous internodes, but these are strigose to hispid in *C. tenella* (Lizarazu 2013). Both Schmidt & Longhi-Wagner (2009) and Lizarazu (2013) report that internodes of *C. tenella* may be hollow or have a small lumen, and we also observed that irregularly hollow culms are common in this species, although some specimens clearly showed solid culms.

Culm Leaves—The culm leaf of sect. *Tenellae* consists of a persistent sheath with free margins and a pseudopetiolate blade that remains green for an extended period before falling off. An outer ligule is present, a sheath summit extension is present on at least one side of the sheath apex (from the underlapping margin), and the inner ligule is adnate to it or to both sheath summit extensions if two are present (Figs. 5A, H, 6D). The sheath summit extension from the underlapping margin is always the better developed if two extensions are present. This culm leaf structure is unique within *Chusquea* and is shared by all five species of the section (only two complete examples from a small culm are known for *C. ovatifolia* and only four sheaths on one specimen of *C. fasciculata* are available, but in both cases the relevant characters are consistent with the other three species), and therefore we propose it as a putative synapomorphy for this section (Fisher *et al.* 2014). In all but *C. tenella* and *C. fasciculata*, the sheath margins become scarios; in *C. tenella*, the margins are densely ciliate whereas in the other species they are glabrous. The girdle is up to 5 mm wide, consistent with infravaginal branching. The juncture of the sheath and the girdle is ciliate in *C. tenella* and bears a short corky ridge in *C. tenuiglumis*, but is glabrous and lacks a ridge in the other two species. As noted above, the blade is not available for study in *C. fasciculata*, but is apparently erect in *C. ovatifolia* and spreading to more commonly reflexed in the other three species.

Buds and Branching—The bud complement in sect. *Tenellae* (Figs. 4C, 5D, 6H) is distinctive in more than one way (but the bud complement of *C. fasciculata* has not been observed). The central bud is parallel-sided with a broadly triangular apex, whereas in most species of *Chusquea* the central bud is triangular or dome-shaped (Judziewicz *et al.* 1999, Mota 2013). The subsidiary buds/branches vary in number, but in the four observed species, a set of 1 to 4 buds on each side is strongly laterally compressed and more or less falcate in shape with the bud apices facing the center line of the bud complement. The remaining smaller subsidiary buds are crowded into the space between the two lateral sets, usually in a triangular arrangement. No other species or recognized groups within *Chusquea* show this pattern (Judziewicz *et al.* 1999). At least the top-most bud in each lateral set is usually markedly larger than the other subsidiaries, forming two size classes of subsidiary buds (Schmidt & Longhi-Wagner 2009, Montti *et al.* 2011). The larger subsidiary buds develop into larger, more robust subsidiary branches, which is the common pattern in this group, although sometimes in *C. ovatifolia* and *C. tenella* the subsidiary branches are more or less subequal; two sizes of subsidiary branches are seen at a few nodes in available specimens of *C. fasciculata* so it is consistent with this pattern. Rebranching of both sizes of subsidiary buds is also characteristic of sect. *Tenellae*. All five species exhibit infravaginal branching, although the nodal line dips more markedly below the bud/branch complement in *C. ramosissima* than in the other four species.

Foliage Leaves—The foliage leaf sheaths of all but *C. fasciculata* are usually maculate when young, and sometimes this mottling is evident even in mature branch complements; only mature foliage leaves on flowering branches have been observed for *C. fasciculata*. A very small (ca. 0.4 mm) to very well developed (30 mm) sheath summit extension is present on at least one side (extending from the underlapping margin) of the sheath, but is often present on both sides, in which case the sheath summit extension from the overlapping margin is much shorter. As with the culm leaf, the inner ligule is adnate to at least the longer sheath summit extension along its full length, and thus when the sheath summit extension is well developed, the inner ligule becomes extremely asymmetric. The outer ligule is always present, but is especially well developed and often split in *C. tenuiglumis*. The foliage leaf blades vary in size and shape, but have an excentric midrib (often approaching more or less centric in *C. fasciculata* and *C. ramosissima*) and a well-defined pseudopetiole that is usually abaxially pubescent or hispid. The blades in *C. ovatifolia* and *C. ramosissima*, and apparently also *C. fasciculata*, show continuous variation within their ranges of length and width, but the longest blades are no more than about twice the length of the shortest ones, and the widest blades are no more than about three times as wide as the narrowest ones. In contrast, in *C. tenella* and *C. tenuiglumis*, the longest blades are 3.5–4 times as long as the shortest ones, and the widest ones are 5–7 times as wide as the narrowest ones, with the robust subsidiary branches and the central branch producing the largest foliage leaves.

Synflorescences, Spikelets and Fruit—The synflorescences in sect. *Tenellae* are borne on a mix of longer leafy and shorter non-leafy subsidiary branches at each node (Figs. 3, 4D, 6B, F); those on the leafy branches tend to be somewhat longer than the synflorescences on the non-leafy branches, but there is some overlap in length. This character is unknown elsewhere in the genus and thus is proposed as a second putative synapomorphy for sect. *Tenellae*. The

synflorescences themselves are racemose or paniculate with the branches appressed to the rachis. The rachis is straight in *C. tenuiglumis* (Fig. 6F) and straight to slightly curved (Figs. 3B, 4D, 5E, 6B) in the other four species. The spikelets are all about the same size in this section and all have scale-like glumes I and II. The thin texture of the spikelets is also characteristic of all five species, and is reflected in the names of *C. tenella* and *C. tenuiglumis*. Glumes III and IV are apiculate to awn-tipped and the lemmas are subulate to awned in *C. fasciculata* (Fig. 3B) but acute to at most mucronate in the other four species (Figs. 4D, 5F, 6C, G). Although we did not observe fruits for any of the species in this study, Lizarazu (2013) reported basic caryopses for both *C. ramosissima* and *C. tenella*.

Taxonomy

***Chusquea* section *Tenellae* L. G. Clark, sect. nov.**—TYPE: *Chusquea tenella* Nees

Diagnosis:—Differs from all other sections recognized within *Chusquea* subg. *Chusquea* by the presence of pseudopetiolate culm leaf blades that remain green; a bud complement with a set of 1–4 strongly laterally compressed, \pm falcate subsidiary buds on each side positioned facing each other, with the top-most bud of each set larger than the others; synflorescences borne on a mix of longer leafy and shorter non-leafy subsidiary branches per node; and thin-textured spikelets with glumes I and II small and scale-like.

Description:—Plants growing in diffuse colonies. Culms 3–5 (–8) m tall/long, (0.3–) 0.5–1 (–1.5) cm in diameter, erect at the base, arching and becoming trailing or scandent, clambering or hanging above; internodes 15–32 (–36) cm long, terete, usually solid or sometimes irregularly hollow. Culm leaves with sheaths persistent, usually striate near the base, a sheath summit extension almost always present on at least one side, often on both, but the one extending from the underlapping margin longer; girdle 0.5–5 mm wide; outer ligule present; inner ligule variable in size but asymmetrical, adnate to the longer sheath summit extension; blades pseudopetiolate, spreading to reflexed (erect in one species), remaining green but eventually deciduous. Nodes at mid-culm with one central bud, this parallel-sided but with a broadly triangular apex, subtended by a cluster of 5–37 smaller subsidiary buds of two sizes, with a set of 1–4 strongly laterally compressed, \pm falcate subsidiary buds on each side facing each other, the top-most bud larger than the others, and the remaining subsidiary buds smaller and positioned in between the two lateral sets, often in a triangular arrangement; the nodal line dipping slightly to markedly below the bud/branch complement; the supranodal ridge more or less conspicuous but the same diameter as the nodal line. Branching infravaginal; central branch often developing at the same time as the subsidiaries or later, subsidiary branches of two sizes (rarely subequal), both usually rebranching. Foliage leaves with the sheaths often maculate when young, keeled, a sheath summit extension almost always present on at least one side, often on both, but the one extending from the underlapping margin longer; pseudopetioles usually pulvinate; blades lanceolate to ovate, base usually asymmetrical, midrib excentric (sometimes \pm centric). Synflorescences 1.5–10 cm long, 0.5–2 cm wide, racemose or paniculate, with branches and pedicels appressed to the rachis or spreading and diffuse, borne on a mix of longer leafy and shorter non-leafy subsidiary branches per node; rachis and pedicels angular, pedicels 0.4–14 mm long. Spikelets (7.5–) 8.5–11.5 (–12.4) mm long, 1.5–2.8 mm wide, \pm laterally compressed, thin-textured (membranaceous); glumes I and II scale-like, no more than 1/10 the spikelet length, usually glabrous, nerves usually absent (sometimes glume II weakly 1–2-nerved); glumes III and IV 1/3–2/3 the spikelet length, triangular to navicular; lemma and palea subequal, the lemma navicular, the palea 4–6-nerved. Lodicules 3, membranaceous, ciliate. Stamens 3; anthers yellow. Gynoecium with styles 2, stigmas 2, weakly to strongly plumose. Fruit not seen.

Comments—As presented in the diagnosis above, *Chusquea* sect. *Tenellae* is easily distinguished from the other sections of *Chusquea* subg. *Chusquea* by its unique culm leaf structure, bud morphology and organization, dimorphic leaf development on flowering branches and spikelet texture (Table 2). The other five sections all share triangular, non-pseudopetiolate and erect culm leaf blades the same color as the sheath; triangular or circular central buds; synflorescences borne on subequal leafy subsidiary branches; and chartaceous spikelets. However, three of these five sections [sect. *Longiprophyllae* Clark (1990: 626), sect. *Serpentes* Clark (1989: 91) and sect. *Verticillatae* Clark (1989: 74)] also exhibit their own unique characters or unique combinations of vegetative or reproductive characters (Table 2). Although the combination of 18–80 subsidiary buds per node, infravaginal branching, and typically linear foliage leaf blades is usually sufficient to diagnose sect. *Longifoliae* Clark (1989: 105), each of these features is characteristic of at least one other section in subgenus *Chusquea*. Sect. *Chusquea* is characterized by a similar number (15–80) of subsidiary buds per node as sect. *Longifoliae*, but has extravaginal branching and its foliage leaf blade shape varies from linear to lanceolate.

TABLE 2. Morphological comparison of the sections of *Chusquea* subg. *Chusquea*. Unique or diagnostic features are underlined.

Character	sect. <i>Chusquea</i>	sect. <i>Longifoliae</i>	sect. <i>Longiprophyllae</i>	sect. <i>Serpentes</i>	sect. <i>Tenellae</i>	sect. <i>Verticillatae</i>
Culm leaf blade	triangular, non-pseudopetiolate, erect; = sheath in color	triangular, non-pseudopetiolate, erect; = sheath in color	triangular, non-pseudopetiolate, erect; = sheath in color	triangular, non-pseudopetiolate, erect; = sheath in color	<u>ovate-lanceolate to lanceolate, pseudopetiolate, usually spreading to reflexed; green for an extended period</u>	triangular, non-pseudopetiolate, erect; = sheath in color
Branching pattern	extravaginal	infravaginal	infravaginal	infravaginal ¹	infravaginal	modified ² extravaginal, less commonly infravaginal or modified infravaginal
Central bud outline	triangular (less commonly circular)	triangular (less commonly circular)	triangular	triangular (less commonly circular)	<u>parallel-sided with a broadly triangular apex</u>	triangular or circular
Central bud prophyll	truncated at bud apex	truncated at bud apex	<u>elongated (3–10 cm long)</u>	truncated at bud apex	truncated at bud apex	truncated at bud apex
Subsidiary bud number, size and arrangement	15–80 per node, subequal, in 1–3 constellate rows	18–80 per node, subequal, in (1–) 2–4 constellate rows	10–40 per node, subequal, <u>in a tight circular cluster subtending the central bud/branch</u>	<u>2–12 per node, subequal, in 1 constellate row</u>	5–37 per node, of two sizes, <u>a set of 1–4 strongly laterally compressed, + falcate buds on each side facing each other, the top-most larger than the others, the remaining buds smaller and positioned in between the two lateral sets</u>	(8–) 30–100 per node, subequal (rarely of two sizes), in (1–) 2–3 rows <u>either nearly encircling the central bud/branch or completely (or nearly completely) encircling the node</u>
Foliage leaf blade shape	linear to lanceolate	linear (to linear-lanceolate)	lanceolate (to linear- or ovate-lanceolate)	ovate or ovate-lanceolate	lanceolate to ovate	lanceolate to ovate-lanceolate
Synflorescence branch length and leaf development	subequal leafy branches	subequal leafy branches	subequal leafy branches	subequal leafy branches	<u>longer leafy and shorter non-leafy branches</u>	subequal leafy branches
Spikelet compression	lateral	lateral	lateral	lateral	lateral	<u>dorsal</u>
Spikelet texture	chartaceous	chartaceous	chartaceous	chartaceous	<u>membranaceous</u>	chartaceous
Development of glumes I and II	reduced or developed and > 1/10 spikelet length, subequal or glume II longer than but not up to 2× glume I	developed, > 1/10 spikelet length, glume II longer than but not up to 2× glume I	developed, > 1/10 spikelet length, <u>glume II 2× glume I</u>	developed, > 1/10 spikelet length, glume II > glume I, sometimes up to 2×	reduced, < 1/10 spikelet length, often scale-like, subequal	reduced, < 1/10 spikelet length, often scale-like, subequal

¹Two Mexican species [*C. enigmatica* Ruiz-Sanchez, Mejía-Saulés & Clark (Ruiz-Sanchez *et al.* 2014: 20) and *C. gibcooperi* Ruiz-Sanchez, Mejía-Saulés, Cortés & Clark (Ruiz-Sanchez *et al.* 2015: 228)] previously classified in this section have both intravaginal and extravaginal branching on the same culm; they are misclassified in this section and are here considered to be *Incertae Sedis* within *Chusquea* subg. *Chusquea*.

