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# Three New Taxa of *Guadua* (Poaceae: Bambusoideae) from South America

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**ABSTRACT.** Two new species of *Guadua* from South America are described, illustrated, and compared with putatively related species. The two new species are *Guadua macrospiculata* from the western Amazon basin in southeastern Colombia, northwestern Brazil, and northern Peru, and *G. uncinata* from southern Colombia and central-eastern Ecuador. A description of the Brazilian species *G. tagoara* is included, establishing one new subspecies, *G. tagoara* subsp. *glaziovii*, from the Atlantic forests of the state of Rio de Janeiro. The empty bracts at the base of the spikelet proper of the pseudospikelet in *Guadua* are reinterpreted as sterile lemmas and not glumes.

**RESUMEN.** Dos nuevas especies de *Guadua* y una subespecie de *G. tagoara* son descritas para Sur America, incluyendo ilustraciones y datos comparativos con especies afines. Las nuevas especies son *Guadua macrospiculata*, que ocurre en la cuenca occidental Amazónica, específicamente en el sur-oriente de Colombia, noroccidente de Brasil y norte del Perú, y *G. uncinata* que habita el sur de Colombia y la región centro-oriental del Ecuador. Se hace una revisión de la especie brasileña *G. tagoara* estableciendo una nueva subespecie, *G. tagoara* subsp. *glaziovii*, que ocurre en la Mata Atlántica del estado de Rio de Janeiro en Brasil. Se reinterpretan las brácteas vacías en la base de la llamada espiguilla de la pseudoespiguilla en *Guadua* como lemas estériles y no glumas.

**Key words:** Andean foothill swamps, Atlantic forest, Bambusoideae, *Guadua*, *igapó*, Poaceae, pseudospikelet morphology, South America, *tahuampa*.

*Guadua* Kunth is distinguished among native New World bamboos by its large size, triangular culm leaves, light-colored supra- and infranodal bands of hair, thorny branches, pseudospikelets, and paleas with winged keels (Judziewicz et al., 1999). Its species are broadly distributed from

Mexico to northern Argentina and Uruguay, with the greatest diversity below 1500 m in elevation in a variety of habitats, including lowland tropical and lower-montane forests, savannas, cerrado, and gallery forests. We here describe two new species, *G. macrospiculata* Londoño & L. G. Clark from the western Amazon basin of southeastern Colombia, northwestern Brazil, and northern Peru, and *G. uncinata* Londoño & L. G. Clark from southern Colombia and central-eastern Ecuador. We also provide a detailed description of *G. tagoara* (Nees) Kunth and establish a new subspecies. Including the 2 new species, *Guadua* comprises 26 described species, although a few names remain to be clarified and some species remain undescribed.

Like other woody bamboos, species of *Guadua* can be distinguished readily by a suite of vegetative and reproductive characters once complete material is available. It is often the case in *Guadua*, however, that pairs of species may be very similar vegetatively but distinct in their reproductive morphology (e.g., *G. macrospiculata* and *G. glomerata* Munro) or very similar in their reproductive morphology but distinct in their vegetative morphology (e.g., *G. paniculata* Munro and *G. weberbaueri* Pilger or *G. macrospiculata* and *G. ciliata* Londoño & Davidse). Thus, lack of flowering material or collection of only flowering branches without additional structures (usually due to the large size and thorniness of the plants) are especially problematic for elucidating the systematics of this genus. An additional compounding factor, which holds for all bamboos with pseudospikelets, is that reproductive morphology changes significantly during development, more dramatically than in bamboos with true spikelets. A corollary of this is that it is difficult to compare developmental stages among herbarium specimens. While the developmental problem is not easily resolved, the value and utility of *Guadua* specimens can be increased greatly by the inclusion of label data on culm size, thorn morphology, size, and distribution of supra- and infranodal



bands, even if these structures are not actually collected.

Interpretation of the bamboo pseudospikelet is still debated. As discussed in Judziewicz et al. (1999: 39), McClure (1934) originally proposed the term to describe the "units in iterant synflorescences of woody bamboos that rebranch to produce successive orders of spikelets." Young and Judd (1992: 757) defined the pseudospikelet as a "shortened vegetative axis or branch that terminates in a single spike of florets." While definitions differ on what the pseudospikelet actually represents, most of the interpretations agree that the pseudospikelet includes at least a prophyll, a series of gemmiparous bracts, and a spikelet proper, this last considered homologous to the spikelets of other bamboos and grasses. Because of this presumed homology, any empty bracts at the base of the spikelet proper usually have been regarded as glumes (Judziewicz et al., 1999).

According to our present interpretation, a pseudospikelet of *Guadua* consists of a prophyll, one to several gemmiparous bracts, none to several sterile lemmas, one to several fertile florets, and a rudimentary floret; each cincinnus and pseudospikelet is subtended by a subtending bract. In contrast to previous interpretations (e.g., Soderstrom, 1981; Young & Judd, 1992; Judziewicz et al., 1999), we argue that the "empty" bracts distal to the gemmiparous bracts and proximal to the fertile florets are best regarded as sterile lemmas rather than glumes. Usually these "empty" bracts are comparable in size to the fertile lemmas, but most important, they often enclose a rudimentary palea in *Guadua*, evidence that they are comparable to or derived from fertile lemmas. Subtending bracts, gemmiparous bracts, glumes, and both sterile and fertile lemmas are all homologous at some level, but what are normally called glumes in bamboos and other grasses may have arisen in different ways in different lineages (Stapleton, 1997; Grass Phylogeny Working Group, 2001).

***Guadua macrospiculata*** Londoño & L. G. Clark, sp. nov. TYPE: Colombia. Amazonas: Mpio. Puerto Nariño, lago de Tarapoto, crece en varzea, a orilla del lago, 16 Nov. 1990, X. Londoño & M. Kobayashi 577 (holotype, COL; isotypes, ISC, US). Figure 1.

*Bambusa lignosa*, spinosa. Rhizoma sympodiale, pachymorphum. Culmi 8–15 m alti, 1.8–4 cm diam.; internodia (11–)20–32 cm longa, solida vel fere solida. Folia culmorum leviter coriacea, decidua; vagina 1.5–2.8-plo longior quam laminam; lamina (2–)5–10 cm longa, persistens, erecta, triangularis. Ramificatio intravaginalis. Folia

cujuisque complementi (5–)8–15; vagina pubescens vel glabrescens, biauriculata vel fimbriata, auriculis falcato-lanceolatis, fimbriatis; pseudopetiolus 1–1.5 mm longus, plerumque reflexus; ligula interior 0.25 mm longa; lamina (2–)5–10(–12) cm longa, (0.8–)1–2(–2.8) cm lata, ovato- vel lineari-lanceolata. Synflorescentiae ramos terminantes cum 1–9 cincinnis. Pseudospiculae (3–)6–12(–17) cm longae, lineari-lanceolatae, prophyllis singulis, bracteis gemmiferis 1–3(–6), lemmata sterilia 1–2, flosculis 6–11(–17); lemma 15–24 mm longum, ovato-lanceolatum, 18–25-nervatum, abaxialiter glabrum; palea sulco pubescenti, carinis alatis 2, alis 0.25–0.5 mm latis, puberulis. Lodicae 3. Stamina 6. Ovarium fusiforme, infra glabrum, supra hispidulum, stigmatibus tribus plumosis.

Woody, thorny bamboo. *Rhizomes* sympodial, pachymorph, short-necked, the neck 3–5 cm long. *Culms* 8–15 m tall, 1.8–4 cm diam., clambering or scandent, the distal portion cascading down from trees, forming clumps 2 × 2 m with ca. 90–100 culms/clump, dark purple when young turning green later and yellow at maturity; *internodes* (11–)20–32 cm long, cylindrical, solid or with a small central lumen, slightly strigose, covered by white-tinged pubescence; *nodes* solitary, the nodal line horizontal, with appressed white hairs in a band 7–12 mm wide above and 3–8 mm wide below the nodal line; *supranodal ridge* manifest ca. 1 cm above the nodal line; *bud* single, triangular, the shoulders of the prophyll ciliate. *Culm leaves* (8–)11–18(–26.5) cm long, (4.5–)12–16 cm wide at base, slightly coriaceous, deciduous, sometimes the basal ones rotting on the culm, triangular, the youngest green-purple then stramineous; *sheaths* 6–14.5 cm long, 1.5–2.8 times as long as the blade, adaxially glabrous, shiny, with a band of hairs 1 cm wide close to the margin, abaxially pubescent, covered with mixed coarse, rigid, hyaline or red-tinged, easily removed hairs 1 mm long, and soft, wavy, white-tinged, shorter hairs, ciliate on one margin, the summit incurved at the middle, continuous with the blade and confluent with the inner ligule, bearing small fimbriate auricles or not; *auricles* 1–3 mm long, brown, fimbriate, the fimbriae 3 mm long, basally scabrid and erect, apically smooth and curled; *inner ligule* 1–1.5 mm long, truncate, stramineous, abaxially pubescent, incurved at the middle, the margin ciliate; *blades* (2–)5–10 × 2.5–9 cm, persistent, triangular, erect, abaxially pubescent, covered by soft, wavy, white appressed hairs less than 0.2 mm long, adaxially conspicuously nerved and pubescent between nerves, marginally ciliate especially toward the base, the apex mucronate, the mucro 2–2.5 mm long. *Branching* intravaginal, typically with one strong dominant branch, armed; thorns (1 to) 3 per node, the central one dominant and bigger, the other two usually slightly reflexed. *Foliage leaves* (5 to) 8 to 15 per complement, ±



