

New species of *Aulonemia* and *Chusquea* (Poaceae: Bambusoideae: Bambuseae) from southeastern Brazil

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ABSTRACT – (New species of *Aulonemia* and *Chusquea* (Poaceae: Bambusoideae: Bambuseae) from southeastern Brazil). *Aulonemia fimbriatifolia* and *Chusquea longispiculata*, two woody bamboo species from the Atlantic forest of southeastern Brazil, are described as new and key characters are illustrated. *Aulonemia fimbriatifolia* is compared and contrasted with four other similar species, but it is considered unique within the genus and possibly among Neotropical woody bamboos due to its basally fimbriate foliage leaf blades. *Chusquea longispiculata* shares extremely reduced glumes I and II and reflexed lower inflorescence branches with a number of other Brazilian species of the genus, but is distinguished based on its spikelets that reach nearly 2 cm in length, as well as several vegetative features.

Key words - Atlantic forest, *Aulonemia*, *Chusquea*, Serra do Mar, woody bamboos

RESUMO – (Espécies novas de *Aulonemia* e *Chusquea* (Poaceae: Bambusoideae: Bambuseae) do sudeste do Brasil). *Aulonemia fimbriatifolia* e *Chusquea longispiculata*, duas espécies de bambus lenhosos da mata Atlântica do sudeste do Brasil, são descritas como novas e os seus caracteres diagnósticos são ilustrados. *Aulonemia fimbriatifolia* é comparada com quatro outras espécies semelhantes do gênero, mas é considerada única dentro do gênero e, possivelmente, entre os bambus lenhosos neotropicais devido às suas lâminas foliares fimbriadas na base. *Chusquea longispiculata* compartilha com várias outras espécies brasileiras do gênero as glumas I e II extremamente reduzidas e os ramos basais da inflorescência reflexos. Distingue-se pelas suas espiguetas mais longas, que alcançam aproximadamente 2 cm de comprimento, e também por vários caracteres vegetativos.

Palavras-chave - *Aulonemia*, bambus lenhosos, *Chusquea*, floresta Atlântica, Serra do Mar

Introduction

During preparation of the treatment of woody bamboos for the Poaceae volume of the Flora Fanerogâmica do Estado de São Paulo (Clark 2001a, b), it became evident that there were at least two undescribed species of woody bamboo among the herbarium collections that were consulted. Each was represented by several flowering specimens in addition to vegetative collections (some including culm leaves), so it was possible to prepare relatively complete descriptions. Both species occur in the Atlantic forest of the Serra do Mar. These two species, *Aulonemia fimbriatifolia* and *Chusquea longispiculata*, are here described as new, and their key characters are illustrated.

Results and Discussion

Aulonemia fimbriatifolia L.G. Clark, sp. nov. Type: BRAZIL: SÃO PAULO: Alto da Serra, mata da Estação

Biológica, 6-X-1936 (fl.), F.C. Hoehne & A. Gerht s.n. (holotype SP36504; isotypes US1764156, US1764157, US2926655).

Figure 1A-B.

Culmi 0.5-1 cm diametro, 1.5-4 m alti, erecti ad basim plerumque scandenti ad apicem. Ramificatio intravaginalis. Folia culmorum brevior quam internodia; vaginae 10-15 cm longae, glabrae, 1-2.3-plo longiores quam laminam, fimbriatae ad apicem et marginem superior; laminae 6-12 cm longae, pseudopetiolatae, reflexae, deciduae. Vagina foliorum glabrae vel interdum pubescens ad apicem, maculatae ad apicem, leviter carinatae, fimbriatae ad apicem et ad marginem superpositum ad apicem; fimbriae complanatae ad basim, 3-12 cm longae ad apicem vaginorum, 1.5-5 mm longae ad marginem, liberae vel partialiter connatae ad basim vel omnino connatae, crispatae vel sinuatae ad apicem; laminae foliorum 17.5-31 cm longae, 2.2-6 cm latae, lanceolatae vel lineari-lanceolatae, glabrae, abaxialiter tessellatae, apicibus longiacuminatis, basibus asymmetricis, rotundatis vel rotundati-attenuatis, fimbriatis. Inflorescentiae paniculatae, 28-45 cm longae, plus minusve

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contractae ramis et pedicellis ascendentibus. Spiculae 3-4 (-5) cm longae, 3 glumis, 0-1 lemmatibus sterilis, 5-7 flosculis fertilis, et 1 flosculo rudimentali; gluma I 1.7-3.2 mm longa (arista exclusa), mucronata vel plerumque aristata, arista 2.2-3 mm longa; lemmata fertilia 6.5-9.5 mm longa (arista exclusa), aristata, maculosa, sparsim pubescentia, arista (1.6-) 2.4-5 mm longa.