²Here, whether describing extravaginal or infravaginal branching, “modified” indicates that culm leaf is deciduous early in the development of the branch complement.

Rhizome morphology is unevenly documented across the diversity of *Chusquea* and for this reason is not included in Table 2, although it may eventually prove informative in distinguishing among some groups (Clark 1989, Mota 2013). *Chusquea* subg. *Magnifoliae*, subg. *Platonia*, subg. *Swallenochloa* and sects. *Longifoliae*, *Longiprophyllae* (inferred from the clumping habit) and *Verticillatae* of subg. *Chusquea* are characterized by pachymorph rhizomes (Clark 1989, 1990; Clark, pers. obs.), but rhizome morphology is poorly documented for subg. *Rettbergia* (Mota 2013, Mota *et al.* 2017). As noted above, the amphimorph condition is inferred for sect. *Tenellae*, but direct observations are needed. The scandent, sprawling or trailing habit of most members of sect. *Serpentes* (Clark 1989) also suggests the possibility of amphimorph rhizomes, but again, this remains to be confirmed by direct observation. However,

amphimorph rhizomes are confirmed for a number of species in sect. *Chusquea*, although it remains to be determined whether this is a consistent feature of the section (Clark 1986; Clark, pers. obs.).

The *Chusquea meyeriana* informal group, as noted in the Introduction, is characterized by reflexed lower inflorescence branches and the usual presence of one or more spathe bracts subtending the inflorescence (Fisher *et al.* 2014). This Brazilian group requires additional study before its status within subg. *Chusquea* can be determined, and thus is not included in Table 2.

Key to the species of *Chusquea* sect. *Tenellae* based on vegetative characters

1. Branch complement of 20–50 branches per node; nodal line dipping markedly below the bud/branch complement..... *C. ramosissima*
- Branch complement of (3–) 5–24 branches per node; nodal line dipping at most only slightly below the bud/branch complement 2.
2. Foliage leaf blade base asymmetrical, sometimes strongly so; branch complement of (3–) 5–9 branches per node; western Bolivia *C. ovatifolia*
- Foliage leaf blade base \pm symmetrical or slightly asymmetrical; branch complement of 7–24 branches per node; eastern Brazil, Uruguay, and Misiones, Argentina 3.
3. Foliage leaf sheath summit extension developed on only one side, 0.1–0.4 mm long; foliage leaf inner ligules 0.2–0.3 mm long...
..... *C. fasciculata*
- Foliage leaf sheath summit extensions developed on both sides, strongly unequal, 1–30 mm long; foliage leaf inner ligules 1–40 mm..... 4.
4. Foliage leaf blades abaxially glabrous except pubescent at the base on both sides of the midrib; foliage leaf sheath summit extensions densely ciliate; culm leaf juncture of sheath and girdle flat, bearing a ring of cilia, corky ridge absent; foliage leaf outer ligules ca. 0.5 mm long and inner ligules 1–7 mm long..... *C. tenella*
- Foliage leaf blades abaxially glabrous at the base; foliage leaf sheath summit extensions glabrous; culm leaf juncture of sheath and girdle bearing a small corky ridge, glabrous; foliage leaf outer ligules 0.5–5 mm long and inner ligules 3.5–40 mm long.....
..... *C. tenuiglumis*

Key to the species of *Chusquea* sect. *Tenellae* based on reproductive and vegetative characters

1. Pedicels mostly 7–14 mm long; spikelets with glumes III and IV apiculate to more usually awn-tipped and lemmas subulate to awned; synflorescence branches and pedicels spreading, diffuse *C. fasciculata*
- Pedicels 0.4–4 mm long; spikelets with glumes III and IV and lemmas acute to mucronate; synflorescence branches and pedicels appressed to the rachis..... 2.
2. Synflorescences 5–10 cm long; inner ligule of the foliage leaf 3.5–40 mm long; eastern Brazil in the states of Minas Gerais, Rio de Janeiro, Santa Catarina and São Paulo *C. tenuiglumis*
- Synflorescences 1.5–6.5 cm long; inner ligule of the foliage leaf 0.2–7 mm long; Argentina, Bolivia, Brazil, Paraguay and Uruguay 3.
3. Glumes III and IV 1/3–1/2 the spikelet length; foliage leaf blade L:W = 2.9–5.6, ovate to ovate-lanceolate, base asymmetrical, sometimes strongly so; western Bolivia *C. ovatifolia*
- Glumes III and IV (1/3–) 2/5–2/3 the spikelet length; foliage leaf blade L:W = (3.8–) 5–14.2, ovate-lanceolate to lanceolate, the base \pm symmetrical; Argentina, eastern Bolivia, Brazil, Paraguay and Uruguay..... 4.
4. Nodal line dipping markedly below the bud/branch complement; foliage leaf blades 4–9.4 (–12) (\bar{X} = 7.1) cm long, 0.5–1.5 (–1.8) (\bar{X} = 0.9) cm wide, abaxially glabrous with a few sparse hairs along the midrib at the base (rarely entirely pilose); subsidiary branches 20–50 per node; culm leaf sheaths abaxially glabrous or less commonly pubescent at the base and finely appressed-pubescent above (rarely hispid), juncture of the sheath and girdle glabrous *C. ramosissima*
- Nodal line dipping slightly below the bud/branch complement; foliage leaf blades 4.9–22.8 (\bar{X} = 11.2) cm long, 0.6–4.1 (\bar{X} = 1.7) cm wide, abaxially glabrous except pubescent on both sides of the midrib; subsidiary branches 7–20 per node; culm leaf sheaths abaxially pubescent-hirsute, the juncture of the sheath and girdle with a ring of cilia *C. tenella*

1.—*Chusquea fasciculata* Döll (1880: 202), Figs. 1, 3.

Lectotype (here designated):—BRAZIL. Minas Gerais: Ad Caldas, 1 August 1854 (fl), *A. F. Regnell III 1427* (MB! with plasticine packet, isoelectotypes S! 3 sheets, US fragm. 2874621!). Syntype: BRAZIL. Minas Gerais: Ad Caldas, 1869, *A. Regnell III 1427* (MB! with two small paper packets).

Description:—Rhizomes unknown. Culms 0.4–0.5 cm in diameter, habit unknown; internodes 8.5–14.6 cm long, solid, glabrous to scabrous-pubescent below the nodes. Culm leaves incomplete, a few persistent sheaths on one specimen only; sheaths 5–5.3 cm long, abaxially appressed hispid-pubescent at the apex and toward the summit on both sides, apex symmetrically concave, sheath summit extension 1.5–2 mm long on the underlapping margin and confluent with the inner ligule; girdle 0.5–1 mm wide, pubescent, persistent; inner ligule 1–1.5 mm long, truncate; outer ligule ca. 0.5 mm long, ciliate; blades not seen. Nodal line dipping very slightly below the branch complement. Branch complement of 11–22 branches (inferred from the number of leafy subsidiary branches bearing synflorescences) subtending the central branch, sometimes one or two subsidiary branches slightly more robust. Foliage leaves 4–7 per complement; sheaths shortly pubescent toward the overlapping margin, margins not scarious, overlapping margin ciliate, keeled,

sheath summit extension 0.1–0.4 mm, erect, acute, developed only on one side of the sheath, ciliate; outer ligules 0.1–0.3 mm long, ciliolate; inner ligules 0.2–0.3 mm long, truncate, abaxially pubescent, ciliolate; pseudopetioles 0.5–1 mm, glabrous; blades 2.4–5.8 (\bar{x} =4) cm long, 0.5–0.8 (–1.4) (\bar{x} =0.7) cm wide, L:W=(4–) 5–7.2 (\bar{x} =6), lanceolate to ovate-lanceolate, adaxially and abaxially glabrous, abaxially a faint marginal green stripe sometimes visible, not tessellate, the base slightly asymmetrical, attenuate, the apex acuminate to apiculate, the margins serrulate, midrib slightly excentric. Synflorescences (1.5–) 2–4 (\bar{x} =2.6) cm long, (0.5–) 1–2 cm wide, racemose to paniculate, slightly curved, branches and pedicels spreading, diffuse; rachis and branches scabrous along edges or scabrous-pubescent throughout; pedicels 7–14 (\bar{x} =10) mm long, very rarely ca. 1.5 mm long, scabrous along edges or scabrous-pubescent throughout. Spikelets 9–11.5 (\bar{x} =10.4) mm long, 2.1–2.8 (\bar{x} =2.5) mm wide; glumes I and II (0.1–) 0.2–0.3 (–0.4) mm long, 1/30–1/50 the spikelet length, abaxially glabrous, nerves absent; glumes III and IV 2/5–1/2 the spikelet length, abaxially scabrous-pubescent at the apex, 3–5-nerved; glume III 3.7–5.2 (–6.3) mm long, apiculate to awn-tipped, the awn (0.2–) 0.5–0.7 (–1.8) mm long; glume IV 4–5.7 mm long, awn-tipped, the awn 0.5–1 mm long; lemma 8.5–10 mm long, subulate to awned, the awn 0.5–1 mm long, abaxially scabrous-pubescent toward the apex, (7–) 11–15-nerved; palea 8.3–9.4 mm long, shortly bisubulate, abaxially scabrous-pubescent toward the apex, 4–6-nerved. Lodicules ovate-lanceolate, apex acute; the anterior pair 1.5–2.5 mm long, the posterior one 1.5–2 mm long. Anthers 3.5–3.8 mm long. Fruit not seen.

Habitat and distribution:—All of the sheets of both collections of this species indicate that it was collected in Minas Gerais, Brazil. Both MB sheets and two of the S sheets of *Regnell III 1427* show Caldas (or Ad Caldas) on the labels, but the third S sheet has “Pedra do Frade” written on its two labels, but not Caldas. A locality called Pedra do Frade exists near Itajubá in Minas Gerais, southeast of Caldas, which is worth exploring to see if this species can be found there. No information is available on the location of Riberão dos Bugres (*Lindberg 513*), although the MB sheet of this collection has “appr. Caldas in paludi “Riberão dos Bugres” ” handwritten on its label, suggesting that this is likely to be found in the region of Caldas. All the evidence, and the fact that it has not been recollected for over 170 years, point to *C. fasciculata* as a narrow endemic in the Caldas region of Minas Gerais. Nothing is known about the habitat of this species, but most likely it is Atlantic forest, considering the vegetation in the region of Caldas, and perhaps in wetter areas based on the notation on the *Lindberg 513* sheet at MB.

Phenology:—Both of the known collections are flowering, but because no notes on flowering behavior were provided and because this species has not been recollected since 1854, it is impossible to infer a flowering cycle or anything about the flowering behavior for this species.

Comments:—Although *C. fasciculata* is incompletely known, the presence of a few persistent culm leaf sheaths with apices showing an unambiguously deciduous blade, both leafy and non-leafy branches bearing synflorescences, and thin-textured spikelets with scale-like glumes I and II place this species in *Chusquea* sect. *Tenellae*. *Chusquea fasciculata* is readily distinguished from the other members of this section by its long pedicels (mostly 7–14 vs. 0.4–4 mm in the other four species) and apiculate to more usually awn-tipped glumes III and IV and subulate to awned lemmas (vs. acute to acuminate glumes III and IV and acute to mucronate lemmas in the other four species). The common name, as indicated on one sheet of *Lindberg 513*, is *cressioma miuda*.

We chose to lectotypify the name *Chusquea fasciculata* because there is some ambiguity among the duplicates of *Regnell III 1427*. One of the two sheets at MB has a label on it indicating that it is a type specimen, and it has the author name written as “Döll”, along with the locality and collector number, in what appears to be Döll’s script (as per a note by Agnes Chase written on the sheet on which the US fragment is mounted along with photos of the two MB sheets) (Fig. 3). It also has attached a small plasticine envelope with a portion of a dissected spikelet in it, although this was attached after the image on the US sheet was taken. This sheet, however, does not show a collection date. The other MB sheet, which has two small paper packets containing portions of dissected spikelets attached, has the same label information as to locality and collector, with “Döll” handwritten in the same script as the other MB sheet (i.e., apparently in Döll’s hand) but has a date of 1869 on it, on the same line as “Communic. A. Regnell”. The three sheets at S, all with labels indicating that they are from Regnell’s Brazilian herbarium, have the date of 1 August 1854, all were collected in Minas Gerais, and all bear the *Regnell III 1427* number. Two of these sheets, which are annotated on the labels as *Chusquea fasciculata* Doell, show Caldas as the locality, whereas the third sheet has the locality written as Pedra do Frade and is not annotated with the species name. We chose the MB sheet shown in Fig. 3 as the lectotype, as it matches the original description perfectly and appears most likely to be the material studied by Döll. The remaining duplicates, with the exception of the other MB sheet, become isolectotypes. Although the small paper packets seem to indicate that this material was studied by Döll and the date of 1869 on the other MB sheet most likely represents the date it was received at MB, we cannot be sure about the date and thus exclude this from the type material.