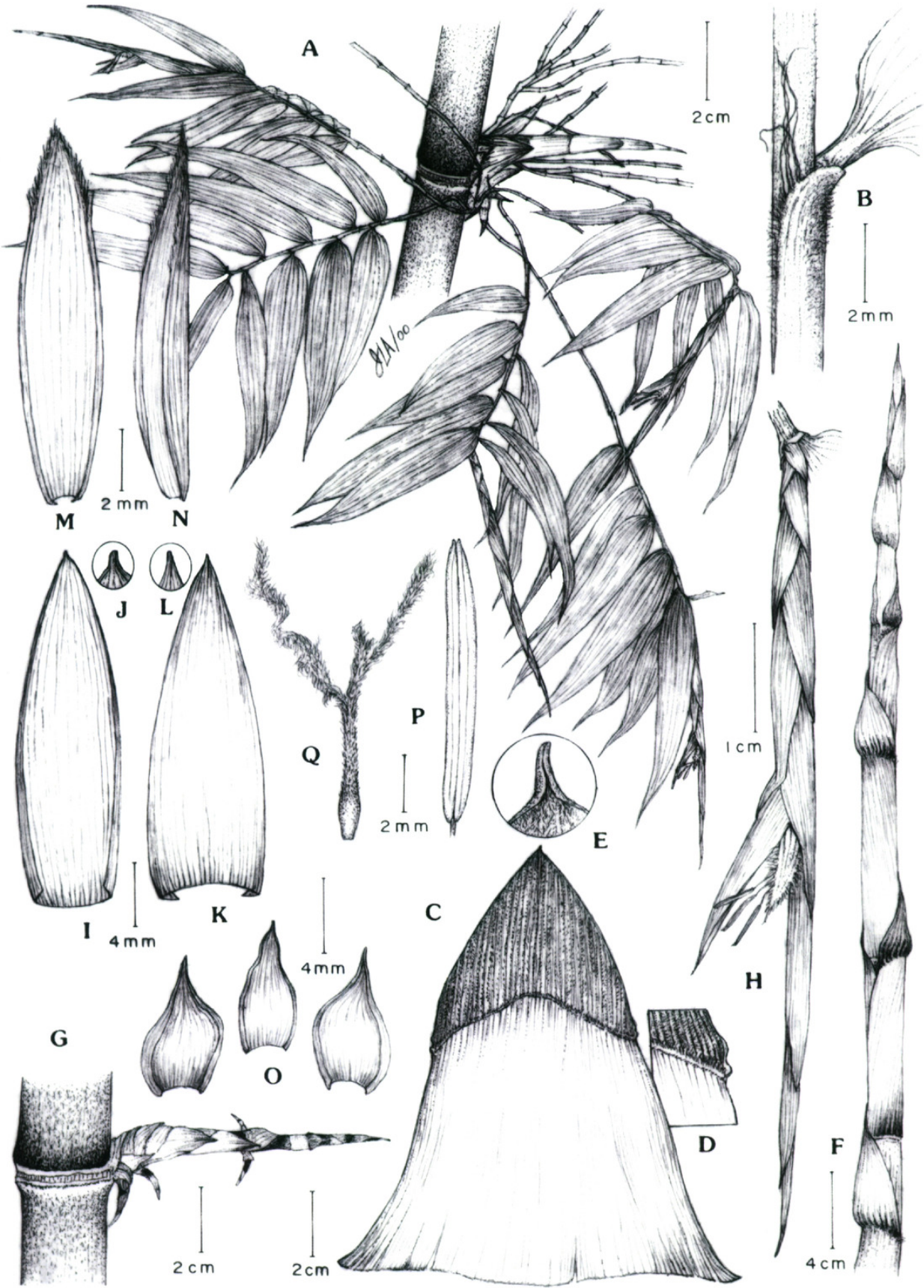


Figure 1. *Guadua macrospiculata* Londoño & L. G. Clark. —A. Mid-culm node with branch complement of leafy flowering axis. —B. Ligular area of the foliage leaf showing blade base and sheath summit with long fimbriae. —C. Culm leaf, adaxial view. —D. Detail of culm leaf inner ligule, adaxial surface. —E. Detail of culm leaf blade apex, adaxial view. —F. Actively growing new culm showing inflated blades. —G. Thorny culm node. —H. Pseudospikelet. —I. Lemma, adaxial view. —J. Detail of lemma apex, adaxial view. —K. Lemma, abaxial view. —L. Detail of lemma apex, abaxial view. —M. Palea showing the ciliate winged keels, abaxial view. —N. Palea, abaxial/lateral view.



pendent or drooping; *sheath* densely pubescent to glabrescent, green when young becoming stramineous, marginally ciliate, bearing fimbriae or fimbriate auricles at the summit; *auricles* 0.5–1.25 mm long, usually present, falcate-lanceolate, dark brown to stramineous, fimbriate; *fimbriae* 3–10 mm long, ivory or brown, basally scabrid and erect, apically smooth and erect or curled; *inner ligule* 0.25 mm long, membranous, stramineous to brown, abaxially densely strigillose, the margin minutely ciliate; *outer ligule* 0.5–0.75 mm long, stramineous, glabrous, shiny, the margin ciliate to smooth; *pseudopetioles* 1–1.5 mm long, usually reflexed, adaxially hispidulous, abaxially hirsute to glabrous and pulvinate, the pulvinus yellow, shiny, hirsute to glabrous; *blade* (2–)5–10(–12) cm long, (0.8–)1–2(–2.8) cm wide, 12- to 14-nerved, ovate- or linear-lanceolate, adaxially scabrid to glabrous, with scattered, sparsely strigose, hyaline hairs 0.3–0.5 mm long, with 3 or 4 rows of prickly-hairs along one edge, abaxially pilose to glabrescent, covered with wavy hairs 0.2–0.3 mm long, the midnerve yellow and prominent in the middle lower portion, the base rounded-attenuate, the margins scabrous, the apex acuminate, with a mucro 1–2 mm long. *Synflorescences* terminating leafy or leafless branches, polytelic, consisting of 1 to 9 cincinni each with 1 to 3 multiflowered pseudospikelets, occasionally forming  $\pm$  dense aggregations of up to 10 pseudospikelets on leafless axes, cincinni and pseudospikelets subtended by bracts; main axes pubescent; *subtending bracts* gemmiparous or not, varying throughout the main axes, fully developed and similar to a foliage leaf with a small blade or the blade a reduced apicule, the blades deciduous, the sheath abaxially pubescent to glabrescent, the margin ciliate, the summit fimbriate. *Pseudospikelets* (3–)6–12(–17) cm long, 3–4(–5) mm wide, linear-lanceolate, usually straight, sometimes slightly curved at the base, green with purple spots when young, later stramineous, consisting of 1 prophyll, 1 to 3 (to 6) gemmiparous bracts, 1 or 2 sterile lemmas, 6 to 11 (to 17) fertile florets, and a terminal rudimentary floret; *prophyll* 0.75–2.5  $\times$  1.3–3 mm, abaxially puberulent between the winged ciliate keels; *gemmiparous bracts* 1 to 3 (to 6), 4–5(–8) mm long, 3–4(–6) mm wide, 11- to 17-nerved, ovate to ovate-lanceolate, sometimes empty, abaxially pubescent to glabrescent, adaxially densely strigillose toward the apex with incon-

spicuous transverse veins, the margins smooth, the apex apiculate with a mucro ca. 0.5 mm long; *sterile lemmas* 1 or 2, 6–14  $\times$  5–7.5 mm, 17- to 20-nerved, rounded on the back, abaxially glabrous and shiny, adaxially densely strigillose toward the apex, always enclosing a rudimentary palea, the margins smooth and purple-tinged to stramineous, the apex acuminate with a mucro 0.25–0.5 mm long; *rachilla segments* (4–)7–9 mm long, 2 mm wide, segments between the lemmas glabrous, those between the prophyll and the gemmiparous bracts pubescent, usually longer between fertile florets, not disarticulating easily at the junction with the floret. *Fertile florets* 6 to 11 (to 17) with *lemmas* 15–24  $\times$  7–9(–10) mm, 18- to 25-nerved, ovate-lanceolate, rounded on the back, abaxially glabrous with inconspicuous transverse veins, adaxially pubescent on the upper  $\frac{1}{3}$ , the margins smooth and purple-tinged, completely embracing the palea, the apex acuminate with a mucro 0.25–0.5 mm long; *paleas* 10–16  $\times$  2–3 mm, 11- to 13-nerved, shorter than the lemma, 2-keeled, the sulcus 6- to 8-nerved with inconspicuous transverse veins, pubescent, the enfolding margins glabrous, 3-nerved, the keels winged, the wings 0.25–0.5 mm wide, 1- or 2-nerved, puberulent on both surfaces toward the upper  $\frac{1}{2}$ – $\frac{1}{3}$ , marginally ciliate above the middle, the cilia hyaline, the wings ending 1–1.5 mm before the apex. *Lodicules* 3, 4–8  $\times$  1–2 mm, many-nerved, membranous, puberulent on the upper half, ciliate on the upper part of the margin, the apex acute, the anterior pair a little longer and wider than the posterior one. *Stamens* 6, the anthers 6–7 mm long, ochre, basally sagittate, apically apiculate. *Ovary* 2–7 mm long, fusiform, basally thickened and glabrous, apically densely hispidulous to glabrescent at maturity; *style* 1, 4–5 mm long, densely antrorse hispidulous; *stigmas* 3, plumose, ca. 4–5 mm long, hyaline. *Caryopsis* 7  $\times$  1.25 mm, fusiform, with a persistent hispidulous style base.

