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# A New Species of *Guadua*, *G. ciliata* (Poaceae: Bambusoideae: Bambuseae), from Venezuela and Brazil

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The genus *Guadua*, as recognized by Soderstrom & Londoño (1987), comprises ca. 30 species and is restricted to lowland areas of the New World. It is included in subtribe Guaduinae of the tribe Bambuseae by Soderstrom & Ellis (1987). Species of *Guadua* are typically large, erect, woody bamboos with thorns. The type species of the genus, *G. angustifolia* Kunth, is the largest bamboo of the New World and among the largest in the world. McClure (1973) enumerated the species but recognized the group as *Bambusa* subg. *Guadua* (Kunth) Hackel.

While writing an account of the genus for the *Flora of the Venezuelan Guayana*, it became apparent that a suite of collections from Venezuela and Brazil represents a new species in the genus.

***Guadua ciliata*** Londoño & Davidse, sp. nov.

TYPE: Venezuela. Territorio Federal Amazonas: Dpto. Atabapo, Cucurital de Caname, southern bank of the middle part of Caño Caname, 3°40'N, 67°22'W, ca. 100 m, edge of forest, with *Mauritia*, seasonally inundated and hummocky, 30 Apr.–1 May 1979, G. Davidse, O. Huber & S. S. Tillet 16924 (holotype, MO; isotypes, INPA, K, SI, TULV, US, VEN). Figures 1, 2.

*Bambusa lignosa*, culmis 4–10 m altis, 0.8–2.0 cm diam., cylindricis, cavis, glabris vel pubescentibus, internodiis 20–30 cm longis. Rhizoma sympodiale, pachymorphum. Folia culmorum demum decidua, vagina laminam excedente; lamina triangularis, erecta, margine ciliata; vagina glabra, basi annularis incrassata indurataque. Ramificationes intravaginales, inermes, ramo uno dominante. Folia in complemento 7–11; lamina 12–27.5 cm longa, 1.9–4.9 cm lata, lineari-lanceolata, nervo principali luteolo, infra prominenti; petiolus longus, hirsutus; ligula interior 1.0–2.2 mm longa; vagina glabra vel pubescens, in juvenilibus setis oralibus distaliter crispis, mox deciduis. Synflorescentiae ramos terminantes, 3–7 cofillorescentiae. Pseudospiculae sessiles, lineari-lanceolatae, bractea singula subtendente, prophylo singulo, glumis fertilibus 1–3, flosculis 5–9 et anthoecii rudimento terminali praesente; lemna ovata, 23–27 nervata, supra glabra vel subglabra, infra strigosa, margine ciliata; palea dorso 2 carinis conspicue alatis ciliatisque praedita; lodiculae 3; stamina 6, filamentis filiformibus, liberis; ovarium fusi-

forme, glabrum, stylo singulo, piloso, stigmatibus tribus plumosis.

Woody, climbing bamboo, lacking thorns, only the lowest portion self-supporting, the distal portion cascading down from trees. *Rhizomes* sympodial, pachymorph. *Culms* 4–10 m long, 0.8–2.0 cm diam., green when young, turning yellowish at maturity, rather slender; *internodes* mostly 20–30 cm long, cylindrical, usually glabrous, sometimes densely puberulent or appressed pubescent, hollow, with thick walls 2–4 mm wide, subsolid in the lower part of the culm and branches; *nodes* with a horizontal nodal line and a nearly horizontal nodal ridge, the area between the nodal line and ridge densely puberulent, a dense band 2–3 mm wide of white, retrorsely appressed hairs below the nodal line; *bud* solitary, positioned close to the nodal line, not elevated, planoconvex, the shoulders of the prophyll ciliolate. *Culm leaves* coriaceous, tardily deciduous, pushed away by the developing axillary branches; *sheaths* 8–15 cm long, 3.5–6.0 cm wide, abaxially glabrescent, adaxially glabrous, tessellate in the upper portion, stramineous when old, indurate, strongly attached by a basal, dark, well-marked, thickened, persistent girdle, the margins ciliate with purplish and hyaline hairs; *auricles* mostly lacking, rarely to 2 mm long and fimbriate on the margin with setae 5–8 mm long; *inner ligule* a truncate, densely ciliolate membrane 0.4–2.2 mm long, abaxially densely strigillose; *outer ligule* lacking; *blades* 1.0–2.4 cm long, 0.5–1.0 cm wide, triangular, erect and appressed to the culm, mucronate, thinner than the sheath, abaxially glabrous and conspicuously many-nerved, adaxially densely strigose between the nerves with hyaline or purple hairs, the margin finely ciliolate, the mucro 2–3 mm long, the junction with the sheath slightly notched. *Branching* intravaginal, typically with one strongly dominant, erect to patent branch at the lower nodes, the middle and upper nodes with a dominant central branch and with 2 slender branches arising from lateral buds at proximal nodes of the central branch. *Foliage leaves* 7–11 per comple-