Additional specimen examined:—BRAZIL. Minas Gerais: Caldas, Riberão dos Bugres (on the MB and one S sheets), 18 August 1854 (fl), *Lindberg 513* (C, K, MB, S, US).



FIGURE 1. Distribution map of *Chusquea fasciculata*, *C. ovatifolia*, *C. tenella* and *C. tenuiglumis*.



FIGURE 2. Distribution map of *Chusquea ramosissima*.



FIGURE 3. *Chusquea fasciculata*. A. Portion of flowering stem, B. Close-up of spikelets. A and B were taken by P. Klahs based on Regnell III 1427, lectotype sheet (MB).

2.—*Chusquea ovatifolia* Attigala, A. Fuentes & L. G. Clark, *sp. nov.*, Figs. 1, 4.

TYPE:—BOLIVIA. Depto. La Paz: Prov. Franz Tamayo, Parque Nacional Madidi, Azariamas, sector Chiriuno, entre San Juan Buena Hora y el poblado de Azariamas, al lado del río Chiriuno, 14°14'31"S, 68°36'12"W, 763 m, 2 July 2013 (fl), A. Fuentes, A. Ubano & M. Jove 18477 (holotype LPB!, isotype MO!).

Diagnosis:—Differs from other species of *Chusquea* sect. *Tenellae* by the combination of foliage leaves with the sheaths bearing a small (0.4–1.5 mm long) sheath summit extension on one side, ovate blades with the length 2.9–5 times greater than the width, the base asymmetrical and the apex acute, subsidiary branches (3–) 5–9 per node and usually subequal, pedicels 0.4–4 mm long and glumes III and IV 1/3–1/2 the spikelet length.

Description:—Rhizomes unknown. Culms ca. 3 m tall, 0.3–0.5 cm in diameter, erect at the base, becoming scandent; internodes 15–28 cm long, solid, glabrous. Culm leaves (only two complete examples from smaller stems seen) with sheaths 5.7–12 (\bar{x} =8) cm, abaxially very shortly pubescent, apex symmetrically concave; girdle 1–2 mm wide; inner ligule not measured; pseudopetiole ca. 0.25 mm long, adaxially glabrous, abaxially shortly pubescent; blades 6.2–8 mm long, 2.2–2.6 (\bar{x} =2.4) mm wide, lanceolate, shortly pubescent on both sides, erect. Nodes at mid culm with ca. 10 buds, consisting of one larger central bud subtended by (5–) 7–9 subsidiary buds, 1–2 buds per lateral set; nodal line dipping slightly below the bud/branch complement. Branch complement of (3–) 5–9 branches subtending the central branch, with 1 or 2 subsidiary branches somewhat more robust but sometimes all subequal. Foliage leaves 4–5 (–7) per complement; sheaths slightly pubescent, maculate when young, ciliate only at the summit, sheath summit extension developed on one side only, 0.4–1.5 mm; outer ligule 0.3–0.5 mm long, ciliolate to ciliate; inner ligule 0.5–2 mm long, truncate to obtuse, glabrous; pseudopetioles 0.5–1.5 mm long, adaxially pubescent, abaxially hispid with a tuft of cilia extending along the midrib into the base of the blade; blades (3–) 4–8.2 (\bar{x} =6.3) cm long, 0.8–2.5 (\bar{x} =1.7) cm wide, L:W=2.9–5.6 (\bar{x} =4.3), ovate to ovate-lanceolate, adaxially glabrous, abaxially sparsely pubescent or less commonly glabrous but with a more or less dense tuft of hairs at the base, usually not tessellate, sometimes abaxially weakly tessellate, base asymmetrical, sometimes strongly so, with the wide side rounded, the narrow side attenuate, apex acute, margins finely serrulate. Synflorescences 1.5–2.8 (\bar{x} =2.2) cm long, ca. 1 cm wide, racemose, slightly curved, pedicels appressed; rachis glabrous below and pubescent above or completely pubescent; pedicels 0.4–4 (\bar{x} =2.2) mm, pubescent. Spikelets 8.5–10.5 (\bar{x} =9.9) mm long, 1.9–2.8 (\bar{x} =2.4) mm wide; glumes I and II abaxially glabrous, nerves absent; glume I 0.5–1 mm long, 1/10–1/20 the spikelet length; glume II (0.5–) 0.8–1.2 mm long, 1/6–1/12 (1/20) the spikelet length; glumes III and IV abaxially mostly glabrous but pubescent along the midnerve toward the apex or the upper 1/4–1/2 pubescent, apex acuminate, 3–5-nerved; glume III 3.4–4.8 (–5.8) mm long, 1/3–1/2 the spikelet length; glume IV 4.3–5.7 (–6.2) mm long, 1/2 the spikelet length; lemma (8.4–) 8.8–10.1 mm long, apiculate, abaxially glabrous or pubescent toward the apex, (5–) 7-nerved; palea 7.9–9.7 mm long, abaxially glabrous or pubescent toward the apex especially in the sulcus, 4–6-nerved. Flowers and fruit not seen.

Habitat and distribution:—*Chusquea ovatifolia* is confirmed only from Province Franz Tamayo in the Department of La Paz in Bolivia, in the middle watershed of the Tuichi river in Parque Nacional Madidi and environs. It occurs at elevations of 760 to 1200 m in Andean dry valleys, in the understory of primary semi-deciduous, deciduous and gallery forests, and less frequently in disturbed forests, with species composition mainly related biogeographically to the Tropical Seasonal Forests Region of the pleistocenic arch (Prado 2000). According to label data and field observations, this species often co-occurs with typical species of these forest formations, such as the mimosoid *Anadenanthera colubrina* (Vellozo (1827 [1831]: t. 16) Brenan (1955: 182) (Fuentes *et al.* 2004). Because of its restricted distribution (Fig. 1), *C. ovatifolia* is here considered to be a narrow endemic.

Etymology:—*Chusquea ovatifolia* is named for its distinctly ovate leaf shape.

Phenology:—This species was collected in flower in 2009 (Fuentes *et al.* 15299 and 15296) and 2013 (Fuentes *et al.* 18477). Collection records are insufficient to exclude the possibility of a short flowering cycle in this species, but given the flowering behavior documented for *C. ramosissima* (see below; Guerreiro 2014, Montii *et al.* 2011), the 2009 and 2013 flowering records for *C. ovatifolia* more likely represent sporadic flowering or an extended mass flowering event.

Comments:—Aside from the ovate foliage leaf blades, *C. ovatifolia* has a small (0.4–1.5 mm) sheath summit extension developed on only one side, an asymmetric foliage leaf blade base, and glumes III and IV 1/3–1/2 the spikelet length, somewhat shorter than in the other species of this section. This species is similar to *C. ramosissima* in many respects, and was first distinguished based on the ovate leaf blades with asymmetric bases. However, a parallel study by Leandro *et al.* (2017) of the foliage leaf anatomy and micromorphology of this section shows that this species and *C. tenella* share the presence of simple papillae on the subsidiary cells of the stomatal apparatus, whereas *C. ramosissima* and *C. tenuiglumis* share the presence of branched papillae, supporting our decision to recognize *C. ovatifolia* as a new species separate from *C. ramosissima*.

Additional specimens examined:—BOLIVIA. San Juan, 3800 ft, 20 March 1902, *Williams 959* (NY). Depto. La Paz, Prov. Franz Tamayo: Parque Nacional Madidi, camino de Apolo-Azariamas, Arroyo Pintata, a 495 m del campamento en dirección SE, aprox. 20 minutos saliendo del camino, 14°28.6'5''S, 68°32'19''W, 1011 m, 19 February 2003, *Cayola et al. 6* (ISC, LPB, MO); Parque Nacional Madidi, Chaquisapa, cerca al río Mojos, 14°34'13''S, 68°43'04''W, 921 m, 9 July 2005, *Fuentes et al. 9662* (ISC, LPB, MO); sector Sumpulo, pasando el río Mojos, entre Mojos y Pata, 14°35'01''S, 68°46'27''W, 1090 m, 26 September 2009 (fl), *Fuentes et al. 15299* (LPB, MO), *15296* (LPB, MO); Río Bilipisa, valle del río Marchariapo, 14°37'S, 68°26'W, 1200 m, 23 July 1993, *Kessler 4162* (ISC, LPB); cerro, 5 kms arriba de la Hacienda Ubito, 14°23'S, 68°28'W, 1000 m, 19 July 1993, *Kessler 4020* (ISC, LPB); 2 kms al W de la Hacienda Ubito, en trocha a Asariamas, 14°22'S, 68°29'W, 850 m, 13 July 1993, *Kessler 3846* (ISC, LPB); aprox. 15 km río arriba de la Hacienda Ubito en trocha a Buena Vista, 14°24'S, 68°27'W, 950 m, 13 July 1993, *Kessler 3930* (LPB); Parque Nacional y Area Natural de Manejo Integrado Madidi, norte de Apolo, 14°32'48''S, 68°41'36''W, 940–1170 m, 7 March 2005, *Uzquiano et al. 10* (ISC, LPB, MO).

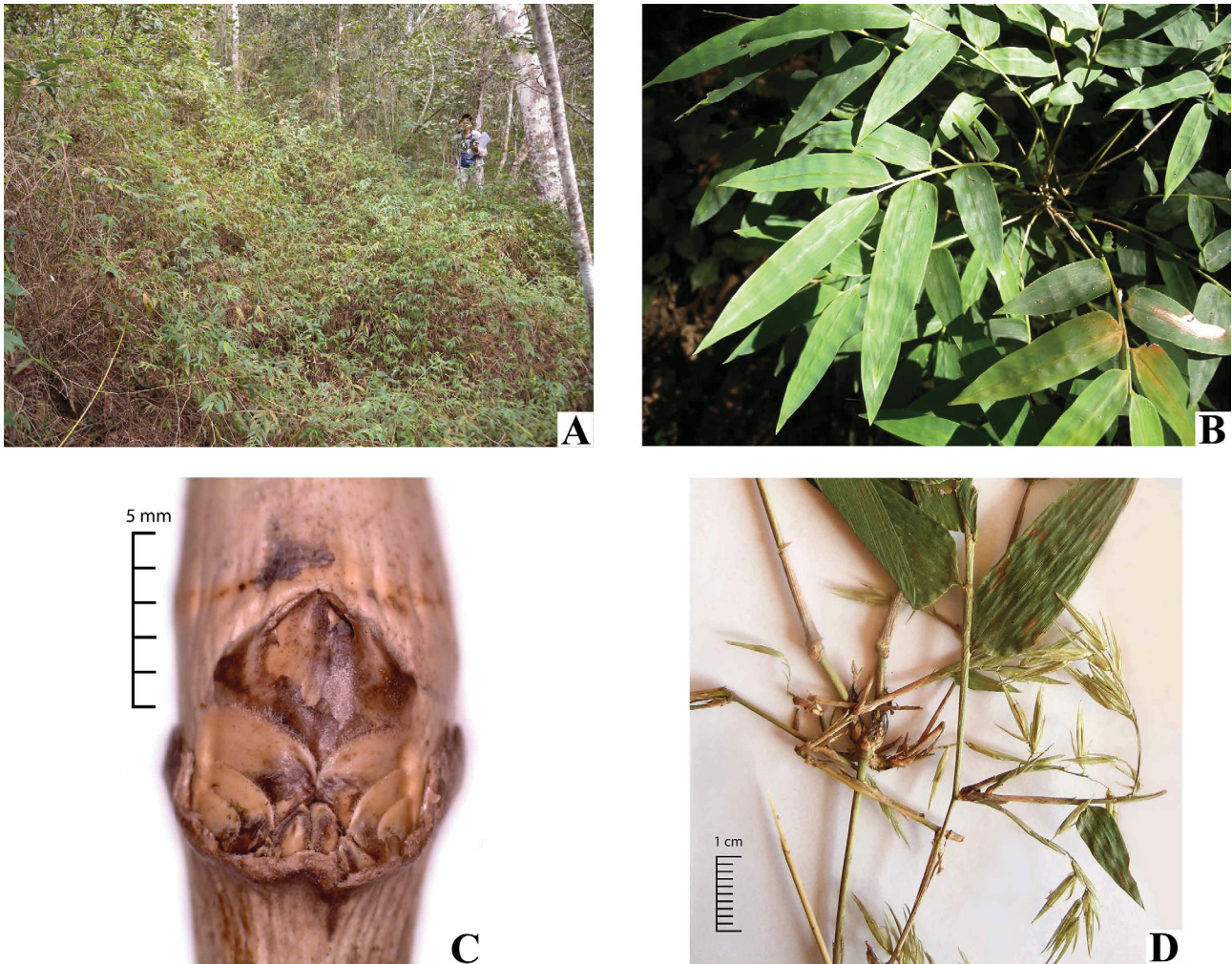


FIGURE 4. *Chusquea ovatifolia*. A. Habit, B. Close-up of leafy subsidiary branches, C. Bud complement, D. Synflorescences and spikelets. A, B, and D were taken by A. Fuentes and C by L. Clark. C is based on *Fuentes et al. 9662* and D is based on *Fuentes et al. 14877*.