*Etymology.* The specific epithet refers to the very long pseudospikelets, which reach up to 17 cm in length.

*Distribution and habitat.* Western Amazon basin in southeastern Colombia (Amazonas), northwestern Brazil (Amazonas), and northern Peru (Loreto). This species occurs in the lowland forests of the Amazon region, mainly on riverbanks, in sta-

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Table 1. Morphological comparison of *Guadua macrospiculata*, *G. glomerata*, and *G. ciliata*.

Character	<i>G. macrospiculata</i>	<i>G. glomerata</i>	<i>G. ciliata</i>
Culms	solid or hollow with a small lumen	solid	hollow
Thorns per node	1–3	(1–)5–7	absent
Internodes	slightly strigose	strigose	usually glabrous
Culm leaf sheath, abaxial indument	pubescent	glabrous	glabrescent
Culm leaf sheath girdle	absent	absent	present
Foliage leaf sheath, abaxial indument	densely pubescent to glabrescent	glabrous	hirtellous to glabrous
Foliage leaf blade position	usually reflexed	erect	erect
Pseudopetiole, abaxial indument	hirsute to glabrous	subglabrous	glabrous
Foliage leaf blade size (cm), abaxial indument	2–12 × 0.8–2.8, pilose to glabrescent	7–22 × 1.3–4.5, glabrous	9–27.5 × 1.2–4.3, glabrous
Pseudospikelet size (cm)	3–17 × 0.3–0.5	4–7 × 0.35–0.6	3–11 × 0.3–0.5
Lemma margins	glabrous	glabrous	ciliate
Palea keel wing width (mm), indument	0.25–0.5, puberulent	ca. 1, glabrous to glabrescent	0.7–0.9, puberulent

tionary flooded forests called *igapó* in Brazil or *ta-huampa* in Peru.

*Common name.* *Num-chí* in Ticuna dialect (Brazil, Colombia), and *maronilla* (Peru).

*Uses.* The Ticuna community in Colombia uses the culms of *G. macrospiculata* to make frames for drying and painting bark fabric, as planting sticks for yuca (*Manihot esculenta* Crantz), and to make arrows for bow hunting; the thorns are used to lance boils.

*Phenology.* The flowering cycle of *G. macrospiculata* is a very short interval for a woody bamboo. Observations of the flowering cycle in a cultivated stand in Quindio, Colombia, from 1990 to 2000 were made annually by the first author, who noted flowering approximately every two years. All the culms in a single clump flowered without interruption during the flowering cycle and remained green, and after flowering the culms did not die. The flowering cycle apparently does not respond to external weather conditions such as the alternation of wet and dry seasons. Flowering dates as determined from herbarium specimens from a single locality are consistent with a short flowering cycle but are not definitive.

*Guadua macrospiculata* is most similar to *G. glomerata* and *G. ciliata*. The three species share a climbing habit, relatively slender culms, and triangular culm leaves. They also all occur in the Amazon basin, along riverbanks that are flooded seasonally, with the bases of the plants submerged in water. The three species are compared and contrasted in Table 1.

*Guadua macrospiculata* differs from *G. glomerata* by its denser and bigger clumps (90 to 100

culms/clump, 2 × 2 m vs. 4 to 13 culms/clump, 1 × 0.5 m); the delicate and mostly uniform size of the foliage leaf blade (vs. conspicuous size variation); the glabrous enfolding margins of the palea (vs. pubescent); and the narrower palea keel wings, ending 1–1.5 mm before the apex with the margins ciliate from the middle toward the apex (vs. ending at the apex with a tuft of hairs at the tip, the margins smooth in the lower and middle portions, but ciliate at the apex). These two species have in common the inner ligule of the culm leaf curled in the middle, lowermost basal culm leaf sheaths that rot on the culm, green pseudospikelets with purple spots when young, a glabrous, many-nerved lemma with smooth margins, and a pubescent palea sulcus.

*Guadua macrospiculata* is distinguished from *G. ciliata* by having dark purple culms when young (vs. green when young), foliage leaf blades usually ovate-lanceolate and (2–)5–10 × 2.5–9 cm [vs. usually linear-lanceolate and (9–)12–27.5 × (1.2–)2–3.5(–4.3) cm], the main axes of synflorescence pubescent (vs. glabrescent), pseudospikelets green with purple spots when young (vs. olive green when young), and lemmas with smooth margins (vs. marginally ciliate with purple-tinged and hyaline hairs). These two species exhibit an inflated culm leaf blade (Fig. 1F, as seen in side view) when the new shoot is growing actively, but this condition disappears later as the culm leaf dries out. Both species also have a pulvinate foliage leaf pseudopetiole, the palea smaller than the lemma, and usually 1 to 3 pseudospikelets per coflorescence.

The new culms of *G. macrospiculata* are hosts to butterflies of the family Nymphalidae, subfamily



Satyrinae, tribe Pronophilini (D. Harvey, pers. comm.). The adult females deposit their eggs at the apex of the new culms. Several other bamboos of the genera *Otatea* (McClure & E. W. Smith) C. Calderón & Soderstrom, *Chusquea* Kunth, *Guadua*, and *Merostachys* Sprengel are also hosts to a wide variety of insects (Judziewicz et al., 1999).

**Paratypes.** BRAZIL. **Amazonas:** Rio Javari above mouth of Rio Taquari, 29 Oct. 1976 (fl), *Prance et al.* 24202 (US); Igarapé Umarizal, Esperança, 8 Dec. 1945 (fl), *Murça & Black* 842 (US). COLOMBIA. **Amazonas:** Mun. Leticia, Parque Nacional Natural de Amacayacu-INDERENA, a orilla de la Q. Bacaba, 100 m, 8 Nov. 1990 (fl), *Londoño & Kobayashi* 536 (COL, ISC, TULV, US); Parque Nacional Natural Amacayacu-INDERENA, a orilla de Q. Matamatá, 100 m, 8 Nov. 1990 (fl), *Londoño & Kobayashi* 537 (COL, ISC, TULV, US); a 30 m de distancia del INDERENA, sobre trocha Amacayacu-Matamatá, cerca de Q. Matamatá, 11 Nov. 1990 (fl), *Londoño & Kobayashi* 563 (COL, ISC, TULV, US); San Martín de Amacayacu, 100 m, 12 Nov. 1990 (fl), *Londoño & Kobayashi* 569 (COL, ISC, TULV, US). PERU. **Loreto:** Maynas, Iquitos, rio Nanay, Cocha de la Marina, 90 m, 2 Jan. 1983 (fl), *McDaniel & Rimachi* 26601 (AMAZ, NY, US); Pto. Almendras, rio Nanay, 20 May 1981 (fl), *Ruiz* 168 (AMAZ); Rio Nanay, Q. Moropon above Bellavista, 7 Jan. 1976 (fl), *McDaniel & Rimachi* 20381 (AMAZ, NY); rio Nanay, slightly below Bellavista on left margin, 90 m, 7 Oct. 1980, *Rimachi* 5344 (USM); Punchana, Rio Nanay, trocha de la Cocha a Manga Posa, frente al puerto de Picuruyacu, 90 m, 20 July 1994 (fl), *Rimachi* 11035 (US); Rio Nanay, Albergue Isabel Loro Park, 3 Aug. 1991 (fl), *Londoño* 675 (TULV, US); Tahuampa near rio Amazonas between Punchana y Sta. Clara de Nanay, outskirts of Iquitos, 120 m, 3 Feb. 1977 (fl), *Gentry et al.* 21614 (MO, TULV, US); Alto rio Nanay, between Santa Maria de Nanay y Diamante Azul, 140 m, 25 Mar. 1979 (fl), *Gentry et al.* 26213 (MO, TULV, US); Rio Itaya, below San Juan de Muniches, 120 m, 19 Mar. 1977 (fl), *Gentry et al.* 18396 (MO, TULV, US); Rio Itaya from Iquitos to San Juan de Muniches, 100 m, 9 Mar. 1973 (fl), *McDaniel & Rimachi* 16927 (AMAZ, MO); Rio Itaya, Moena caño, 4 km de Iquitos, 1 Apr. 1976 (fl), *Revilla* 470 (MO, TULV, US); Yanomono explorama tourist camp, rio Amazonas, above mouth of rio Napo, 120 m, 28 Dec. 1982 (fl), *Gentry & Emmons* 38746 (USM); Petrópolis, rio Yavaris, 12 Aug. 1976, *Revilla* 1090 (MO). **Requena:** Caño Iricahua, abajo de Jenaro Herrera, margen izquierda rio Ucayali, 26 Nov. 1982 (fl), *Encarnación* 25086 (AMAZ, NY, US); Rio Tapiche, tributario del Ucayali, ca. 1 hr. above Requena, 8 Dec. 1977 (fl), *Gentry et al.* 21236 (MO, TULV, US, USM).