ment,  $\pm$  horizontal to drooping; *sheaths* green when young, turning stramineous, abaxially glabrous, rarely sparsely hispid, shiny, strongly nerved, bearing oral setae at the summit, the margins ciliate; auricles usually absent, occasionally developed to 1–3 mm long and fimbriate; *oral setae* irregularly developed, 2–11 mm long, early deciduous, straight below, curled distally, yellowish to stramineous; *inner ligule* 1.0–2.2 mm long, slightly incurved, membranous, broadly obtuse to truncate, glabrous or puberulent and finely ciliate; *outer ligule* a stramineous rim 0.3–1.0 mm long, dipping in the middle, glabrous; *pseudopetiole* 0.5–1.4 cm long, pulvinate, adaxially hispidulous, abaxially glabrous, sometimes with a patch of hairs above the pulvinus, the pulvinus shiny, glabrous and yellowish; *blades* (9–)12–25(–27.5) cm long, (1.2–)2–3.5(–4.3) cm wide, linear-lanceolate, to ovate-lanceolate in flag blades, olive green, apically acuminate, 15–23-nerved, marginally scabrous, adaxially glabrous, abaxially glabrous and tessellate, the midnerve prominent, yellowish. *Syn-florescences* usually terminating leafy branches of all orders, itercaucant, consisting of 3–7 cincinni, each with 1–3 multiflowered pseudospikelets, occasionally forming  $\pm$  dense aggregations of up to 100 pseudospikelets on leafless axes, the main axes glabrescent. *Pseudospikelets* (3–)5–7(–11) cm long, 3–4(–5) mm wide, linear-lanceolate, sessile, olive green when young, stramineous when mature, covered with wax, all but the terminal one on each branch consisting of 1 subtending bract, 1 prophyll, 1–3 gemmiparous glumes, and 5–9 florets, the distal 2–4 florets progressively reduced, ending in a rudimentary floret, the terminal pseudospikelet lacking an immediately subtending bract and prophyll; *rachilla* segments 3.0–9.5 mm long, ciliate on the rim, disarticulating just below its juncture with the lemma, densely puberulent on segments between the subtending bract and the gemmiparous glumes, varying to glabrescent on the segments between the lemmas; *subtending bracts* throughout the main axis with blades from fully developed and similar to small foliage blades varying to reduced apicules, generally gemmiparous, the blades deciduous; *prophyll* 3–13 mm long, abaxially puberulent, adaxially shiny and glabrous, rarely enclosing a bud, the keels and margins ciliate; *gemmiparous glumes* 5–16 mm long, 6–9 mm wide, ovate to ovate-lanceolate, 13–19-nerved, only the midnerve prominent distally, usually apiculate, sometimes with a small blade, mar-