3.—*Chusquea ramosissima* Lindman (1900: 24), Figs. 2, 5.

Lectotype (designated by Parodi 1941: 338):—PARAGUAY. Cordillera de Villa Rica, in silvis abundans, 30 September 1874, *B. Balansa 134a* [S 055423 photo SI, isolectotypes BR, S0510846 photo SI, US 2874652! (fragm. ex S)].

Chusquea affinis Munro ex Camus (1913: 80). Type:—BRAZIL. Minas Gerais, 1816–1821, *A. de Saint-Hilaire 1010* [holotype P! 00625480, isotypes K!, P! (2 sheets), US 1645640! (fragm. ex P), US 2874613! (fragm. ex P)].

Chusquea phacellophora Pilger (1923: 456). Lectotype (designated by Guerreiro *et al.* 2014: 175):—BRAZIL. Rio Grande do Sul: Rio Pardo, Fazenda Soledade, December 1916, *C. Jürgens 511* [US 2874644! (fragm. ex B)].



FIGURE 5. *Chusquea ramosissima*. A. Persistent culm leaf sheath in place, B. Apical portion of a new shoot showing culm leaves and infravaginal branching, C. Branch complement with a central branch, and two robust and several smaller subsidiary branches, D. Bud complement, E. Synflorescence, F. Spikelet, G. Ligular region of a foliage leaf, H. Ligular region of a culm leaf, adaxial view. Illustration by Sue Aldworth; A is based on *Medina 12*, B, D and G are based on *Soderstrom & Sucre 1986*, C is based on *Klein 7796*, E and F are based on *Pederson 6515*, and H is based on *Lindman A.1239*.

Description:—Rhizomes leptomorph, probably amphimorph. Culms 3–8 (–10) m tall, 0.4–1 (–1.5) cm in diameter, erect at the base, arching to scandent, clambering or hanging above; internodes 22–32 cm long, solid, usually glabrous, sometimes hispid just below the nodes. Culm leaves with sheaths 13–26 (–31.5) (\bar{x} =16.6) cm long, 1–3 (–4) times as long as the blade, persistent, abaxially glabrous or less commonly pubescent at the base and finely appressed-pubescent above or rarely hispid, slightly keeled toward the apex, apex symmetrically concave, margins becoming scarious toward the apex; sheath summit extensions 0.9–3.2 (\bar{x} =1.6) mm long, glabrous, erect, strongly unequal; girdle 0.5–4 mm wide, glabrous at the juncture with the sheath; outer ligule 1–2 mm long, glabrous or ciliate; inner ligule 2–10 mm long, asymmetrical, glabrous or abaxially pubescent; pseudopetioles 1.5–5 (\bar{x} =3.4) mm long, adaxially glabrous or stiffly pubescent, abaxially ciliate along the midrib; blades (6.5–) 10–18 (–20.5) (\bar{x} =14.6) cm long, 1–3 (–3.5) (\bar{x} =2.2) cm wide, L:W = 5.4–10 (\bar{x} =6.9), lanceolate, reflexed. Nodes at mid culm with 21–38 buds, consisting of one larger central bud subtended by 20–37 smaller, closely adjacent buds, 3–4 per lateral set; nodal line dipping markedly below the bud/branch complement. Branch complement of 20–50 branches subtending the central bud/branch, subsidiary branches of 2 sizes, with 2–4 more robust ones. Foliage leaves 5–9 per complement; sheaths glabrous or puberulent, maculate when young, margins usually becoming scarious, overlapping margin ciliate toward the apex, keeled, summit glabrous to finely ciliate, sheath summit extension 0.5–2 mm long, erect, acute, developed only on one side of the sheath, glabrous or less commonly ciliate; outer ligules 0.1–1.5 mm long, sometimes glabrous, usually ciliate or ciliate; inner ligules 0.4–1.5 mm long, truncate, glabrous or abaxially pubescent; pseudopetioles 1–2 mm long, adaxially glabrous, abaxially strongly ciliate; blades 4–9.4 (–12) (\bar{x} =7.1) cm long, 0.5–1.5 (–1.8) (\bar{x} =0.9) cm wide, L:W=5–12.6 (\bar{x} =8.3), lanceolate, adaxially glabrous, abaxially glabrous with a few sparse hairs along the midrib at the base or rarely abaxially pilose, abaxially a green marginal stripe often visible, not tessellate, the base \pm symmetrical, attenuate to rounded, the apex acuminate, the margins serrulate, midrib slightly excentric to more or less centric. Synflorescences 2–6.5 (\bar{x} =3.5) cm long, 1–1.5 cm wide, narrowly paniculate, straight to slightly curved, branches and pedicels appressed; rachis glabrous but ridges often scabrous; pedicels 0.5–4 mm long, scabrous-pubescent. Spikelets (7.5–) 8.5–11 (\bar{x} =9) mm long, ca. 2 mm wide; glumes I and II glabrous, apex obtuse, margins erose; glume I 0.5–1 mm long, 1/20–1/10 the spikelet length, 0–1-nerved; glume II 0.6–1.2 mm long, 1/20–1/8 the spikelet length, 0–2-nerved; glumes III and IV glabrous with apically ciliate margins, apex acute; glume III 3.6–8.3 mm long, 2/5–2/3 the spikelet length, 3–5-nerved; glume IV 3.9–8.6 mm long, 1/2–2/3 the spikelet length, 5–7-nerved; lemma 7–9.7 mm long, apex mucronate, margins slightly ciliate towards the apex, 7–9-nerved; palea 7.3–9 mm long, (4–) 6–7-nerved, weakly keeled towards the apex, weakly sulcate only towards the apex, apex biapiculate, ciliate. Lodicules lanceolate, apex acute; the anterior pair 1–1.2 mm long, the posterior one 0.7–1.1 mm long. Anthers ca. 3.5 mm long. Fruit not seen.

Habitat and distribution:—*Chusquea ramosissima* occurs in Argentina, Bolivia, Brazil, Paraguay and Uruguay from 3°54'16"S in the state of Ceará, Brazil to nearly 33°S in the department of Treinta y Tres, Uruguay. This species inhabits Atlantic forests near streams, in the understory and along edges, more or less dry transitional Atlantic forest (*mata mesófila*), semi-deciduous Atlantic forests, seasonally dry tropical forests of the Caatinga, Misiones and Piedmont areas (*sensu* Pennington *et al.* 2000), forest remnants and secondary habitats from sea level to 720 m in elevation. Representative specimens examined by LGC and LA are cited below to document the distribution of this species. Schmidt & Longhi-Wagner (2009) and Lizarazu (2013) cite some or many of the same specimens, but the former authors also cite additional specimens for Rio Grande do Sul, Brazil, and the latter author for Misiones, Argentina.

Phenology:—Guerreiro (2014) documented an approximately 30-year flowering cycle for *C. ramosissima*, noting that mass flowering events last for two to four years and that there are many sporadic flowering records from the intervals between mass flowering. Our records are consistent with this insofar as can be determined from label data, which often do not indicate the extent of flowering. From observations of this species from 2001 to 2009, Montti *et al.* (2011) described an extended flowering event lasting 3–5 years in different areas within a broader region in Argentina. Non-flowering culms were always mixed with flowering culms, but at any given site, most of the culms flowered during the 3–5 year period for that site. They hypothesized a possible 23-year cycle, but emphasized the need to obtain data from the same cohorts. Regardless of the length of the cycle, flowering behavior in *C. ramosissima* differs from the more typical gregarious monocarpy documented for many woody bamboos (e.g., Franklin 2004; Guerreiro 2014), with implications for population structure.

Comments:—*Chusquea ramosissima* differs from the other species of sect. *Tenellae* by having a nodal line position dipping markedly below the bud/branch complement, 20–50 branches per node (vs. 5–24), foliage leaf blades abaxially glabrous with a few sparse hairs along the midrib at the base (rarely abaxially pilose) but never with the base abaxially completely pubescent, and foliage leaf blades with a slightly excentric to more or less centric midrib. Schmidt & Longhi-Wagner (2009) reported 25–65 (–70) branches per node in this species, which still sets it apart

from the others. We did not observe the higher number of branches per node in the specimens available to us but this estimate is reasonable considering the typical pattern of rebranching that occurs in this section. Another interesting feature is the abaxial marginal green stripe that is often visible on the foliage leaf blades of this species. This green stripe is characteristic of the subtribe *Arthrotyliidiinae*, but also occurs in some other taxa of woody and herbaceous bamboos (Judziewicz *et al.* 1999). This feature, the well-defined pseudopetioles and its smaller leaf size may account for the difficulty in identification of herbarium specimens of this species, despite its broad distribution and otherwise distinctive morphology, because it is easily confused with members of the *Arthrotyliidiinae*.

Common names for this widespread species include *cará* (Klein 7796; Smith *et al.* 1981), *carajá* (Smith & Longhi-Wagner 2009), *corda-de-viola* (Smith & Longhi-Wagner 2009), *creciuma* or *creciuma* or *criciúma* (Klein 7815, 7796; Lindman A.1239; Pereira 5363; Lizarazu 2013, Smith *et al.* 1981, Smith & Longhi-Wagner 2009), *lambedor* (Smith *et al.* 1981), *tacuarembó* or *takuarembó* or *taquarembó* (Binacional 835; Carnevali 5442; Curran 9; Lizarazu 2013, Smith *et al.* 1981), *taquari* (Smith & Longhi-Wagner 2009) and *vengala* (Hatschbach 21511). Several of these names are also applied to other sympatric species of *Chusquea* (Smith *et al.* 1981). The label of *Hatschbach 7088* notes this species is used in making hats, and Lizarazu (2013) indicated it is used in basketry and has good forage value, although Smith *et al.* (1981) described its forage value as average.

Representative specimens examined:—ARGENTINA. Misiones: Iguazú, January 1944 (fl), *Bridocolli 3600* (LIL, US); Loreto, 8 July 1927, *Burkhart 1465* (BAA); Apóstoles, 27°55'S, 055°46'W, 30 November 1943, *Burkhart 14389* (MO, SI); Puerto San Misión, 18 July 1914, *Curran 726* (LIL); vicinity of Puerto León, 75–100 m, 12–21 July 1914, *Curran 726* (US); Iguazú, 19 January 1918 (fl), *Hauman s.n.* (BAA); Dep. Cainguas, Puerto Rico, 12 July 1945 (fl), *Hunziker 787* (LIL); Iguazú, 25°25'50"S, 54°33'33.3"W, 193 m, 6 March 2012 (fl), *Keller 10859* (CTES, HUEFS); Centro de Estudios del Bosque Subtropical, San Antonio, 28 August 1969 (fl), *Klein & Eskuche 9115* (HBR, PACA, US); Salto Iguazú, 29 December 1910, *Lillo 10602* (LIL); San Pedro, entre Irigoyen y San Pedro, Ruta 14, 26°19'50"S, 53°44'14"W, 770 m, 30 July 2010, *Lizarazu & Guerreiro 50* (MO); Colonia Leandro N. Alem, March 1940 (fl), *Mangieri s.n.* (K); San Ignacio, July 1945, *Martínez C. 3407* (LIL); Arroyo Qimbocay, 5 February 1947 (fl), *Meyer 11903* (LIL); Parque Nac. Iguazú, ruta 101, Ao. Sto. Domingo Chico, 12 January 1972 (fl), *Mroginski et al. 357* (BAA, G, ICN, US); Guaraní, Fracrán, picada a S. Pedro, 23 February 1924, *Parodi 5664* (BAA); Concepción, 28 January 1926, *Parodi 6937* (BAA, US); Dep. Ldor. Gral. San Martín, Salto Encantado, Arroyo Cuñapiru, 18 December 1993, *Rúgolo 2016* (ISC, SI); Dep. San Ignacio, Puerto Pauto Pipó, 13 May 1946 (fl), *Schwarz 2631* (LIL, NSW); Candelaria, Mártires, 15 April 1947 (fl), *Schwarz 4463* (LIL); Dep. San Ignacio, Bolsa Haucaguazú, 8 June 1948 (fl), *Schwarz 6062* (LIL); Cerro Moreno, 7 March 1907 (fl), *Spegazzini s.n.* (BAA); Apóstoles, Ruta Prov. 203, de San José a San Juan, Arroyo San Juan, 27°45'S, 55°37'W, 210 m, 15 June 2003, *Zuloaga et al. 4943* (MO, SI). Corrientes: Dep. Ituzaingó, Barrancas del Paraná, en Rincón del Ñaembé, 16 February 1982, *Carnevali 5442* (CTES); Dep. Santo Tomé, Garnichos, Cabaña San Juan Bautista, 12 April 1974, *Krapovickas et al. 25143* (CTES); Dep. Ituzaingó, Ea. Santa Rita, afluente del ayo. Ñaembé (Nambi-i), 27°03'S, 56°04'W, 31 May 1987, *Tressens et al. 3306* (CTES). BOLIVIA. Santa Cruz: Ñuflo de Chavez, Rancho Jinca, near Zapoco, 90 km E of Concepción, 16°30'S, 61°40'W, 400–550 m, 27 November 1985, *Killeen 1529* (LPB, MO) and *1530* (ISC); Ñuflo de Chavez, Las Trancas, Lomerío, parcelas de Bolfor, Las Trancas '95, 16°31'18"S, 61°50'53"W, 400 m, 18 November 1994, *Jardim & Mamani M. 1239* (USZ); Prov. Florida, 3 km SW of Angostura, 18°10'S, 63°33'W, 800–1000 m, 27 December 1992, *Nee & Vargas 43373* (NY). BRAZIL. Bahia: Mun. Jussari, on the road from Jussari to Palmira, 15°07'27"S, 39°32'08"W, 235 m, 2 February 1994, *Carvalho et al. 4359* (CEPEC, ISC, NY, SJRP, SP, US); Santa Cruz da Vitória: Estrada para Itajú do Colonia, Faz. Boa Fé, 9.3 km a partir de St. Cruz, 15°2'24"S, 39°47'10"W, 258 m, 2 April 2010, *Côrtes & Borges 246* (HUEFS); Maracás: ca. de 2 km do Cruzeiro, Estrada a esquerda da primeira bifurcação, 13°24'46"S, 40°24'25"W, 11 March 2008, *Dorea 80* (HUEFS); Coração de Maria: Mata Engenho da Raiz, próximo a Furnas, localidade conhecida como Belmonte, 12°15'S, 38°48'W, 320 m, 1 June 2000, *de Queiroz et al. 624* (HUEFS); Mun. Floresta Azul, 5 km W of Floresta Azul toward Santa Cruz da Vitória, 210 m, 3 April 1976, *Soderstrom et al. 2107* (ISC, K, SP, US); Mun. Belmonte, Fazenda Gaio Lego, 2 km N of Rio Jequitinhonha on BR 101, 40 m, 9 April 1976, *Soderstrom et al. 2135* (ISC, K, SP, US); Maracás: 2 km a E da cidade, depois do cruzeiro da cidade, Fazenda Juliana, 13°24'51"S, 40°24'37"W, 1016 m, 23 April 2002, *de Souza et al. 186* (HUEFS); Jussari: Serra do Teimoso, 7.5 km N then W of Jussari on road to Palmira, then 2 km S to Fazenda Teimoso, "Reserva da Fazenda Teimoso", southern end, 15°09'S, 39°31'W, 300 m, 1 February 1999, *Thomas et al. 11903* (MO, NY); Mun. Jequié, Serra do Castanhão, 14.5 km S of Jequié on BR-116 to road (at Churrascaria Corujão) then 7.2 km W, 13°56.522'S, 40°11.468'W, 775 m, 23 October 2001, *Thomas et al. 12561* (ISC, NY). Ceará: Ibiapina, Serra entre Ibiapina e Mucambo, CE-253, trecho interditado, 3°54'16"S, 40°52'13"W, 16 August 2011, *Mota & Silva 447* (HUEFS). Espírito Santo: Mun. Conceição do Castelo, BR-262, viaduct ca. 1 km past the exit for Conceição do Castelo, in direction of Belo Horizonte, 20°19'S, 41°13'W, 770 m, 22 February 1990,