***Guadua uncinata*** Londoño & L. G. Clark, sp. nov.

TYPE: Ecuador. Tungurahua: found wild between San Francisco and Machay, along the road in the valley of the Pastaza River, 3500 ft., 13 July 1945 (fl), *F. A. McClure* 21364 (holotype, US; isotypes, COL, ISC, MO, NY). Figure 2.

Bambusa lignosa, spinosa. Rhizoma sympodiale, pachymorphum. Culmi 3–8 m alti, 2–4(–6) cm diam.; internodia 20–40 cm longa, ad basim et apicem culmorum solida

aliter cava. Folia culmorum leviter coriacea, decidua; vagina 2.8–7.5-plo longior quam laminam; lamina (1.7–)3–5(–8.5) cm longa, persistens, erecta, triangularis. Ramificatio intravaginalis; ramus dominans unus ramis minoribus 1–3, rami conspicue spinosi; spinae uncinatae. Folia cujusque complementi 7–9(–16); vagina glabra vel pubescens, biauriculata, fimbriata, auriculis (1–)2–4 mm longis; lamina (6.5–)10–15(–18) cm longa, (1.4–)2–3.5(–4.2) cm lata, ovato- vel lineari-lanceolata; pseudopetiolus 3–6 mm longus; ligula interior 0.2–0.5(–0.8) mm longa. Synflorescentiae ramos terminantes cum 1–5(–7) cofilis. Pseudospiculae 3–6(–8) cm longae, lineari-lanceolatae, prophyllis singulis, bracteis gemmiferis 1–4(–6), lemmata sterilia 1–2(–3), flosculis (3–)4–5; lemma 10–15 mm longum, ovato-lanceolatum, 12–25-nervatum, supra glabrum vel puberulum; palea sulco pubescenti, carinis conspicue alatis 2, alis 0.5–1 mm latis, glabris. Lodiculae 3. Stamina 6. Ovarium fusiforme, infra glabrum, supra hispidulum, stigmatibus tribus plumosis.

Woody, thorny bamboo. *Rhizomes* pachymorph. *Culms* 3–8 m tall, 2–4(–6) cm diam., erect at the base, immediately arching to broadly arching apically and climbing on trees, white-green to green when young becoming stramineous; *internodes* 20–40 cm long, cylindrical, the basal and upper ones solid, the middle ones hollow with a small lumen ca. 5 mm diam., densely pubescent when young, covered by very appressed strigose, antrorse, hyaline or brown hairs, glabrous at maturity; *nodes* solitary, the nodal line horizontal, with appressed, white, soft, short, hairs in a band 5–10 mm wide above and 8–12 mm wide below the nodal line; *supranodal ridge* manifest; *bud* single, triangular, the shoulders of the prophyll ciliate. *Culm leaves* (14.5–)19–26(–35.5) cm long, 11–14 cm wide at the base, slightly coriaceous, deciduous, triangular, green-stramineous with yellow spots when young becoming stramineous; *sheaths* 13–28 cm long, 2.8–7.5 times as long as the blade, abaxially pubescent, covered by (1) strigose, antrorse, transparent or brown hairs 0.8–1.5 mm long that rub off easily, (2) shorter, strigose, mostly retrorse, hyaline or brown hairs, and (3) appressed, white-tinged, wavy, tiny hairs, the margins papery, ciliate or smooth, the cilia transparent to brown, up to 3 mm long, rubbing off easily, bearing fimbriate auricles and fimbriae at the summit; *auricles* 4–6 × 1–1.2 mm, falcate, puberulous, fimbriate; *fimbriae* 3–7 mm long, ivory, straight to curled, basally scabrid, apically smooth; *inner ligule* 0.5–1 mm long, truncate, straight, slightly curled, or inclined, dark brown to stramineous, abaxially pubescent, sometimes not extending completely from margin to margin, the margin ciliolate; *blades* (1.7–)3–5(–8.5) cm long, 1–6 cm wide, triangular, erect, abaxially pubescent, with white, wavy, appressed, tiny hairs, adaxially densely pubescent between the nerves, the margins basally fimbriate, otherwise ciliate to



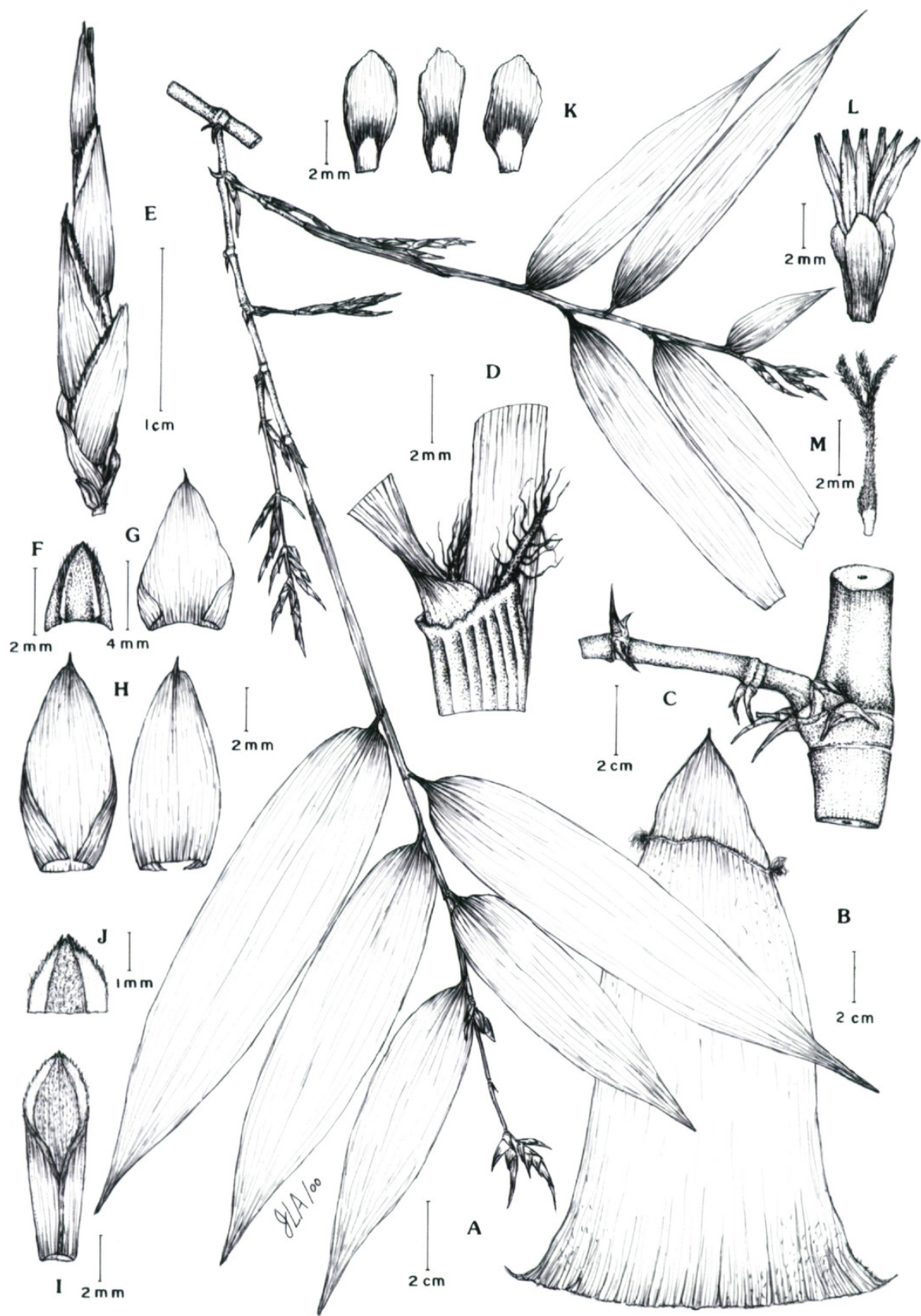


Figure 2. *Guadua uncinata* Londoño & L. G. Clark. —A. Flowering branch. —B. Culm leaf, adaxial view. —C. Mid-culm node with branch complement showing single dominant branch and recurved thorns. —D. Ligular area of foliage leaf, showing pseudopetiole, sheath summit, and auricles. —E. Pseudospikelet. —F. Prophyll, abaxial view. —G. Gemmiparous bract, adaxial view. —H. Lemma, adaxial (left) and abaxial (right) views. —I. Palea, abaxial view. —J. Apex of palea showing winged keels, abaxial view. —K. Lodicules. —L. Young androecium and gynoecium surrounded