ginally ciliate, abaxially glabrous or appressed pubescent, adaxially tessellate and densely strigillose toward the apex; *lemmas* 1.4–2.3 cm long, 7–9 mm wide, ovate, rounded on the back, 23–27-nerved, completely embracing the palea and the rachilla segment, apiculate, shiny, marginally ciliate with purplish and hyaline hairs 0.4–0.9 mm long, abaxially with appressed hyaline hairs between the nerves or glabrescent, adaxially tessellate and densely strigillose in the upper  $\frac{1}{2}$ , the apiculum 1–2 mm long; *palea* smaller than the lemma, 8–17 mm long, ca. 2 mm wide, 2-keeled, the keels abaxially prominently winged, 4–7-nerved between the keels, purplish ciliate at the summit between the keels, the wings of the keels 0.7–0.9 mm wide distally, 1–2-nerved, puberulent on both surfaces in the upper  $\frac{1}{2}$ – $\frac{1}{3}$ , purplish ciliate above the middle, the cilia finer and hyaline toward the base, the margins of the palea overlapping, 2-nerved, glabrous on the back, ciliate in the upper half; *lodicules* 3, 5.1–7.2 mm long, 1.5–2 mm wide, 9–13-nerved, acute, ciliate near the apex with minute purple cilia, the anterior pair slightly asymmetrical, fleshy thickened below, thinly membranous above, the posterior one symmetrical, slightly narrower and thinner than the anterior pair; *stamens* 6, the filaments filiform, free, the anthers 5.5–7.5 mm long, attached in the lower  $\frac{1}{2}$ , yellowish purple when young then brown, sagittate basally and emarginate apically; *ovary* fusiform, glabrous; style 1, pilose; stigmas 3, yellowish to red-brown, plumose. *Fruit* a caryopsis, 8.5–10.0 mm long (including the style base), 2.5–2.6 mm wide, dark brown, the body glabrous, the embryo side convex, the hilum side somewhat flattened, the apical portion asymmetrically curved in side profile; *embryo*  $\frac{1}{2}$  as long as the caryopsis; *hilum* a prominent groove as long as the caryopsis body; *style base* 1.5–2.7 mm long, persistent, densely pilose.

*Additional collections examined.* VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Dpto. Atabapo, Caño Caname, S bank near Mavacal, 3°41'N, 67°23'W, ca. 95 m, 29 Apr. 1979, *Davidse et al.* 16871 (BRI, CAY, MO, US, VEN); upper portion of Caño Caname, 3°40'N, 67°13'W, ca. 100 m, 3 May 1979, *Davidse et al.* 17114 (COL, L, MO, US, VEN); lower part of Caño Yagua, Chipital, 3°29'N, 66°41'W, ca. 120 m, 7 May 1979, *Davidse et al.* 17318 (MO, US, VEN); Río Puruname, 30–35 km desde la boca, 3°24'N, 66°20'W, 100–150 m, 30 May 1982, *Huber & Tillett* 6389 (MO, US); Dpto. Río Negro, 0–0.5 km NW of San Carlos de Río Negro along river, 1°55'N, 67°5'W, 120 m, 28 Nov. 1977,

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Figure 1. *Guadua ciliata* Londoño & Davidse. —A. Culm internode with an erect, appressed culm leaf;  $\times$  1. —B. Upper branch complement with one dominant central branch;  $\times$  1. —C. Flowering leafy branch showing the progressive reduction of the foliage leaves to the subtending bracts of the pseudospikelets;  $\times$  4. —D. Foliage leaf





showing ligules and pseudopetiole;  $\times 5$ . — E. Culm leaf with glabrous sheath and adaxially densely strigose blade;  $\times 2.5$ . — F. Solitary bud on culm node with persistent girdle of culm sheath and bands of hairs above and below the nodal line;  $\times 3$ . (Based on the type collection *Davidse et al.* 16924.)