Clark & Morel 694 (ISC, MO, SJRP, SP, US); São Mateus: Povoado Barra Seca, ca. 17 km no ramal que sai da Estrada para a Cachoeira Barra Seca, 28 September 2009, *Ferreira et al. 2170* (HUEFS); Mun Santa Teresa: encosta no Vale do Canaã, 22°49'54"S, 41°04'34"W, 700 m, 26 July 2009 (fl), *Simon* (HUEFS, MBML). Minas Gerais: Mun. Caparaó, Parque Nacional do Caparaó, Vale Verde, 1,100 m, 15 June 1991, *G. & M. Hatschbach 55543* (MBM, MO); Salto da Divisa, Fazenda Santana, 16°04'17"S, 40°03'19.2"W, 97 m, 19 August 2003, *Lombardi et al. 5274* (BHCB, HUEFS); Almenara, Fazenda Limoeiro, 16°00'35"S, 40°52'09"W, 481 m, 29 February 2004, *Lombardi et al. 5694* (BHCB, HUEFS). Paraná: Mun. Araucaria, margins of the floodplain of the Rio Iguacu, near the bridge crossing of BR-476, Curitiba-Lapa, 25°35'S, 49°26'W, 880 m, 3 March 1991, *Clark & Windisch 849* (ISC, MBM, MO, SJRP, SP, US); Mun. Lapa, road Lapa-Campo do Tenente, ca. 12 km from Lapa, 25°50'S, 49°45'W, 880 m, 4 March 1991, *Clark & Windisch 852* (ISC, MBM, MO, SJRP, SP, US); Iguazu Falls, Iguazu river, 15 July 1967, *Fosberg 48548* (ISC); Mun. Cerro Azul, Rio Ponta Grossa, 350–400 m, 4 July 1962 (fl), *Hatschbach 7088* (US); Mun. Terra Boa, Fda. Mururê, 15 May 1969 (fl), *Hatschbach 21511* (C, K, US, S); Mun. Chopinzinho, Rio Iguacu, Salto Santiago, 11 April 1975 (fl), *Hatschbach 36631* (US); Mun. Santa Helena Porto Verde, 12 December 1977 (fl), *Hatschbach 40533* (K, MO, US); Mun. Cerro Azul, Cab. Rib. do Tigre, 24 January 1980 (fl), *Hatschbach 42746* (US); Mun. Jaboti, Varzeão, 18 September 1993 (fl), *G. & M. Hatschbach & Barbosa 59412* (ISC, MBM); Mun. Tomazina, Rio das Cinzas, Corredeiras, 17 March 1994, *G. & M. Hatschbach & Barbosa 60544* (ISC, K); a 16 km de Pirai do Sul, Lambedor, Pirai do Sul, 1000 m, 27 October 1978, *Klein & Campos 12025* (HBR, US); Paraná (Ponto 12), 27 July 1978, *Klein & Maria s.n.* (US 2908494 & 2979667); forest reserve of CMNP, W of Rio Ivaí, 1100 m from forest border N of Faz. Boa Esperança, ca. 30 km E of Cianorte, 300 m, 20 March 1966, *Lindeman & Haas 818* (US); P. N. do Iguacú, 19 February 1960 (fl), *Pereira 5363* (K, US); Cascavel, Distrito de Juvinópolis, Castelo Branco, Sitio Snak, 4 April 2012, *Snak et al. 822* (HUEFS). Pernambuco: Sanharó: Distrito Jenipapo, Serra da Solidão, 8°17'18"S, 36°30'14"W, 15 August 2013, *Dorea et al. 128* (HUEFS). Rio de Janeiro: Mun. de Petrópolis, Vale de Bom Sucesso, "Caixa de Agua", 22°25'S, 43°07'W, 720 m, 6 May 1972, *Soderstrom & Sucre 1986* (ISC, K, US). Rio Grande do Sul: camino serrano de Porto Alegre a São Francisco de Paula, selva RS-2, 29 January 1964 (fl), *Burkhart 25062* (SI); road Encruzilhada do Sul-Passo dos Marinheiros, ca. 14 km N of Rio Camaquã, 250 m, 30°50'S, 52°27'W, 13 March 1991, *Clark & Oliveira 916* (ICN, ISC, MO, SJRP, SP, US); BR-116, between Caxias do Sul and Vacaria, 11 km N of San Marcos, 28°55'S, 51°07'W, 670 m, 15 March 1991, *Clark & Oliveira 920* (ICN, ISC, SJRP, SP, US); Mun. Candelaria, just S of Candelaria and N of the highway, 29°40'S, 52°45'W, 23 February 1992, *Clark et al. 1039* (ICN, ISC, SJRP); S. Leopoldo, September 1916 (fl), *Dutra 418* (SI, US); Faz. Faxinal, Arroio dos Ratos, 24 August 1980 (fl), *Hagelund 13303* (US); Mun. Dois Irmãos, Cascata São Miguel, 31 May 1980 (fl), *Irgang s.n.* (ICN); Mun. de Tenente Portela, Parque Estadual Florestal do Turvo, 9 July 1980 (fl), *Irgang s.n.* (ICN); Boa Vista, Salvador do Sul, 200 m, 22 April 1969, *Klein 8307* (HBR, US); Alto da Cruz, Cordeiro de Farias, Pelotas, RS, 25 October 1980 (fl), *Klein et al. 11911* (HBR, US); Caçapava do Sul, Arroio Irapuazinho, 30°32'26"S, 53°22'33"W, 8 September 2006, *Longhi-Wagner & Schmidt 10151* (ICN, K); Itati, RS 453, 18 January 2006, *Longhi-Wagner & Schmidt 10091* (ICN, K); Silveira Martins et alibi, 6 March 1893, *Lindman A.1239* (S); Caçapava do Sul: ca. 47 km NE de Caçapava do Sul na Estrada para Lagoão e Bom Jardim, 30°19'40"S, 53°12'54"W, 122 m, 13 November 2006, *de Queiroz & Machado 12451* (HUEFS); Schwabenschneis p. Dois Irmãos, 25 June 1949 (fl), *Rambo 42188* (US); Travessão, para Hamburgo, 25 June 1949 (fl), *Rambo 42188* (K, LIL); prope Caí, 18 July 1949 (fl), *Rambo 42566* (LIL, MO, PACA, SI); Montenegro, 17 September 1949 (fl), *Rambo 42951* (US); Schwabenschneis p. Dois Irmãos, 12 August 1949 (fl), *Rambo 42882* (LIL, US); Pelotas, Mato do Hôrto Botânico, 16 December 1955, *Sacco 449* (PEL, US); Santa Cruz do Sul, RS 287, 29°40'44"S, 52°25'46"W, 14 February 2007, *Schmidt 1483* (HUEFS, ICN); Encruzilhada do Sul, Passo dos Marinheiros, 12 December 2006, *Schmidt & Pelegrin 1448* (HUEFS, ICN); Campo Bom, 20 December 2006, *Schmidt s.n.* (HUEFS); Pelotas, Instituto Agronômico do Sul, 31 October 1945, *Swallen 7251* (US); Tenente Portela, 3 km SE Derrubadas, na Estrada T. Portela a Derrubadas, 31 January 1973, *Valls et al. 2579* (CEN); Quaraí, estr. Quaraí-Uruguariana, pelo Cerro do Jarau, junto a ponte sobre o Rio Quaraí Mirim, 21 November 1973, *Valls & Barcellos 2992* and *2994* (ICN); Santa Cruz do Sul-Trombudo, 8 September 1981 (fl), *Waechter 1848* (ICN). Santa Catarina/ Rio Grande do Sul: Marcelino Ramos-BR-153, ca. 3 km from Marcelino Ramos, 27°27'S, 51°55'W, 600 m, 12 March 1991, *Clark & Oliveira 909* (ISC, SJRP, SP, US). Santa Catarina: Mun. Rio do Sul, BR-470, Rio do Sul-Curitibaños, near exit to Laurentino, 27°15'S, 49°40'W, 340 m, 10 March 1991, *Clark & Oliveira 887* (ISC, MO, SJRP, SP, US); road Tupitinga-Barracão, canyon of Rio Uruguay, ca. 1 km from the border with Rio Grande do Sul, 27°35'S, 51°28'W, 550 m, 11 March 1991, *Clark & Oliveira 902* (ISC, MO, SJRP, SP, US); road Capinzal-Piratuba, ca. 2.5 km before Piratuba, 27°25'S, 51°44'W, 460 m, 12 March 1991, *Clark & Oliveira 908* (ISC, SJRP, SP, US); Mun. Mafra, BR-116, at bridge crossing the border, along Rio Negro, 26°07'S, 49°47'W, 820 m, 3 March 1991, *Clark & Windisch 853* (ISC, MO, SJRP, SP, US); Mun. Ituporanga, SC-427, ca. 3–4 km from Ituporanga, on the road to Petrolândia, 27°37'S, 49°37'W, 380 m, 5 March 1991, *Clark & Windisch*