smooth, the cilia easily removed, the apex mucronate, the mucro 1–1.5 mm long. *Branching* intravaginal, the branches manifestly thorny, consisting of one main branch and 1 to 3 secondary branches; thorns (1 to) 3 to 5 per node, recurved. *Foliage leaves* 7 to 9 (to 16) per complement,  $\pm$  horizontal-drooping; *sheath* abaxially usually glabrous or sparsely covered by appressed, strigose, antrorse, transparent or brown hairs up to 1 mm long on the lower portion, bearing fimbriate auricles and fimbriae at the summit, the overlapping margin conspicuously ciliate, the underlapping margin ciliate to smooth; *auricles* (1–)2–4  $\times$  0.25–0.5 mm, ligulate, puberulous, dark purple to stramineous, fimbriate; *fimbriae* (3–)6–11 mm long, ivory, basally scabrid, straight, apically smooth, wavy to curled; *inner ligule* 0.2–0.5(–0.8) mm long, truncate, membranous, abaxially puberulous, the margin ciliate to smooth; *outer ligule* 0.2–0.7 mm long, glabrous, shiny, stramineous, the margin ciliate to smooth; *pseudopetioles* 3–6 mm long, adaxially glabrous except puberulous on the lower portion, abaxially glabrous, pulvinate, the pulvinus yellow, shiny, puberulous or glabrous; *blades* (6.5–)10–15(–18)  $\times$  (1.4–)2–3.5(–4.2) cm, 15- to 17- (to 20)-nerved, juvenile leaves wider than adult leaves, ovate-lanceolate or linear-lanceolate, adaxially glabrous except with a few sparsely strigose, transparent hairs up to 1 mm long, with 3 or 4 raised scabrid submarginal nerves on one side, abaxially sparsely hairy, covered by strigose, straight, antrorse, hyaline or white-tinged hairs up to 1 mm long, tessellate, lighter green than adaxially, the midnerve yellow and conspicuous in the middle lower portion, the margins scabrous, the apex acuminate with a mucro 1.5–3 mm long. *Synflorescences* terminating leafy and leafless branches of all orders, polytelic, consisting of 1 to 5 (to 7) cincinni each with 1 to 3 (to 15) multiflowered pseudospikelets, cincinni and pseudospikelets subtended by bracts, the main axes hispidulous or glabrous; *subtending bracts* varying in size and shape throughout the main axes, fully developed and similar to a small foliage leaf with a small blade to triangular and apiculate, the blade when present deciduous, the sheath abaxially glabrous, ciliate to glabrous along one margin and bearing fimbriae or not at the summit. *Pseudospikelets* 3–6(–8)  $\times$  0.3–0.5(–0.6) cm, linear-lanceolate, straight to slightly curved, green with purple spots when young becoming brown to stramineous,

consisting of 1 prophyll, 1 to 4 (to 6) gemmiparous bracts, 1 to 2 (to 3) sterile lemmas, (3 to) 4 to 5 fertile florets, and a terminal rudimentary floret; *prophyll* 2–4  $\times$  1.5–4 mm, abaxially puberulous between the winged keels, the wings ciliate, pubescent on both sides, occasionally gemmiparous; *gemmiparous bracts* 1 to 4 (to 6), 3–8  $\times$  3–4 mm, 10- to 15-nerved, ovate to ovate-lanceolate, sometimes with a small blade, deciduous or not, abaxially puberulous or glabrous, adaxially tessellate, densely pubescent toward the apex, the margins minutely ciliate or smooth, the apex shortly mucronate, the mucro 0.2–0.5(–0.8) mm long; *sterile lemmas* 1 or 2 (to 3), 7–9(–11)  $\times$  5–6 mm, 15- to 16-nerved, ovate-lanceolate, lighter in color than the lemmas, abaxially puberulous or glabrous, adaxially pubescent, densely so toward the apex, the margins smooth, enclosing a rudimentary palea, mucronate, the mucro 0.5–0.8(–1) mm long; *rachilla segments* 4–6(–9) mm long, glabrous and shiny, apically with a rim of puberulous hairs, straight to slightly zigzag along the pseudospikelet, disarticulating below the attachment of each lemma and falling attached to the floret. *Fertile florets* (3 to) 4 to 5 with winged palea keels exceeding the lemma margins, basally thickened; *lemma* 10–15  $\times$  6–9 mm, 12- to 25-nerved, ovate-lanceolate, abaxially puberulous or glabrous, adaxially densely pubescent at the tip otherwise puberulous or glabrous, the margins smooth and papery, the apex shortly mucronate, the mucro (0.2–)0.5–0.7 mm long; *palea* 9–14  $\times$  2–2.5 mm, 9- to 13-nerved, 2-keeled, the sulcus 2 mm wide, 4- to 7-nerved, densely pubescent, tessellate, the enfolding margins 3- to 4-nerved, glabrous, tessellate, the keels winged, the wings 0.5–0.8(–1) mm wide, 2-nerved, shiny, glabrous except puberulous at the junction with the keels, the margins minutely ciliate for the upper  $\frac{1}{3}$ . *Lodicules* 3, 4–6  $\times$  1–3.5 mm, many-nerved, concave, thicker below, membranous for the upper  $\frac{1}{3}$ , bearing dark brown prickly hairs on the upper membranous portion, the margins apically ciliate, acuminate, the posterior one symmetrical, narrower and slightly longer than the asymmetrical anterior pair. *Stamens* 6, the anthers 4–6(–7) mm long, when young white-yellow becoming creamy yellow with purple spots and ochraceous to stramineous, basally sagittate, apically apiculate. *Ovary* (1.5–)2–4 mm long, fusiform, basally yellow or purple and glabrous, apically densely hispidulous; *style* 1.5–

←



3.5 mm long, densely antrorse hispidulous; stigmas 3, plumose, ca. 3–6 mm long, with the main nerve yellow to purple. *Caryopsis* not seen.

**Etymology.** The specific epithet refers to the strongly recurved thorns of the branches, like cat's claws, which help the plant to climb on trees.

**Distribution and habitat.** This species occurs in southern Colombia and central-eastern Ecuador, on the eastern side of the Andes (Eastern Cordillera in Colombia), in the foothills of the mountains, at elevations between 280 and 1200(–1500) m. It grows in swamps (locally called *chucuas*) associated with *Mauritia flexuosa* L. f., *Heliconia* L., and *Ficus* L., where it forms very dense and hard to penetrate clumps.

**Common name.** *Cachupenda*.

**Uses.** In Colombia this species is not used probably because of its poor wood quality. In Ecuador, however, according to *McClure 21364*, the species has many local uses.

**Phenology.** The flowering cycle of *G. uncinata* apparently is 10 years long. In late 1987, a plantlet from a flowering clump was taken from its natural habitat in Putumayo, Colombia, and planted at the Bamboo Germplasm bank of the Juan Maria Cespedes Botanical Garden, in Tuluá, Valle del Cauca, Colombia (*Londoño & Quintero 208*). During the first four years (1988–1992), the plantlet did not increase very much in size, reaching 0.6 cm in diameter and 2.5 m in height, but it continued to flower. Between 1992 and 1996 the plantlet increased in size, reaching 2.5 cm in diameter and 8 m in height, but it ceased flowering. In 1997, however, it started to flower again. Based on the 13 years of observations made by the first author, it can be inferred that *G. uncinata* has a flowering cycle of 10 years, it remains green and does not die after flowering, and it can continue to flower for approximately 5 years.

*Guadua uncinata* is most similar to *G. angustifolia*. The two have foliage leaf blades of similar size and shape, with sparse hairs on both surfaces; ciliolate margins on the foliage leaf sheath with the outer ligule abaxially pubescent; straight or slightly curved pseudospikelets; mature florets with the winged keels of the palea exceeding the margins of the lemma; lemmas with smooth, papery margins; paleas with a hairy sulcus and glabrous enfolded margins; and a basally glabrous, apically hispidulous, fusiform ovary.

*Guadua uncinata* is distinguished from *G. angustifolia* by having culms erect at the base then broadly nodding above and climbing apically (vs. erect); much shorter and thinner culms [3–8 m ×

2–4(–6) cm vs. 10–30 m × 6–22 cm]; solid basal and apical internodes (vs. hollow); smaller culm leaves (14.5–35.5 × 11–14 cm vs. 30–60 × 20–50 cm) that are much less pubescent abaxially, lighter in color, and bear fimbriate auricles or fimbriae at the summit of the culm leaf sheath (vs. absence of auricles); fimbriate auricles at the summit of the foliage leaf sheath (vs. auricles absent); more congested cincinnatae at maturity [1 to 3 (to 15) pseudospikelets/cincinnatae vs. 1 to 4]; and the winged keels of the palea surpassing the apex of the palea (vs. ending at the apex). Additionally, although the strongly recurved thorns of *G. uncinata* are found in other climbing species, this feature contrasts with the longer, straighter thorns of *G. angustifolia*.