*Liesner* 3977 (ISC, MO, PRE, US, VEN); Solano, along the Brazo Casiquiare, 1°57'N, 66°57'W, 75 m, 26 June 1984, *Davidse & Miller* 26665 (MO, US, VEN); 0–0.3 km NW of San Carlos and Río Negro, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 1°56'N, 67°03'W, 120 m, 8 Apr. 1979, *Liesner* 6373 (MO). BRAZIL. AMAZONAS: Río Negro, Tapuruquara, 22 Jan. 1978, *Steward et al.* 466 (MO); Río Negro, Rio Tea, Bacurí, 12 Sep. 1979, *Kubitzki et al.* 79-243 (MO, US); Río Negro, Ilha Tamanquaré, near Santa Isabel do Rio Negro (Tapuruquara), 12 Sep. 1979, *Kubitzki et al.* 79-251 (MO, US); Río Negro, Tapuruquara, Igarapé Dará, 4 Sep. 1979, *Kubitzki et al.* 79-135 (MO, NY, US); Río Negro, lower Rio Curicuriary, 7 Sep. 1979, *Kubitzki et al.* 79-177 (MO, NY, US); Río Negro, proximo a Ponta Negra, Mar. 1976, *Coelho & Cosme Mota* 762 (NY, US); Amazon River about 1 hr. above Manaus, 18 Aug. 1979, *Calderón et al.* 2985 (NY); Río Urubú, between intersection with Manaus–Caracarái Road and Serra da Lua, 2 Aug. 1979, *Calderón et al.* 2910 (MO, US); basin of Río Negro, between Moreria and Rio Quinini, 10 Nov. 1971, *Prance et al.* 16251 (NY, US); along the Río Negro between Manaus and San Gabriel, between Paraná de Floresta and the mouth of the Rio Branco, 26 June 1979, *Alençar* 56 (US); Secus Rio Negro, Brasiliae septentionalis, inter Barcellos et San Gabriel, Dec. 1851, *Spruce* 1954 (GH, K, NY, P, US, W).

This new species is included in *Guadua* because it possesses the following combination of characters: similar branching pattern, pseudospikelets, fertile florets several, stamens 6, lodicules 3, stigmas 3, style 1 and pilose, palea keels winged, a band of hairs below and above the nodal line, and erect triangular culm blade contiguous or almost so with the culm sheath. Soderstrom & Londoño (1987) considered the last three characters, plus the presence of thorns on the culms and branches, to be apomorphies that define this genus. However, as pointed out by L. G. Clark (in litt.), culm blades contiguous or nearly so with the sheath is a character also found in *Rhipidocladum*, *Arthrostyloidium*, and most species of *Chusquea*, so that this character is really not apomorphic for *Guadua*. In addition, as shown below, not all species of *Guadua* have thorns, and a few species of *Bambusa* possess them. Thus, only the winged palea keels and the band of hairs below the nodal line seem to be good apomorphic characters for *Guadua*.

At least two other described species of *Guadua*, *G. capitata* (Trin.) Munro and *G. glomerata* Munro, as well as several undescribed species, are also climbing with relatively slender culms. Most of these have thorns, but some, including *G. capitata*, lack them. Presently, some of these species are so incompletely known that it is difficult to make an assessment, but further studies may show some of the climbing species to form a distinct group.

*Guadua ciliata* appears to be most closely related to *G. latifolia* (Humb. & Bonpl.) Kunth and *G.*

*glomerata*. The three species are very similar in the form of the culm and foliage leaves. *Guadua ciliata* is distinguished from *G. glomerata* by the hollow, smooth, and thornless (vs. solid, strigose, and slightly thorny) culms, the erect (vs. reflexed) pseudospikelets, and the ciliate (vs. glabrous) margins of the spikelet bracts. They are similar in the climbing habit and the form of the branch complements.

*Guadua ciliata* is distinguished from *G. latifolia* by the climbing (vs. erect) habit, the much thinner (0.8–2 cm vs. 3–7 cm diam.) culms, lack of thorns, the usual lack of prominent auricles and fimbria on the culm leaves, and the relatively narrower paleas with fewer veins and narrower wings on the keels. In *G. latifolia* the palea keel wings are widest below the middle, whereas in *G. ciliata* they are widest above the middle. *Guadua ciliata* is similar to *G. latifolia* in its usually glabrous culm sheaths and prominently ciliate spikelet bracts; the specific epithet is based on the latter character. The lower branches of *G. latifolia* are usually strongly thorny, although there seems to be a lot of variation in this feature.

*Guadua ciliata* was apparently first collected by Spruce in 1851 along the Río Negro in Brazil under his number 1954. Shortly afterwards, Munro (1868) misidentified *Spruce* 1954 as *G. latifolia*, probably because of the general similarity of the spikelets, and especially because of the ciliate lemmas. As noted by McClure (1973), this mistake was repeated by Doell (1880) in *Flora Brasiliensis*. The illustration (tab. 49) of *G. latifolia* in *Flora Brasiliensis* was also based on *Spruce* 1954, but actually represents *G. ciliata*. In his notebook, Spruce named his collection 1954, *G. fragilis*, a name cited as a nomen nudum in synonymy by Munro (1868) but never validly published.