863 (ISC, MO, SJRP, SP, US); Mun. Petrolândia, road Petrolândia, 27°35'S, 49°43'W, 680 m, 5 March 1991, *Clark & Windisch 866* (ISC, MO, SJRP, SP, US); road from S. Miguel d'Oeste to Dionisio Cerqueira, before Guaraciaba, at the Atlantic gas station, 26°42'S, 53°32'W, 20 February 1992, *Clark et al. 1037* (HBR, ISC, SJRP, SP); Princesa, São José do Cedro, 650 m, 17 July 1968, *Klein 7796* (HBR, US); Rio Chapecó, Nova Erechim, 300 m, 20 July 1968, *Klein 7815* (HBR, US); 5 km ao sul de Araranguá, Araranguá, 20 m, 1 September 1976, *Klein & Bresolin 11421* (HBR, US); Santo Antônio, Itapiranga, 400 m, 20 January 1974, *R. M. & M. M. Klein 11041* (HBR, US); ao oeste de Nova Erechim, Nova Erechim, 700 m, 20 January 1974, *R. M. & M. M. Klein 11046* (HBR, US); Barragem, Taió, 500 m, 22 January 1974, *R. M. & M. M. Klein 11071* and *11073* (HBR, US); Picada, 181 km da ERF, Papavanduva, 750 m, 25 October 1962 (fl), *Reitz & Klein 13540* (HBR, US). São Paulo: Campinas, Reserva St. Genebra, 3 October 1995 (fl), *Bernacci 2165* (UEC); Riberão Preto, Mata da Fazenda Santa Teresa near the Instituto Agronômico, 21°10'S, 47°50'W, 630 m, 19 January 1994, *Clark & Salgado 1186* (ISC, MO, US); Riberão Preto, Mata da Fazenda Santa Teresa near the Instituto Agronômico, 21°10'S, 47°50'W, 630 m, 19 January 1994, *Clark & Salgado 1187* (ISC, MO, SJRP, SP, US); SP-139, Itapetinga-São Miguel do Arcanjo-Sete Barras, near Rio Turvo, 23°50'S, 48°04'W, 750 m, 28 January 1990, *Clark & Windisch 642* (ISC, MO, SJRP, SP, US); Mun. Itapeva, SP-258 between Itapeva and Itararé, 24°01–02'S, 49°W, 830 m, 29 January 1990, *Clark & Windisch 649* (ISC, MO, SJRP, SP, US); Mun. Ipero, Faz. Ipanema, FLONA Ipanema, 6 August 1994, *Mamede et al. 583* (GSA, HRCB, SPF, UEC, UGC); Mun. Tatuí, on open bank of Guarapó River, 10 km due NW of city of Tatuí on road to Porangaba, 8 April 1960, *Medina 12* (US); Estação Ecológica de Juréia, 2 February 1986 (fl), *Suemitsu 68* (ESA, HUEFS); S. Cruz fl. Rio Pardo, 1901 (fl), *Wettstein & Schiffner s.n.* (W). PARAGUAY. S.l., s.d. (fl), *Balansa 2965* (G, US); on the Parana, April 1883 (fl), *Parodi 47* (K). Dep. Alto Paraná: Puerto Bertoni, March 1918 (fl), *Bertoni 384a* (BAA); Rio Monday, 16 May 1945 (fl), *Bertoni 1368* (LIL); Regione fluminis Alto Paraná, October 1909 (fl), *Fiebrig 5944* (G, K, LIL, SI, US); Centre forestier du Haut Parana, 12 km a l'ouest de Ciudad del Este, *Stutz 1693* (G). Dep. Amambay, in altaplanitie Sierra de Amambay, December 1912 (fl), *Hassler 12052* (BAA, G, US). Dep. Caaguazú: Grande-Picada de Caaguazú, April 1876 (fl), *Balansa 134* (G, K). Dep. Caazapá: Dist. Yuty, 15 km S de Capitindy, 10 September 1987, *Arbo et al. 2804* (CTES, G); Tavai, Castor cue, Arroyo Moroti, 26°10'S, 55°20'W, 4 December 1988, *Basualdo 1975* (FCQ, ISC, MO); Cumbey, Comunidad Mbya, 26°20'S, 55°40'W, 30 June 1989, *Basualdo 2513* (MO). Dep. Canendiyú: Itabo, Reserva de Itaipu, 25°40'S, 54°40'W, 24 May 1989, *Basualdo 2469* (MO); Rva. Itabó, 28 August 1980, *Binacional 835* (MO); Ruta 10, 80 km W de Guayrá, cruce Ybyrobará, 26 May 1976, *Carnevali s.n.* (CTES). Dep. Central: Villa Elisa, 22 September 1962 (fl), *Pedersen 6515* (BAA, C, K, P, US). Dep. Guairá: Colonia Independencia, 1 April 1950, *Anderson 1188* (US); Cumbre del Cerro Acati, 25°55'S, 56°15'W, 30 March 1989, *Basualdo 2438* (FCQ, ISC, MO). Dep. Itapúa: Obligado, El Tirol, 19.5 km by road NNE of Encarnación, 6 November 1976, *Foster 76-35* (US); Pastoreo, Obligado, 300 m, 20 Feb 1971 (fl), *Klein & Lopez 9345* (HBR, US); Hotel Tivol, 5 March 1985 (fl), *Krapovickas & Cristóbal 40058* (BAA, C, MO). Dep. Paraguari: Cerro Acahay, Compañía Virgen de Fátima, 5 km al sur de la ruta entre Carapegua y Ybycui, 25°54'S, 57°09'W, 250 m, 30 May 1985, *Brunner 1154* (G, MO, PY); Cerro de Acahay, February 1919 (fl), *Rojas 3275* (BAA, MO); Compañía Costa Segunda, Cerro Palacios, 25°25'S, 57°10'W, 250 m, 8 June 1988, *Zardini 4594* (MO); Cerro Palacios, 25°25'S, 57°10'W, 250 m, 9 July 1988, *Zardini 5573* (MO); P. N. Ybycu'i, near Arroyo Minas, 15 September 1988, *Zardini 7333* (MO); Cordillera de Ybytyruzú, Destacamento de Tororo, 400 m, 25°55'S, 56°15'W, 11 November 1988, *Zardini 7957* (FCQ, MO); Macizo Acahay, Forest on rocks on Eastern Peak, 500 m, 25°54'S, 57°09'W, 3 September 1988, *Zardini & Florentín 6883* (MO, PY); Acahay Massif, Easternmost Peak, Western part, 25°52'S, 057°08'W, 13 January 1992, *Zardini & Tillería 29802* (MO, PY); Cordillera de Ybytyruzú Melgarejo-Cerro Acati, 8 km S of Melgarejo, 25°48'S, 56°16'W, 10 July 1992, *Zardini & Tillería 32651* (FCQ, MO). Dep. San Pedro: Primavera, Alto Paraguay, 18 June 1957, *Woolston 113* (K) and 22 December 1957, *Woolston 144* (K). URUGUAY. Dep. Artigas: Tres Cruces, 15 October 1902, *Berro 2674* (K). Dep. Cerro Largo: Tacuari, November 1933, *Herter 1089B* (MO). Dep. Treinta y Tres: Olimar, 27 November 1899, *Berro 797* (K); Vergara, December 1932 (fl), *Herter s.n.* (ICN 90904).

4.—*Chusquea tenella* Nees (1835: 492), Figs. 1, 6A-E.

Lectotype (designated by Guerreiro *et al.* 2014: 175):—BRAZIL. In Brasilia, no date, *J. Lhotsky s.n.* [US 2874662! (fragm. ex B), isolectotypes BAA 804 (fragm. ex US), E 373675 (fragm. ex B)].

Chusquea tenella var. *latifolia* Dutra (1938: 146). Lectotype (designated by Clark 2000: 50):—BRAZIL. Rio Grande do Sul: São Leopoldo, Amaral, in selva, 30 July 1932 (fl), *T. J. Dutra 1543* (US 1723529!, isolectotype ICN!).

Chusquea uruguayensis Arechavaleta (1897: 546). Lectotype (designated by Guerreiro *et al.* 2014: 175):—URUGUAY. Tacuarembó: bosques, October 1896, *J. Arechavaleta s.n.* [MVM 5121, isolectotype BAA 810 (fragm. ex MVM)].

Description:—Rhizomes unknown. Culms 3–4 (–6) m tall, 0.5–1 (–1.5) cm in diameter, erect at the base, arching to scandent, clambering or trailing above; internodes 20–30 cm long, solid or irregularly hollow, strigose or hispid; supranodal ridge conspicuous. Culm leaves with sheaths (5–) 8.3–21.2 (\bar{x} =14.5) cm, 0.7–2 times the length of the blade, persistent, abaxially pubescent-hirsute, mottled (mainly visible when young), keeled toward the apex, apex symmetrically concave, margins ciliate, the cilia tan to golden, margins typically not becoming scarious, sheath summit extension 1.2–10 (\bar{x} =4.7) mm long, glabrous, erect, strongly unequal; girdle 0.5–5 mm wide, flat and with a ring of tan to golden cilia at the juncture with the sheath, cilia 4–5 mm long; outer ligule a minute rim, sometimes ciliate; inner ligule (1.5–) 3–11 (\bar{x} =5.2) mm long; pseudopetiole 2–9 mm (\bar{x} =5.8) long, abaxially strongly ciliate at the base, adaxially glabrous; blades (5.5–) 7–20 (28–34) (\bar{x} =15.3) cm long, 1.5–4.4 (4.8–5.7) (\bar{x} =3.3) cm wide, L:W = 3–7 (\bar{x} =4.5), lanceolate, reflexed. Nodes at mid culm with 6–10 buds, consisting of one larger central bud subtended by 5–9 smaller, closely adjacent buds, with 1–2 per lateral set; nodal line dipping slightly below the bud/branch complement. Branch complement of 7–20 subsidiary branches subtending the central branch, 2–4 of the subsidiaries more robust. Foliage leaves 6–15 per complement; sheaths often maculate, slightly puberulent, the base ciliate, overlapping margin ciliate, sheath summit extensions 1–7 mm long, erect, acute, strongly unequal, densely ciliate; outer ligule ca. 0.5 mm long, erect, ciliate; inner ligule 1–7 mm long, abaxially sparsely pubescent; pseudopetiole 1–7 mm long, adaxially glabrous, abaxially scabrous to strongly ciliate; blades 4.9–22.8 (\bar{x} =11.2) cm long, 0.6–4.1 (\bar{x} =1.7) cm wide, L:W=3.8–14.2 (\bar{x} =7.9), ovate-lanceolate, adaxially glabrous, abaxially glabrous except pubescent at the base on both sides of the midrib, the blade often becoming discolored on both surfaces in this region, pubescence sometimes extending along both sides of the midrib for most of the length, or sometimes completely pubescent, not tessellate, base \pm symmetrical, attenuate, apex acuminate, margins scaberulose. Synflorescences 2.5–5.1 (\bar{x} =3.3) cm long, 0.5–1 cm wide, racemose or weakly paniculate, straight to slightly curved, branches and pedicels appressed; rachis glabrous; pedicels 1–4 mm long, glabrous or scabrous. Spikelets (8) 9–11.5 (\bar{x} =10) mm long, 1.5–2 mm wide; glumes I and II glabrous, but glume I sometimes abaxially finely pubescent, nerves absent; glume I 0.5–0.8 mm long, 1/10–1/20 the spikelet length, apex acute to obtuse; glume II 0.5–1.3 mm long, 1/10–1/20 (–1/8) the spikelet length, apex acute to obtuse or irregular; glumes III and IV slightly ciliate at the base, 3–5-nerved; glume III (3.5–) 4.5–5.2 mm long, 1/3–3/5 the spikelet length, apex acuminate; glume IV 4.4–6 mm long, 1/2–3/5 the spikelet length, apex acute; lemma 7.6–10 mm long, apex acute to mucronate, margins slightly ciliate towards the apex, 5–7-nerved; palea 8–9.5 mm long, subequal to the lemma but occasionally overtopping it, 4–6-nerved, weakly keeled towards the apex, sulcus absent, apex biapiculate, ciliate. Lodicules 3, ovate, apex acute; the anterior pair ca. 1.5 mm long, the posterior one ca. 1.5 mm long. Anthers ca. 5 mm long. Fruit not seen.

Habitat and distribution:—*Chusquea tenella* occupies relatively undisturbed Atlantic forests and forest remnants along rivers and streams and by waterfalls in Argentina, Brazil and Uruguay at 100–910 m elevation, but can be an aggressive colonizer in disturbed habitats in the semideciduous Atlantic forest (Montti *et al.* 2014). Representative specimens examined by LGC and LA are cited below to document the distribution of this species. Schmidt & Longhi-Wagner (2009) and Lizarazu (2013) cite some or many of the same specimens, but the former authors also cite additional specimens for Rio Grande do Sul, Brazil, and the latter author for Misiones, Argentina.

Phenology:—Guerreiro (2014) inferred a 16-year flowering cycle for *C. tenella*, and our records largely confirm this pattern. One deviation is a set of flowering records in 1969, 1971 and 1972 from three collections in Rio Grande do Sul and Santa Catarina, Brazil, but no information is available to determine whether these represented a regional mass flowering event or simply sporadic, asynchronous flowering.

Comments:—Characters that differentiate *C. tenella* from other sect. *Tenellae* species are its abaxially pubescent-hirsute culm leaf sheaths, the presence of a ring of cilia at the juncture of the sheath and girdle, ciliate culm leaf sheath margins that do not become scarious, and foliage leaf blades abaxially with a pubescent base, with both surfaces often becoming discolored in the area of the pubescence. As noted previously, Schmidt & Longhi-Wagner (2009) reported on the great variation in foliage leaf size, which we also observed and that is also seen in *C. tenuiglumis*.

Common names include *cará* (Smith *et al.* 1981), *cresume* or *criciúma* (Rosengurt B-4822; Smith *et al.* 1981), *pitinga* or *potinga* or *putinga* or *butinga* (Dutra 416; Reitz & Klein 14698; Bodrati & Areta 2006, Smith *et al.* 1981, Smith & Longhi-Wagner 2009), *taquara-lisa* (Smith *et al.* 1981), *taquary* or *taquari* (Dutra 416; Smith & Longhi-Wagner 2009), and *taquari-do-miúdo* (Klein 8320; Smith *et al.* 1981). Several of these names are also applied to other sympatric species of *Chusquea* (Smith *et al.* 1981). Smith *et al.* (1981) and Lizarazu (2013) cited the forage value of this species.