The size difference between *G. uncinata* and *G. angustifolia* persists even when both species are grown under the same conditions. As described under Phenology, plantlets of *G. uncinata* grown in cultivation reached to 2.5 cm in diameter and to 8 m in height after 13 years. Plantlets of *G. angustifolia* (*Londoño & Quintero 235*) planted at the same time (Mar. 1987), in the same soil and weather conditions, and coming from the same region (Putumayo), developed culms 12 cm in diameter and 18 m tall over the same period of time.

**Paratypes.** COLOMBIA. **Putumayo:** Puerto Caicedo, 1 km de Pto. Caicedo en la vía a Garzón, sobre la Q. El Achote, 340 m, 5 Mar. 1987 (fl), *Londoño & Quintero 208* (COL, TULV, US). **Caquetá:** vía Florencia–Belén de los Andagües, desviándose por la vía Morelia–San Jorge, a 2 km de Morelia, finca San Francisco, 280 m, 8 Feb. 1987, *Londoño & Quintero 109* (COL, TULV, US). ECUADOR. **Tungurahua:** on the trail up to Hacienda La Gloria from “Rio Negro,” 5000 ft., 12 July 1945, *McClure 21361* (US); found wild along the trail leading from the “Rio Negro” bridge across the Pastaza River, 4000 ft., 12 July 1945 (fl), *McClure 21362* (COL, ISC, MO, US); valley of the Pastaza River, along the road from Rio Negro to the Hacienda La Gloria, 4000 ft., 12 July 1945 (fl), *McClure 21363* (NY, MO, US).

**Guadua tagoara** (Nees) Kunth, Enum. Pl. 1: 434. 1833. *Bambusa tagoara* Nees, Fl. Bras. Enum. Pl. 2: 532. 1829. *Arundarbor tagoara* (Nees) Kuntze, Revis. Gen. Pl. 2: 761. 1891. TYPE. Brazil. “Habitat in sylvis altitudine: 1800 ped in adscensu montis, Serra do mar dicti, euntibus versus Guaratingueta, provinciae S. Pauli,” *Martius s.n.* (holotype, BR not seen).

*Bambusa barbata* Trinius, Mem. Acad. Imp. Sci. Saint-Petersbourg, Ser. 6, Sci. Math., Seconde Pt. Sci. Nat. 3, 1: 627. 1835. *Nastus barbatus* (Trinius) Ruprecht, Bambuseae 42, t. 17. 1939 [preprint]. TYPE. Brazil. “Hab. in sylvis provinc. Minarum Bras.,” *L. Riedel 520* (holotype, LE not seen; isotypes, G, K, P not seen, US-fragment).



*Bambusa distorta* Nees, Linnaea 9: 470. 1834. *Arundarbor distorta* (Nees) Kuntze, Revis. Gen. Pl. 2: 761. 1891. *Guadua distorta* (Nees) Ruprecht, Bambuseae 41, t. 16, f. 59. 1939 [preprint]. TYPE. Brazil. S.d., *F. Sellow s.n.* (holotype, B not seen; isotype, US [flowering piece is *Guadua*, sterile pieces are Poaceae, not *Guadua*]).

*Bambusa spinosissima* Hackel, Oesterr. Bot. Z. 53: 197. 1903. *Guadua spinosissima* (Hackel) E.-G. Camus, Les Bambusées 1: 112. 1913. TYPE. Brazil. "In provincia Santa Catharina, prope Blumenau," July 1888, *E. Ule 878* (holotype, W; isotype, US-fragment).

*Rhizomes* sympodial, pachymorph, 30–40 cm long. *Culms* 10–15(–20) m tall, 5–10 cm diam., erect at the base, the apical portion arching after developing foliage leaves, with the secondary branches very elongate, leaning on or pendent from trees, glaucous when young, becoming green mottled with light yellow-green dashes at maturity; *internodes* (16–)20–60(–80) cm long, cylindrical, hollow, some filled with water, walls 5–10 mm thick, the surface roughened, striate and slightly tuberculate, covered by short, brown, antrorse hairs below the nodes when young then becoming glabrous; *nodes* solitary, the nodal line horizontal, with a supranodal band (0.8–)1.1–1.5(–1.9) cm wide of dense, white, antrorse, appressed hairs, and an infranodal band 0.7–1(–1.5) cm wide of brown-red to white retrorse, appressed hairs; *supranodal ridge* pronounced; *bud* single, positioned ca. 2 mm above the nodal line, triangular, plano-convex, the shoulders of the prophyll glabrous. *Culm leaves* slightly coriaceous, deciduous, pushed away by the developing axillary branches, but those at the lowermost nodes strongly attached to the culm, purple-green and maculate with yellow when young becoming brown to stramineous, usually lacking auricles and fimbriae; *sheaths* 17–38 × 10–44 cm, 5–12 times as long as the blade, abaxially pubescent with a mix of (1) coarse, rigid, irritating, brown-red hairs to 2.5 mm long, (2) prickly, retrorse, brown-red hairs less than 1 mm long, and (3) soft, wavy hyaline hairs, the margins entire; *inner ligule* 1–2 mm long, truncate, densely ciliate, not extending to the culm leaf margins; *blades* (2–)3–5.5(–7) cm long, 9–10(–13) cm wide, very broadly triangular, erect, persistent, abaxially less pubescent than the sheath but densely covered with soft, appressed, hyaline hairs and some scattered coarse, shorter, rigid, antrorse, brown-red hairs, adaxially conspicuously nerved and densely strigose between the nerves, the margins entire, the apex strongly mucronate usually split in two parts, the mucro up to 2 mm long. *Branching* intravaginal, branches solitary and armed, usually not developing at the lower

nodes, the middle and upper nodes with a dominant central branch held at a 45°–50° angle, with age developing 1 to 4 secondary branches from the basal nodes of the central branch, the secondary branches extending outward, clambering over trees to 2–6 m long; *thorns* usually on the lateral branches, 1 to 5 per node, absent from the lowermost nodes of the lateral branches on the main culm. *Foliage leaves* 5 to 8 (to 10) per complement; *sheaths* abaxially densely pubescent to glabrous, usually with a patch of hyaline hairs on one side of the midnerve near the apex, green when young, becoming stramineous, tessellate venation through the margins, the margins ciliate, the summit fimbriate, auricles usually absent; *auricles* when present 1–5 mm long, dark brown, marginally fimbriate; *fimbriae* 7–15 mm long, ivory, curled distally; *inner ligule* 0.5–2 mm long, pubescent, the margin finely ciliate; *outer ligule* 0.5–1 mm long, usually glabrous and shiny, stramineous, the margin minutely ciliate when young, becoming smooth; *pseudopetioles* 4–10(–15) mm long, pulvinate, adaxially hispidulous to glabrous, abaxially glabrous; *blades* (9–)15–25(–41) × (1.1–)2–5(–6) cm, L:W = 4–9:1, 15- to 29-nerved, linear-lanceolate to broadly ovate-lanceolate, adaxially glabrous, abaxially glabrous and strongly tessellate, the midnerve and primary nerves prominent and yellow, one margin scabrous, the other scabrid, the apex acuminate, ending in a mucro. *Synflorescences* terminating leafless or leafy branches of all orders, polytelic, consisting of 7 to 11 (to 13) cincinni, each with 1 to 6 (to 9) multiflowered pseudospikelets, cincinni and pseudospikelets subtended by bracts, the main axes glabrous; *subtending bracts* 7–13 × 4–6 mm, triangular, deciduous, mucronate, generally gemmiparous, abaxially pubescent to glabrous, adaxially pubescent toward the apex. *Pseudospikelets* (0.5–)1–3(–4) × 2–4(–6) mm, linear-lanceolate, glabrescent, yellow-green mottled with purple to stramineous, consisting of 1 prophyll, 2 to 3 (to 4) usually gemmiparous bracts, 1 (or/to 2) sterile lemma, 1 to 4 (to 6) fertile florets, and a terminal rudimentary floret; *prophyll* 1.5–2 × 3–4 mm, abaxially pubescent, usually gemmiparous, the keels ciliate; *gemmiparous bracts* 2 or 3 (to 4), 2–4 × 1.5–4 mm, 4- to 8- (to 10)-nerved, broadly ovate, abaxially puberulent to glabrous with the midnerve strongly marked, adaxially shortly pubescent throughout the upper 2/3 with antrorse, appressed hyaline hairs, the apex shortly mucronate; *sterile lemmas* 1 (or 2), 4.5–6(–7) × 4–6 mm, 10- to 12-nerved, broadly ovate to ovate, abaxially puberulent to glabrous, adaxially pubescent for the upper 2/3, usually enclosing a rudimentary palea,