We have studied an isotype and a photograph of the holotype of *Bambusa latifolia* Humb. & Bonpl. (Venezuela. Amazonas: Río Casiquiare, *Humboldt & Bonpland* 1090 (isotype, P)), which is the basionym for *G. latifolia*. We consider the following collections to belong to this species: Venezuela. Territorio Federal Amazonas: Dpto. Río Negro, Neblina Base Camp on the Río Mawarinuma, 0°50'N, 66°10'W, elev. ca. 140 m, 17 July 1984, *Davidse & Miller* 27454 (MO, VEN); same locality, 17 July 1984, *Davidse & Miller* 27432 (BRI, COL, K, LE, MEXU, MO, P, PRE, TULV, US, VEN); 22 Feb. 1984, *Liesner* 16183 (MO); 19 Feb. 1985, *Nee* 30958 (MO, NY); upper Río Baria, ca. 0°55'N, 66°15'W, elev. 100 m, 2–3 July 1984, *Davidse & Miller* 26893 (CANB, COL, F, INPA, ISC, K, L, LE, MEXU, MG, MO, NY, PRE, TULV, US,



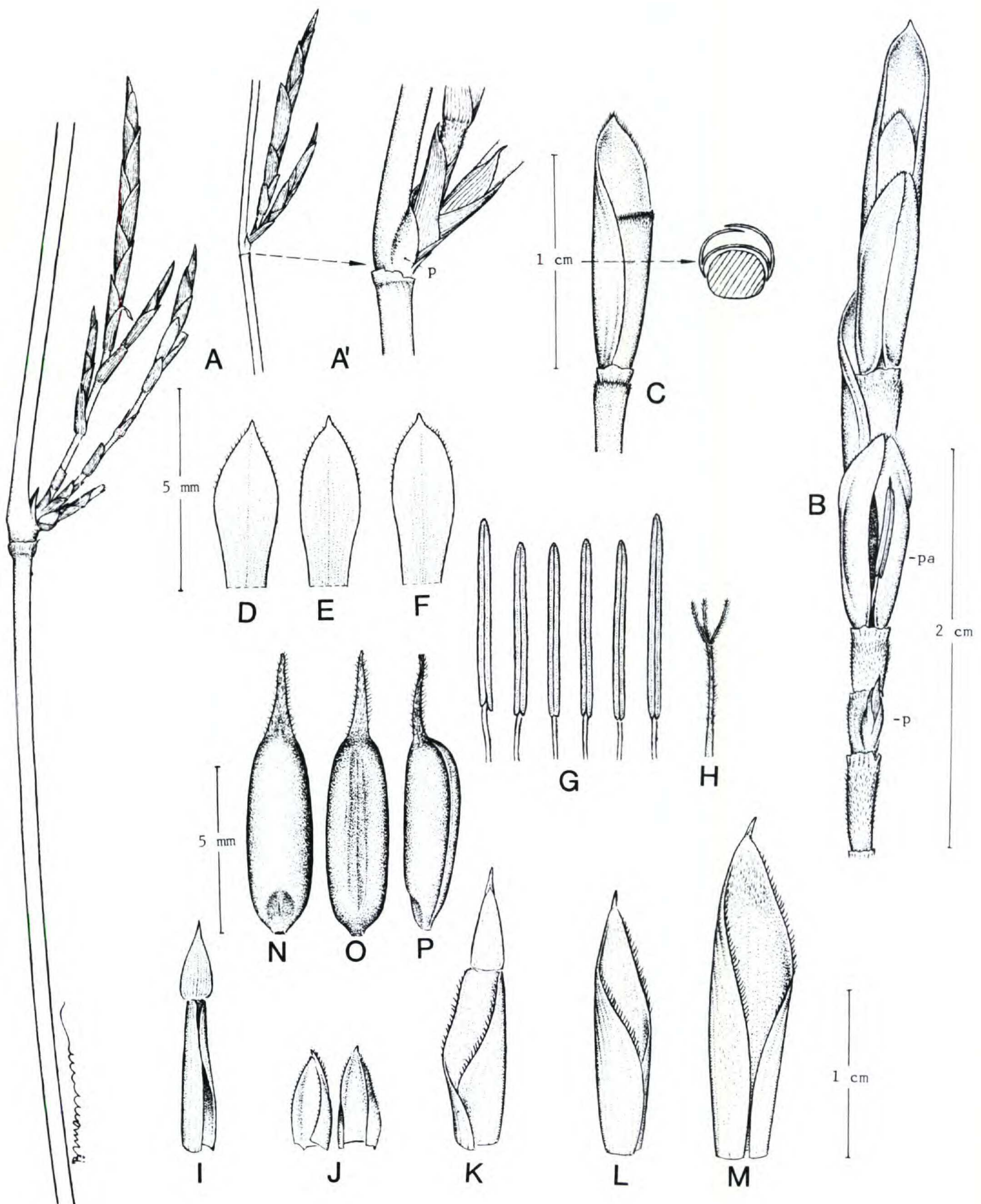


Figure 2. *Guadua ciliata* Londoño & Davidse. —A. Leafless flowering branches with 4 pseudospikelets (left) and 2 pseudospikelets (right);  $\times 1$ . —A'. Enlargement of Figure A (right) with the subtending bract of the cincinnus removed (arrow), thus exposing the position of the prophyll (p);  $\times 6$ . —B. Partial dissection of pseudospikelet with gemmiparous glumes and lemmas removed showing rachilla segments, prophyll enclosing a pseudospikelet bud (p), and palea enclosing a flower (pa). —C. Palea with winged keels attached to rachilla segments with the lemma removed; the arrow points to a diagrammatic cross-sectional view showing the clasping wings of the palea keels and the overlapping palea margins. —D. Anterior lodicule. —E. Posterior lodicule. —F. Anterior lodicule. —G. Androecium of 6 young stamens. —H. Gynoecium with glabrous ovary, pilose style, and 3 plumose stigmas. —I. Subtending bract with developed blade. —J. Prophyll of pseudospikelet, abaxial view (left), adaxial view (right). —K. Gemmiparous glume with blade. —L. Gemmiparous glume with apiculum. —M. Lemma with apiculum, adaxially densely strigillose in the upper portion. —N–P. Caryopsis. —N. Embryo view. —O. Hilum view. —P. Lateral view. (Figs. 2A–M based on the type collection Davidse et al. 16924, N–P on Davidse et al. 17318.)



VEN); forested riverbank of the Brazo Casiquiare between mouth of the Río Pasimoni and Culimacare, 1°53'–1°58'N, 66°50'–66°35'W, elev. 80 m, 25 July 1984, *Davidse 27872* (CANB, COL, INPA, ISC, K, MEXU, MG, MO, NY, P, TULV, US, VEN).

*Guadua ciliata* is known from the southwestern quarter of Territorio Federal Amazonas, Venezuela, and northwestern Amazonas, Brazil, but is also to be expected in adjoining areas of Colombia. All collections have been made on riverbanks, which are also the habitat of *G. latifolia* and *G. glomerata*. *Guadua ciliata* appears to be much less common than *G. latifolia* based on the populations that Davidse has observed in Venezuela. In Venezuela, all populations of *G. ciliata* had relatively few individuals on high riverbanks that are flooded only infrequently. On the other hand, *G. latifolia* formed extensive colonies on gravel and sandbars and low riverbanks subject to frequent flooding. However, label data for some of the Brazilian collections indicate that *G. ciliata* grows in igapó forest, with the base of the plants submerged in water.

The southernmost collections of *G. ciliata* from Dpto. Río Negro, Amazonas, Venezuela, and two from Amazonas, Brazil (*Liesner 6373*, *Huber & Tillett 6389*, *Davidse & Miller 26665*, *Steward et al. 466*, *Calderón et al. 2985*), differ from the remaining collections by their pubescent culms, pubescent foliage sheaths and subtending bracts, and slightly larger spikelets and auricles.

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