Representative specimens examined:—ARGENTINA. Misiones: Iguazú, 6 March 2000 (fl), *Deginani et al.* 1746 (MO, SI); San Pedro, 5 April 1944, *Porta* 208 (SI); Fracrán, 18 February 1924, *Parodi* 5575 (BAA); Dep. Guaraní, Ruta 15, limite del Pred. Guaraní con el Inst. de Prev. Soc. (IPS), 7 September 1994, *Schininni et al.* 28725

(MO); Dep. Guarani, Predio Guarani, Sendero CIFOR en selva, 15 September 1998, *Tressens et al. 6017* (CTES); Dep. Guarani, Predio Guarani “Caramelito Racá”, Borde de arroyo, 2 September 1999, *Tressens et al. 6414* (MO). BRAZIL. S.I., s.d., *Sellow* (K, US frag.). Paraná: Mun. Piraquara, Pinhal, 3 July 1949 (fl), *Hatschbach 1403* (BAA, SI); Mun. Palmital, Rio do Cobre, 15 October 1991, *Hatschbach & Silva 55767* (HUEFS, MBM); Campo Morão, 28 March–2 April 1946, *Swallen 9004* (US); Ponto 12, 27 August 1978, *Klein & Maria s.n.* (US); Mun. Campina Grande do Sul, Sítio do Belizário, 7 September 1996 (fl), *Silva et al. 1690* (HUEFS, MBM). Rio Grande do Sul: Proximo a Novo Hamburgo, 26 April 1980 (fl), *Breyer s.n.* (ICN); Morro Azul, Torres, 21 April 1979 (fl), *Citadini Zanette & Waechter 363* (ICN); Mun. Sapiranga, Arroio Feitoria, Picada Verão, 29°37'S, 51°05'W, 200 m, 15 March 1991, *Clark et al. 918* (ISC, MO, SJRP, SP, US); in silva prope S. Leopoldo, March 1916 (fl), *Dutra 416* (SI, US); São Leopoldo, Quinta S., March–April 1916 (fl), *Dutra 1545* (ICN); Viamão - Parque Saint Hilaire, 14 September 1972 (fl), *Irgang & Baptista s.n.* (ICN); Morro de Côco, 25 km sul de Porto Alegre, 20 June 1973, *Lindeman et al. 24062* (CEN); Parque de Torres—Morro Itapeva (beira da lagoa) no topo, 7 August 1972, *Lorscheiter s.n.* (ICN); Caí, Alto Felis, 3 March 1933 (fl), *Orth 871* (BAA, LIL); Morro Sapucaia, 29 January 1948 (fl), *Palacios-Cuezzo 474* (LIL, US, W, WIS); Caracol, 8 km N de Canela, parque estadual, vale abaixo da cachoeira, 28 December 1972, *Pellizzaro et al. s.n.* (ICN); P. Alegre, Vila Manresa, 14 May 1949 (fl), *Rambo 41560* (LIL, US); Schwabenschneib, 25 May 1949 (fl), *Rambo 41726* (US); ad montem Ferrabraz p. Taquara, 5 July 1949 (fl), *Rambo 42386* (US); Amaral Ribeiro para Taquara, 5 July 1949 (fl), *Rambo 42386* (K, US); Pareci Velho pr. Caí, 7 July 1949 (fl), *Rambo 42473* (US); Montenegro, 17 September 1949, *Rambo 42951* (US); Faz. Do Arroio p. Osorio, 4 January 1950 (fl), *Rambo 45212* (ISC, LIL); Vila Manresa p. P. Alegre, 15 May 1950 (fl), *Rambo 47076* (US); S. Leopoldo Dois Irmãos, 10 October 1946, *Ritter 35528* (US); Morro do Côco—Viamão, 22 November 1979 (fl), *Soares 191* (ICN); São Leopoldo, Morro do Paulo, 5 August 1978 (fl), *Waechter 902* (ICN). Santa Catarina: BR-470, Rio do Sul-Curitibaños, ca. 28.5 km W of Pouso Redondo, cabeceras do Rio Agua Preta, 27°18'S, 50°08'W, 830 m, 10 March 1991, *Clark & Oliveira 891* (ISC, MO, SJRP, SP, US); Tupitinga-Celso Ramos, about 13 km from Tupitinga, 27°36'S, 51°24'W, 530 m, 11 March 1991, *Clark & Oliveira 904* (ISC, MO, SJRP, SP, US); BR-470, ca. 30.3 km from Pouso Redondo and 47.5 km from the Curitibaños exit, 27°18'S, 50°08'W, 820 m, 19 February 1992, *Clark et al. 1032* (HBR, ISC, MBM, MO, SJRP, SP, US); Road from BR-282 to Modelo, Lajeado Fabiano, 26°48'S, 53°04'W, 20 February 1992, *Clark et al. 1036* (HBR, ISC, MBM, MO, SJRP, SP, US); Road from Orleans to Bom Jardim da Serra, 28°20'S, 49°34'W, 910 m, 24 February 1992, *Clark et al. 1045* (HBR, ISC, MO, SJRP, SP, US); Mun. Aiurê, pass of Serra do Corvo Branco, road between Urubici and Grão Pará, 28°04'S, 49°26'W, 850 m, 25 February 1992, *Clark et al. 1049* (HBR, ISC, MBM, MO, SJRP, SP, US); Serra Geral, road Timbé do Sul-S. José dos Ausentes, 28°49'S, 49°55'W, 600 m, 6 March 1991, *Clark & Windisch 874* (HUEFS, ISC, MO, SJRP, SP, US); Rio Uruguay, in silva primaeva, 25 February 1916 (fl), *Dusén 17788* (BAA, G, K, S, SI, US); Catanduvas, Joaçaba, 25 August 1964 (fl), *Klein 5443* (HBR, US); Princesa, São José do Cedro, 650 m, 17 August 1968, *Klein 7797* (HBR, US); Morro do Ribeirão, 400 m, 21 May 1969 (fl), *Klein 8320* (HBR, US); Pântano do Sul, Ilha de S. Catarina, Florianópolis, 5 m, 26 July 1967, *Klein & Bresolin 7494* (K, US); Morro do Rio Vermelho, 250 m, 27 June 1968 (fl), *Klein & Bresolin 7761* (HBR, US) and *7766* (HBR, US); Morro do Rio Vermelho, 200 m, 15 April 1969 (fl), *Klein & Bresolin 8283* (HBR, US); Palmas, Governador Celso Ramos, 100 m, 19 May 1971 (fl), *Klein & Bresolin 9477* (HBR, US); Morro do Rio Vermelho, 200 m, 27 June 1968, *Klein & Bresolin 9761* (US); Serra do Espigão, Curitibaños, 900 m, 7 September 1957 (fl), *Reitz & Klein 4893* (HBR, US); Lacerdópolis, Caponzal, 500 m, 12 April 1963 (fl), *Reitz & Klein 14698* (HBR, US); Passo do Rio Canoas, Anita Garibaldi, 600 m, 12 April 1963 (fl), *Reitz & Klein 14763* (HBR, US); Passo do Rio Canoas, Anita Garibaldi, 600 m, 11 July 1963 (fl), *Reitz & Klein 15383* (HBR, US); No pendor da Serra do Oratorio, April 1889 (fl), *Ule 1340* (HBG, P). São Paulo: BR-116, ca. Km 515, about 38 km S of Jacupiranga, Braço Feio, Serra do Azeite, 24°53'S, 48°16'W, 400 m, 4 March 1990, *Clark & Windisch 725* (ISC, MO, SJRP, SP, US); a 30 km al sur de São Paulo, 23 May 1948 (fl), *Joly s.n.* (BAA, K, SI). URUGUAY. Maldonado: Pan de Azucar, s.d., *Arechavaleta s.n.* (US); Sierra de las Animas, 14 December 1899 (fl), *Berro 805* (K); Sierra de Animas, Cerro de las Animas, 34°46'S, 55°19'W, 16 February 1992, *Mujica-Sallés 405* (MVFA). Dep. Montevideo: Tacuarembó, s.d., *Felippone 4432* (SI). Dep. Tacuarembó: bosques, October 1896, *Arechavaleta s.n.* (BAA 809, MVM 5120); Gruta Helechos, ca. 150 m, 28 September 1933, *Herter 1089A* (SI). Dep. Treinta y Tres: Q. de los Cuervos, April 1936, *Legrand 695* (BAA); Isla Patrulla, Quebrada de los Cuervos, 20 March 1945, *Rosengurt B-4822* (US).

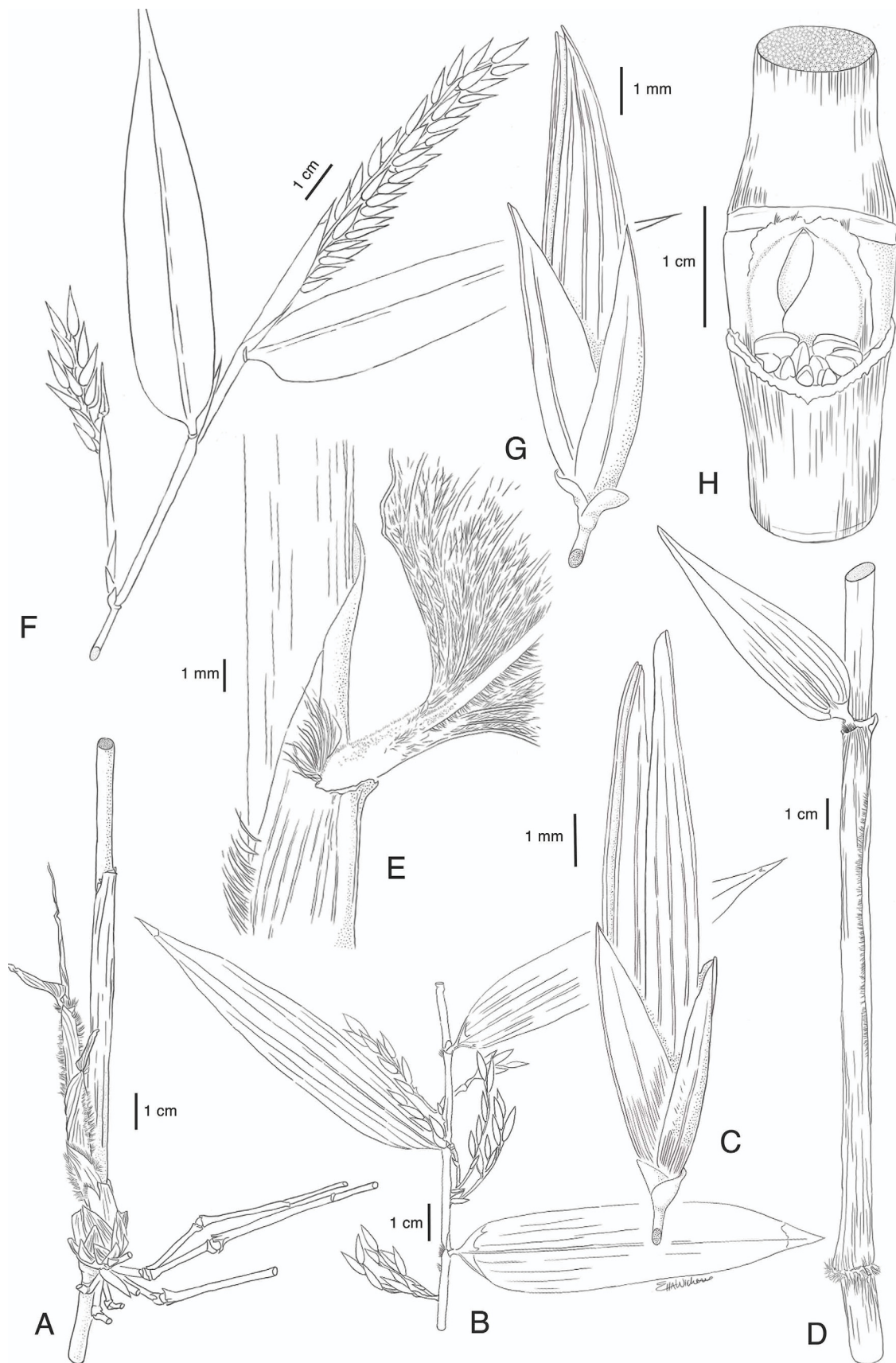


FIGURE 6. *Chusquea tenella* and *C. tenuiglumis*. *C. tenella*: A. Branch complement with developing central branch, B. Synflorescences on a leafy subsidiary branch, C. Spikelet, D. Culm leaf in place, E. Ligular region of a foliage leaf. *C. tenuiglumis*: F. Synflorescences on a leafy subsidiary branch, G. Spikelet, H. Bud complement. Illustration by Ella Wichers; A is based on Clark & Windisch 725, B and C are based on Rambo 41560, D and E are based on Clark & Windisch 874, F and G are based on Regnell III 1426, and H is based on Clark & Morel 707.

5.—*Chusquea tenuiglumis* Döll (1880: 199), Figs. 1, 6F-H.

Lectotype (here designated):—BRAZIL. Minas Gerais: Caldas, 18 July 1862 (fl), *A. F. Regnell III 1426* (S! signed A. F. Regnell, isolectotypes S! signed Regnell, S! signed R). *Chusquea tenuiglumis* var. *subcylindrica* Döll (1880: 200). Lectotype (here designated):—BRAZIL. Minas Gerais: Caldas, 18 July 1862 (fl), *A. F. Regnell III 1426* (S! signed A. F. Regnell, isolectotypes S! signed Regnell, S! signed R). Syntypes:—BRAZIL. Minas Gerais: Caldas, 1861? (fl), *A. F. Regnell III 1426* (C!, K!, S! signed R).