marginally ciliate especially on the upper  $\frac{1}{3}$ , the cilia wavy and deciduous, the apex mucronate; *rachilla segments* less than 1 mm long between prophyll and glumes then elongated after the first floret up to 5 mm, hispid, disarticulating just below the juncture with the lemma. *Fertile florets* 1 to 4 (to 6) with the winged palea keels exceeding the lemma margins; *lemmas* (6-)7-11(-14)  $\times$  (4-)5-7(-8) mm, (9- to) 11- to 13- (to 18)-nerved, ovate, rounded on the back, when mature not embracing the palea completely, abaxially glabrescent, usually glabrous with the nerves strongly manifest, adaxially pubescent for the upper  $\frac{2}{3}$  with antrorse, appressed, hyaline hairs, the margins ciliate, bearing a tuft of hyaline hairs distally below the mucro, the cilia wavy, soft, and deciduous, the mucro 0.5-1 mm long, the apex mucronate; *paleas* 7-11(-13)  $\times$  4-5 mm, 9- to 15-nerved, 2-keeled, abaxially and adaxially puberulent, the apex acute with a tuft of hyaline hairs, the sulcus 5- to 9-nerved, puberulent, the enfolding margins 2- to 4-nerved, glabrous and shiny, the keels winged, the wings 0.8-1.2 mm wide, wider apically than basally, puberulent on both surfaces, with very short, appressed, hyaline hairs, 1- to 2-nerved, ciliolate on the upper  $\frac{1}{3}$ . *Lodicules* 3, 2.5-4  $\times$  1-3 mm, 12- to 15-nerved basally, hyaline to yellow-brown, acute, the upper half covered with brown-red to hyaline prickles, ciliolate on the upper margin, thickened and darker below, thinner and membranous above, the anterior pair slightly asymmetrical, the posterior one symmetrical. *Stamens* 6, the anthers 5-6.5 mm long, yellow-brown, basally sagittate, apically emarginate. *Ovary* 3-6 mm long, fusiform, brown-red, antrorse hispidulous; style 1, hispidulous; stigmas 3, plumose. *Caryopsis* not seen.

*Distribution.* Atlantic and montane forests of the eastern coast of Brazil, from Bahia to Santa Catarina; 50-1200 m.

*Uses.* Split culms are used in the construction of mud huts and shelters, water pipes, sheathing of cart sides, and as a fire starter.

*Common names.* *Taquaraçu*; *taquara grossa* (Tupi-guaraní).

*Phenology.* The flowering cycle of this species has not been studied or reported. Based on herbarium specimens, however, it is probable that flowering occurs every two years. This species does not die after flowering, and only a few culms of the clump flower at the same time.

*Guadua tagoara* is characterized by apically climbing culms, glaucous new culms (Judziewicz et al., 1999: fig. 153), very broadly triangular culm leaf blades often with a split apex (Judziewicz et

al., 1999: fig. 7E, F), and usually a patch of hyaline hairs toward the apex of the foliage leaf sheath. It most closely resembles *G. weberbaueri* and *G. sarcocarpa* Londoño & P. Peterson, which are restricted to the Amazon basin and eastern slope of the Andes. All three species share basally erect culms that are apically arching and branching, reaching over trees for support; a prominent supranodal ridge; adaxially appressed pubescence on lemmas and bracts; the pubescent sulcus of the palea; prickles on the upper portion of the lodicules; and antrorse-hispidulous ovary and styles.

*Guadua tagoara* is distinguished from *G. weberbaueri* and *G. sarcocarpa* by its culm leaves with the margins continuous at the junction of the sheath and blade (vs. culm leaves with the margins slightly discontinuous at the junction of the sheath and blade); and the very broadly triangular culm leaf blade with the apex usually split in two (or more) parts (vs. a triangular culm leaf blade with a strong mucro at the apex). In addition, *G. tagoara* differs from *G. weberbaueri* by the abaxially glabrous and conspicuously tessellate foliage leaf blades (vs. abaxially pilose and inconspicuously tessellate blades).

Considerable morphological variation exists among and within the populations of *G. tagoara*, perhaps related to the apparently short flowering cycle of this species. A study to evaluate the genetic variability of *G. tagoara* would be worthwhile, especially if these data could be related to flowering specimens and morphological variation. All variants show the distinctive culm leaf and other features mentioned above as characteristic of *G. tagoara*, and thus we have chosen to recognize a single species. Within the range of variation of *G. tagoara*, however, some specimens representing perhaps three or four populations from Rio de Janeiro show a distinctive correlation among extremes of variation in cincinnose congestion, pseudospikelet size, and the occurrence of fimbriate auricles on the foliage leaf sheaths. We recognize this set of populations as *G. tagoara* subsp. *glaziovii*. This subspecies is known from a limited number of populations from a restricted geographic range nested within the distribution of the autonymic *G. tagoara* subsp. *tagoara*; it is unknown whether populations of the two subspecies are strictly sympatric.

#### KEY TO THE SUBSPECIES OF *GUADUA TAGOARA*

- 1a. Pseudospikelets 9 to 15 (to 40) per cincinnose; pseudospikelets lanceolate, 1-3(-4) cm long, 3-6 mm wide; foliage leaf sheaths fimbriate



- but not auriculate at the summit . . . . .  
. . . . . *G. tagoara* subsp. *tagoara*  
1b. Pseudospikelets usually 1 to 6 (to 9) per cofil-  
rescence; pseudospikelets narrowly lanceolate,  
2.5–4 cm long, 2–3 mm wide; foliage leaf  
sheaths auriculate-fimbriate at the summit . . .  
. . . . . *G. tagoara* subsp. *glaziovii*

**Guadua tagoara** (Nees) Kunth subsp. *tagoara*

Foliage leaf sheaths bearing only fimbriae at the summit, the fimbriae 8–15 mm long. Pseudospikelets 9 to 15 (to 40) per cofilrescence, 1–3(–4) cm long, 3–6 mm wide, lanceolate, with 1 to 4 fertile florets; sterile lemmas 5–6(–7) mm long; lemmas 7–11(–14) mm long, 5–7(–8) mm wide, the mucro 0.5–1 mm long; paleas 7–11(–13) mm long, 4–5 mm wide. Lodicules 2.5–4 mm long, 1–3 mm wide. Ovary 3–6 mm long.

*Distribution.* Atlantic and montane forests of the eastern coast of Brazil from Bahia to Santa Catarina; 50–1200 m.

One collection from Serra do Mar in São Paulo (*Medina* 5), with shorter pseudospikelets and very congested cofilrescences with up to 40 pseudospikelets, and another from the Serra dos Órgãos in Rio de Janeiro (*Reitz* 6926), with robust pseudospikelets up to 3.6 cm long and 6 mm wide, differ from the remaining collections. However, populations of *G. tagoara* in the two areas were visited by both authors; only minor variations in vegetative features were observed and the specimens fit well within this subspecies in every other respect.

*Specimens examined.* BRAZIL. **Bahia:** Mun. Gandú, 2 km N of Gandú City, Faz. Santo Antonio, 90 m, 19 Apr. 1972, *Calderón & Pinheiro* 2228 (CEPEC, K, MO, US); Mun. Itajuípe, 2 km S of Pimenteira on road to União Queimada, Fazenda São Jorge, 500 m, 5 May 1976, *Soderstrom et al.* 2186 (CEPEC, F, K, MO, SP, US); Mun. Jequié, road Jequié–piaú, ca. 40 km SE of Jequié, 175 m, 16 May 1976, *Calderón et al.* 2439 (INPA, K, MO, US); Mun. Mascote, 20 km E of Camaça, 9 km W of Santa Luzia do Salobro on road to Canavieiras, edge of rio Belém, 7 Apr. 1976, *Soderstrom et al.* 2128 (CEPEC, F, K, SP, US). **Espírito Santo:** Vitória, Viana, 12 June 1987 (fl), *Gomez* 84 (SP); Mun. Domingo Martins, km 42 before Marechal Floriano, 530 m, 21 Feb. 1990, *Clark & Morel* 691 (ISC, MBML, MO, NY, RB, SJRP, SP, US). **Minas Gerais:** Mun. Marliéria, Parque Estadual do Rio Doce, 400 m, 18 Sep. 1975, *Heringer & Eiten* 15024 (MO, US). **Paraná:** Capão Bonito, in silva primaria, 27 Mar. 1915 (fl), *Dusén* 16878 (F, K, MO, NY, US); Mun. Campina Gde. do Sul, Figueira, rio Capivari, 19 Dec. 1972 (fl), *Hatschbach* 31014 (ISC, MBM, SP, US); Mun. Antonina, rio Pequeno, 50 m, 10 Jan. 1974 (fl), *Hatschbach* 33640 (ISC, MBM, US); Mun. Lima Duarte, Serra do Ibitipoca, about 110 m before the entrance to the Parque Estadual (Florestal) do Ibitipoca, 1220 m, 3 Feb. 1991, *Clark & Morel* 784 (BHCB, ISC, MO, SJRP, SP, US). **Rio de Janeiro:** Mun. Resende, 27 Apr. 1926, *Gehrt & Hoehne* 17589