Description:—Rhizomes unknown. Culms 2–8 m tall, 1–1.5 cm in diameter, erect at the base, arching or scandent; internodes 20–30 (–36) cm long, solid, glabrous; supranodal ridge conspicuous. Culm leaves with sheaths 12.5–27.5 (\bar{x} =18.7) cm, 0.8–1.6 times as long as the blade, persistent, abaxially glabrous or sparsely appressed-hispid, sometimes mottled when young, apex \pm horizontal, margins smooth, becoming scarious, sheath summit extensions 0.6–5 (\bar{x} =3) mm long, papery, glabrous, erect, strongly unequal; girdle 0.5–4 mm wide, glabrous to finely pubescent, a glabrous corky ridge to 1 mm wide present at the juncture with the sheath; outer ligule 1–4 mm wide; inner ligule 9–38 mm long, asymmetrical, papery; pseudopetioles 3–12 mm (\bar{x} =6.5) long, abaxially strongly ciliate, adaxially glabrous; blades 13–26.2 (\bar{x} =19.8) cm long, 2.4–5.5 (\bar{x} =4) cm wide, L:W = 3.8–6 (\bar{x} =4.9), lanceolate, slightly spreading or reflexed. Nodes at mid culm with 6–9 buds, consisting of one larger central bud subtended by 5–8 smaller subsidiary buds, 2 per lateral set; nodal line dipping slightly below the bud/branch complement. Branch complement of 7–24 branches, consisting of 2–4 robust and 5–20 smaller subsidiaries subtending the central bud/branch, sometimes the subsidiary branches subequal. Foliage leaves (3–) 5–7 (–8) per complement; sheaths glabrous or sparsely appressed-hispid, more or less strongly keeled, overlapping margin glabrous or ciliate, if ciliate then the sheath also hispid on that side, margins becoming scarious, summit glabrous, sheath summit extensions 4–30 mm long, erect, acute, strongly unequal, glabrous; outer ligules 0.5–5 mm long, erect to reflexed, often split; inner ligules 3.5–40 mm long, glabrous, papery, adnate to the longer sheath summit extension; pseudopetioles 2–6 mm long, adaxially glabrous, abaxially strongly hispid, hairs often extending along the midrib for a short distance; blades 6.6–24.5 (\bar{x} =16.5) cm long, 1–5.6 (\bar{x} =2.7) cm wide, L:W=3.7–8.5 (–11.9) (\bar{x} =6.5), ovate-lanceolate, adaxially and abaxially glabrous, not tessellate, base \pm symmetrical to slightly asymmetrical with the narrow side attenuate, the wide side rounded, apex acuminate, margins serrulate. Synflorescences 5–10 (\bar{x} =7.7) cm long, 1–1.5 cm wide, paniculate, straight, branches and pedicels appressed; rachis glabrous; pedicels 1.5–4 mm long, finely scabrous-pubescent. Spikelets 8.4–12.4 (\bar{x} =10) mm long, ca. 2 mm wide; glumes I and II glabrous, abaxially scabrid at the base, nerveless, apex obtuse to truncate and slightly erose; glume I 0.6–1 mm long, 1/15–1/20 the spikelet length; glume II 0.8–1.2 mm long, 1/10–1/20 the spikelet length; glumes III and IV 3–5-nerved; glume III 5.1–6.7 mm long, 1/2–3/5 (–2/3) the spikelet length, apex acuminate, margins ciliate; glume IV 6.2–7 mm long, 3/5–2/3 (–7/10) the spikelet length, apex acuminate to mucronate, margins ciliate towards the base; lemma 8.7–11 mm long, apex acute, margins slightly ciliate towards the apex, 7-nerved; palea 8.5–11.3 mm long, 6-nerved, weakly sulcate only towards the apex, apex acute, ciliate. Lodicules lanceolate, apex acute; the anterior pair ca. 1.3 mm long, the posterior one ca. 1.1 mm long. Anthers ca. 4.5 mm long. Fruit not seen.

Habitat and distribution:—*C. tenuiglumis* inhabits Atlantic forests and disturbed forest and forest remnants in Brazil (states of Minas Gerais, Rio de Janeiro, Santa Catarina and São Paulo) at (100–) 530–1180 m elevation.

Phenology:—The only known flowering collection of this species is the type, from 1862. All subsequent collections are vegetative, with the next earliest collection from 1972, so it seems likely this species flowered in that 110-year interval. Collections since 1972 are from 1990, 1991, 1992, 2004, 2008 and 2015, though no two are from the same locality. *Clark & Morel 839* was gathered in 1991 from the area of Caldas, Minas Gerais, the type locality. A thorough examination of Brazilian herbaria, especially in Minas Gerais, might reveal additional flowering collections.

Comments:—The presence of a small corky ridge at the juncture of the culm leaf sheath and girdle, a more or less horizontal culm leaf sheath apex, an often split foliage leaf outer ligule, foliage leaf inner ligules (3.5–40 mm, the longer ones on leaves of more robust branches) with a papery texture, and the synflorescences 5–10 cm long are the most diagnostic characteristics of *C. tenuiglumis*. As noted for *C. tenella* (this study and Schmidt & Longhi-Wagner 2009), foliage leaf blade size is extremely variable. Therefore, foliage leaf blade size may be useful in identification of this species (compared with *C. ramosissima*) but more consistent characters are the often long, papery inner ligules, which will be visible on at least some leaves on more robust branches, and the presence of the small corky ridge between the girdle and culm leaf sheath.

The lectotypification of the name *C. tenuiglumis* presented an interesting problem. In the original description, Döll (1880) designated two varieties, each with only one specimen cited [“Habitat ad Caldas prov. Minarum (*Regnell III 1426*)” for var. *subcylindrica* and “Habitat in prov. Minarum prope Lagoa Santa (*Warming*)” for var. *laxiuscula*]. Neither of these specimens was cited following the species description. Several sheets bearing the collector name and number *A. F. Regnell III 1426* are now deposited in several herbaria (C, K, S) and consist of abundant flowering

material borne on leafy branches, some of which show the long, papery inner ligules. This material is consistent with Döll's general description of the species, and is also consistent with other collections from Caldas and other locations in the state of Minas Gerais (as well as the other states cited below). The other variety (see **Incertae Sedis**) clearly does not match the preceding material, and in fact is more similar to *C. tenella* (Döll's comment after the description of this variety started with "*Fortasse Ch. tenellae varietas*") so we exclude it from the circumscription of *C. tenuiglumis*, making the recognition of var. *subcylindrica* unnecessary. However, we have lectotypified both the species name and the varietal name to make this completely unambiguous.

Among the sheets labeled as *Regnell III 1426*, three have a date of "1861?" (one each at C, K, S) and three (all at S) have a date of "18 July 1862". Because Regnell lived in Caldas from 1840 to the end of his life in 1884 (Stafleu & Cowan 1983), and because bamboo flowering events can extend over a year or more, as documented for *C. ramosissima* (Montti *et al.* 2011, Guerreiro 2014), it is conceivable that these sheets reflect different gatherings, even though they bear the same collector number. Three different sets of handwriting are evident among the six sheets: 1) one S sheet (18 July 1862) and the two 1861? sheets from C and K, each bearing the same printed label with handwriting, all signed "A. F. Regnell"; 2) one S sheet (18 July 1862 but with two printed labels, one the same as in the previous group of three), signed "Regnell" on the label that is the same as that on the S, C and K sheets in 1); and 3) the two remaining S sheets (one 18 July 1862 and the other 1861?), both signed "R". Although the different sets of handwriting could point to different gatherings, these could also indicate that sets of duplicates were sent at different times or that a label was copied. Of the three sheets of *Regnell III 1426* deposited at S with the unambiguous date of 18 July 1862, we chose the one that best matches the original description as the lectotype (and the other two become the isolectotypes). The remaining three sheets of *Regnell III 1426* with the 1861? date therefore become syntypes.

Additional specimens examined:—BRAZIL. Minas Gerais: Mun. Viçosa, municipal road from Viçosa to Araponga, sitio Mundial, before São José do Triunfo, 20°45'S, 42°49'W, 730 m, 25 February 1990, *Clark & Morel 706* (BCHB, ISC, MO, SJRP, SP, US); Mun. São Miguel do Anta, municipal road from Viçosa to Araponga, ca. 6 km before São Miguel do Anta, 20°47'S, 42°47'W, 770 m, 25 February 1990, *Clark & Morel 707* (BCHB, ISC, MO, SJRP, SP, US); Mun. Santa Luzia, between Santa Luzia and BR-262 at the Km 299 entrance, ca. 2 km from BR-262, near Dist. Industrial Simão da Cunha, 19°50'S, 43°55'W, 670 m, 26 January 1991, *Clark & Morel 762* (BCHB, ISC, MO, SJRP, SP, US); Mun. Poços de Caldas, Serra de São Domingo, ca. 3 km along the road to Leite Sta. Marina, ca. 1.1 km beyond the fork leading to the Cascata das Antas, 21°46'S, 46°37'W, 1110 m, 27 February 1991, *Clark & Morel 839* (BCHB, HUEFS, ISC, MO, SJRP, SP, US); Mun. Camanducaia, road to Monte Verde, Serra da Mantiqueira, 22°47'S, 46°09'W, 1180 m, 13 January 1991, *Clark & Windisch 734* (ISC, MO, SJRP, SP, US); Baependi: Toca dos Urubus, face leste da Serra de Santa Maria do Baependi, 21°56'15"S, 44°56'15"W, 3 May 2008, *Ferreira et al. 1946* (HUEFS); Salto da Divisa, Fazenda Santana, 16°03'41"S, 40°03'23.5"W, 150 m, 4 March 2004, *Lombardi et al. 5824* (BCHB, HUEFS); Mun. Araponga, Parque Estadual da Serra do Brigadeiro, Trilha Matipó, 16 April 2015, *Silva & Machado 167* (VIC). Rio de Janeiro: Estrada Rio de Janeiro-Grumari, 100 m, 23 March 1972, *Soderstrom & Sucre 1918* (ISC, K, NY, US). Santa Catarina: Mun. Petrolândia, SC-427, road Ituporanga-Petrolândia, 3 km before Petrolândia, 27°30'S, 49°39'W, 530 m, 5 March 1991, *Clark & Windisch 864* (ISC, MO, SJRP, SP, US). São Paulo: Mun. Cunha, road Cunha to Campos da Cunha (Campos Novos), ca. 12 km from Cunha, 23°02'S, 44°52'W, 960 m, 2 March 1992, *Clark & Windisch 1058* (HUEFS, ISC, MO, SJRP, SP, US).

***Chusquea* sect. *Tenellae* Incertae Sedis**

C. tenuiglumis* var. *laxiuscula Döll (1880: 200). Lectotype (here designated):—BRAZIL. Minas Gerais: Lagoa Santa, May 1865 (fl), *Warming s.n.* (C! label handwritten, with the locality in red ink, isolectotype C! typeset collector name and locality, the date handwritten in red ink). This collection consists of just these two sheets, the lectotype consisting of a leafy flowering branch and the isolectotype consisting of a branch complement bearing leafy flowering branches and non-leafy synflorescences. This entity shares more in common with *C. tenella* than with *C. tenuiglumis* in terms of synflorescence branching and size, but the foliage leaf blades lack the basal pubescence on the abaxial surface characteristic of *C. tenella* so we exclude it from our concept of that species. Additionally, the northernmost verified population of *C. tenella* is in southern São Paulo state (*Clark & Windisch 725, Joly s.n.*), so this collection from Lagoa Santa would represent a significantly disjunct population if treated as that species. Despite the broad distribution of *C. ramosissima*, this collection is unlikely to represent that species, as its foliage leaf blades are 9–12.5 × 1.1–1.8 cm wide vs. 4–9.4 (–12) × 0.5–1.5 (–1.8) cm in *C. ramosissima*, and glumes III and IV extend only about 1/2 the spikelet

length, vs. 2/5 to 2/3 in *C. ramosissima*. To our knowledge, this population has not been recollected since the original collection, but field work to obtain a complete vegetative collection is needed to determine its status.

***Chusquea* sp. indet.** BOLIVIA. Dep. La Paz, Prov. Sud Yungas, Chulumani 107 km hacia NNE, pasando Asunta, Alto Charia sobre el río San José, afluente del Río Boopi, 900 m, 6 August 1983 (fl), *Beck 8517* (K, LPB); Dep. La Paz, Prov. Nor Yungas, por debajo de Yolosa, ca. 2 km arriba del embarcadero, al sur del río Huarinillas, 16°12'09"S, 67°46'22"W, 1250 m, 4 August 1991, *Beck 18797* (K, LPB). These two collections, from parallel valleys, almost certainly represent a new species within sect. *Tenellae*, but the material is too incomplete to describe adequately. The culm leaf is persistent, branching is infravaginal, the subsidiary branches are of two sizes, the relatively large foliage leaves (the two complete leaf blades on *Beck 8517* measure 16 × 4.3 cm and 10.5 × 2.8 cm) have strongly excentric midribs, and the thin-textured spikelets are ca. 13 mm long with glumes I and II scale-like and relatively short, and glumes III and IV 1/3–1/2 the length of the spikelet.

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