(US); Parque Nac. de Itatiaia, 12 Nov. 1943 (fl), *McClure* 21285 (ISC, K, US), *McClure* 21291 (K, US); Parque Nac. de Itatiaia, road to Maromba, near Hotel Simon, 1000 m, 12 Feb. 1990, *Clark et al.* 670 (AAU, ISC, K, MO, NY, RB, SJRP, SP, US); between Nova Friburgo and Cachoeiro de Macaco, 980 m, 30 Apr. 1972 (fl), *Soderstrom & Sucre* 1978 (CEPEC, INPA, K, RB, US); Mun. Nova Friburgo, Macaé de Cima, nascente do Rio Macaé, 1000 m, 28 Nov. 1986, *Martinelli et al.* 12008 (RB); Reserva Macaé de Cima, sítio Taquara-oca, trail to Cascada Preta, 710 m, 8 Mar. 1992, *Londoño & Sarahyba* 720 (IBGE, RB, TULV, US); Parque Nac. de Itatiaia, 1050–1250 m, 30 Apr. 1985 (fl), *Zuloaga et al.* 2344 (MO, US, WIS), 1110 m, 6 Mar. 1992, *Londoño & Sarahyba* 707 (IBGE, RB, TULV, US); Nova Friburgo, 9 Dec. 1918, *Curran* 622 (US); Mun. Teresópolis, Serra dos Órgãos, Rio Paquequer, 1000 m, 15 Aug. 1940 (fl), *Brade* 16566 (IAN, RB), 12 June 1940 (fl), *Brade* 16280 (IAN, R); Parque Nacional da Serra dos Órgãos, 16 Feb. 1990, *Clark et al.* 685 (ISC, MO, NY, RB, SJRP, SP, US), 1170 m, 6 Mar. 1992, *Londoño & Sarahyba* 713 (IBGE, RB, TULV, US); 16 km S of Itaipara, Serra dos Órgãos, 950 m, 26 Mar. 1976 (fl), *Davidse et al.* 11420 (K, MBM, MO, NY, US); Serra dos Órgãos, s.d. (fl), *Reitz* 6925 (SP, US); Soberbo, 13 July 1968 (fl), *Braga* 28 (RB); Mun. Petrópolis, vale de Bom Sucesso, 720 m, 6 May 1972, *Soderstrom & Sucre* 1985 (INPA, RB, US); Vasouras, 400 m, Apr. 1976 (fl), *Sucre* 11192 (K, RB, US); Bom Jesus de Itabapoana, Carabuçu, 7 July 1982 (fl), *Carauta et al.* 4293 (R); Rio de Janeiro, s.d. (fl), *Glaziou* 20153 (K, SP, US); Rio de Janeiro (fl), s.d., *Glaziou* 13324 (F, K); Rio, s.d. (fl), *Sello* 17 (US). **Santa Catarina:** Teresópolis, S. Amaro, 400 m, 24 Aug. 1958 (fl), *Reitz & Klein* 7058 (US); Rio Tavares, Ilha de S. Catarina, Florianópolis, 200 m, 28 July 1965 (fl), *Klein & Bresolin* 6119 (US); Vargem Grande, Lauro Müller, 350 m, 11 July 1958 (fl), *Reitz & Klein* 6732 (US); Mata da Cia. Hering, Blumenau, 23 Nov. 1954 (fl), *Reitz & Klein* 2283 (US); Novo Horizonte, Lauro Müller, 350 m, 22 Aug. 1958 (fl), *Reitz & Klein* 7036 (MBM, SP, UB, US); Parque Botânico do Morro Baú, Ilhota, 300 m, 1 Nov. 1968 (fl), *Reitz* 6890 (SP, US); ca. 10 km from Aiure, 25 Feb. 1992, *Londoño & Clark* 705 (IBGE, TULV, US); about 12–13 km along turn off from BR-101 to Brusque near Cunhas, 20 m, 9 Mar. 1991, *Clark & Oliveira* 886 (HRB, ISC, SJRP, SP, US); road São Bento do Sul–Corupá, 17 km NW of Corupá, 590 m, 4 Mar. 1991, *Clark & Windisch* 857 (HRB, ISC, MO, RB, SJRP, SP, US); Serra Geral, road Timbé do Sul to S. José dos Ausentes, 9.8 km from Timbé do Sul, Serra da Rocinha, 425 m, 6 Mar. 1991, *Clark & Windisch* 873 (HRB, ISC, SJRP, SP, US). **São Paulo:** Taubaté et Lorena, Oct. 1833, *Riedel* 1636 (K, NY, US-fragment); road between Piedade and Tapirai at Km 107 marker, 3 Mar. 1960, *Medina* 10 (SP); Serra da Cantareira, 18 May 1901 (fl), *Hammar* 6116 (SP, US), 14 June 1948 (fl), *Kuhlmann s.n.* (SP); between Taubaté & Ubatuba, Serra do Mar, 20 Nov. 1962 (fl), *Medina* 5 (SP, US); Serra da Cantareira, 22 Oct. 1948 (fl), *Pickel* 5891 (SP, US); Carlos Botelho State Park, Ribeirão Branco, km 55, ca. 23 km S of Park headquarters, 2 Sep. 1987, *Gentry et al.* 58817 (MO); Reserva Forestal Carlos Botelho, Serra de Paranapiacaba, past Rio Bonito, 28 Jan. 1990, *Clark & Windisch* 648 (ISC, K, MO, NY, RB, SJRP, SP, US), 185 m, 16 Feb. 1992, *Clark & Oliveira* 1025 (ISC, SJRP, SP, US); Sta. Izabel, Igaratá, 26 June 1952 (fl), *Kuhlmann & Gonzalves* 3147 (SP, UB), 26 Sep. 1950 (fl), *Kuhlmann* 2549 (SP); Mun. de Salesópolis, Boracéia, 28 Apr. 1949 (fl), *Kuhlmann* 3146 (SP); base of Serra da Bocaina, road Areias–



São José de Barreiro, km 251.5, 15 Jan. 1990, *Clark & Morel 624* (AAU, ISC, MO, NY, RB, SJRP, SP, US); Mun. Biritiba Mirim, Estação Biol. Boracéia, Casa Grande, 800 m, 24 Feb. 1991, *Clark & Morel 815* (ISC, MBM, MO, NY, RB, SJRP, SP, US); SP-183, road Piquete–Cruzeiro, about 10 km E of Piquete, near the gate of a fazenda, 570 m, 16 Jan. 1991, *Clark & Morel 749* (ISC, K, MO, RB, SJRP, SP, US); 5.5 km from the Paraná border, route BR116, 630 m, 17 Feb. 1992, *Londoño & Clark 689* (IBGE, SP, US).

***Guadua tagoara* subsp. *glaziovii*** (Hackel) Londoño & L. G. Clark, comb. et stat. nov. Basionym: *Bambusa glaziovii* Hackel, Oesterr. Bot. Zeit. 53(5): 194. 1903. *Guadua glaziovii* (Hackel) E.-G. Camus (as *glaziovii*), Les Bambusées 1: 108, pl. 66, fig. A. 1913. TYPE. Brazil. Rio de Janeiro, s.d., *A. F. M. Glaziou 17450* (holotype, W; isotypes, K, MB, P, US-fragment).

*Guadua longifimbriata* E.-G. Camus, Les Bambusées 1: 113, pl. 64, fig. C. 1913. *Bambusa longifimbriata* (E.-G. Camus) McClure, Smithsonian Contr. Bot. 9: 66. 1973. TYPE: Brazil. Rio de Janeiro: Petrópolis, São Cristóvão, 29 Feb. 1872, *A. F. M. Glaziou 5717* (holotype, P not found; isotypes, C, IAN, K, US-fragment).

Foliage leaf sheaths bearing fimbriate auricles at the summit, the auricles 2–5 mm long, dark brown, the fimbriae 6–15(–20) mm long. Pseudospikelets 1 to 6 (to 9) per cincinnus, 2.5–4 cm long, 2–3 mm wide, narrowly lanceolate, with 2–6 fertile florets; sterile lemmas 4.5–6 mm long; lemmas 7.5–9 mm long, 5–6 mm wide, the mucro 0.5 mm long; paleas 7–8.5 mm long, 3.5–4.5 mm wide. Lodicules 2.5–3.2 mm long, 1–2.5 mm wide. Ovary 3–4 mm long.

**Etymology.** This subspecies is named for Auguste F. M. Glaziou, a prolific French collector in Brazil during the 19th century.

**Distribution.** This subspecies occurs in the Atlantic forests only of the state of Rio de Janeiro.

**Paratypes.** BRAZIL. **Rio de Janeiro:** Mun. Nova Friburgo, Distr. de Macaé de Cima, a 3 km do Hotel Fazenda São João, 1000 m, 6 June 1989 (fl), *Lima et al. 3581* (MO, NY, R, RB, US), 960 m, 8 Mar. 1992, *Londoño & Sarayba 716* (IBGE, RB, TULV, US); Parque Nacional da Tijuca, Bom Retiro, 575 m, 25 Feb. 1972, *Soderstrom et al. 1854* (CEPEC, INPA, K, RB, US); Rio de Janeiro, 24 May 1895 (fl), *Ule 4113* (IAN, US).

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