Rhizomes sympodial, pachymorph. Culms 1.5-4 m tall, 0.5-1 cm in diameter, erect at the base and then often scandent above; internodes ca. 30 cm long, all elongated, hollow, glabrous, finely mottled. Culm leaves shorter than the internodes; sheaths 10-15 cm long, abaxially glabrous, 1-2.3 times the blade length, bearing fimbriae at the summit on each side and along the upper part of the overlapping margin, the fimbriae flattened, ivory to reddish-brown, 1-3 cm long at the summit, to ca. 1 cm long on the margin, separate to partially connate at the base to completely connate, wavy to curly at the apex; blade 6-12 cm long, pseudopetiolate, reflexed, deciduous. Branching intravaginal; usually one branch per node, borne on a promontory, rarely the single branch rebranching from its basal nodes, first order branches often arching. Foliage leaves with the sheaths glabrous or sometimes pubescent toward the summit, mottled toward the apex, slightly keeled, bearing fimbriae at the summit on both sides and on the upper part of the overlapping margin, the fimbriae flattened at the base, ivory to reddish-brown, 3-12 cm long at the summit, 1.5-15 mm long on the margin, separate to partially connate at the base or completely connate, wavy to curly at the apex; blades 17.5-31 cm long, 2.2-6 cm wide, lanceolate or linear-lanceolate, glabrous, abaxially tessellate, the apex long acuminate, the base asymmetrical, rounded to rounded-attenuate, fimbriate for 0.5-3 cm along the margins, the fimbriae 2-6 mm long, flattened at the base, separate to partially connate, curly at the apex; pseudopetiole 2-3 mm long, abaxially glabrous, adaxially hispidulous; inner ligule not seen, possibly confluent with the fimbriae; outer ligule ca. 0.5 mm long, glabrous to shortly fimbriate. Inflorescences 28-45 cm long, paniculate, more or less contracted with the branches and pedicels ascending. Spikelets 3-4 (-5) cm long, consisting of 3 glumes, 0-1 sterile lemma with a rudimentary palea, 5-7 fertile florets and 1 rudimentary floret; glume I 1.7-3.2 mm long (excluding the awn), mucronate to more commonly awned, not mottled, the awn 2.2-3 mm long, scabrous; glume II 3.3-5.3 mm long (excluding the awn), awned, not mottled, the awn 1.5-2.4 mm long, scabrous; glume III 5-7.5 mm long (excluding the awn), awned, mottled,

the awn 2-2.3 mm long; sterile lemma 7.5-9 mm long (excluding the awn), awned, mottled, the awn 1.2-3.6 mm long, enclosing a rudimentary palea; fertile lemma 6.5-9.5 mm long (excluding the awn), awned, mottled, sparsely pubescent, the awn (1.6-) 2.4-5 mm long; palea 5.6-7 mm long, broadly 2-keeled for its full length. Lodicules not seen. Stamens 3; anthers ca. 3.5 mm long. Ovary not seen. Fruit not seen.

Specimens examined: BRAZIL: PARANÁ: Campina Grande do Sul, serra Ibitiraquire, subida ao pico Paraná, 1,500 m, 30-XI-1996 (fl.), *J. Cordeiro & O.S. Ribas 1379* (ISC, MBM); 1,000 m, 14-VII-1996 (fl.), *O.S. Ribas & F. Schwerdt 1448* (ISC, MBM); 1,500 m, 5-X-1997 (fl.), *J.M. Silva et al. 2045* (ISC, MBM); Quatro Barras, Serra da Graciosa, along trail to morro Mãe Catira, above a creek flowing into the rio Corvo, 1,150 m, 18-III-1991, *L.G. Clark et al. 936* (ISC, MBM, SJRP, SP, US); morro Mãe Catira, 1,200 m, 25-V-1967, *G. Hatschbach & C. Koczicki 16478* (US - mixed collection with *Chusquea*); morro Sete, Serra do Mar, 850 m, 9-III-1994, *L.G. Clark et al. 1195* (ISC, K, MBM, SJRP, SP, US); 1,200 m, 11-III-1992, *J. Cordeiro & E. Barbosa 815* (ISC, MBM). SANTA CATARINA: Campo Alegre, along the rio Negro, serra do Iquererim below the morro, about 19.5 km from Postema, 870 m, 16-III-1991, *L.G. Clark & W. Oliveira 926* (ISC, SJRP, SP, US). SÃO PAULO: Biritiba Mirim, Estação Biológica de Boracéia, along rio Claro, Pouso Verde, 770 m, 24-II-1991, *L.G. Clark & M. Morel 824* (ISC, SJRP, SP, US); Santo André, Paranapiacaba, Estação Biológica, 29-VI-1948 (fl.), *M. Kuhlmann 3137* (SP, US) and 18-III-1948 (fl.), *M. Kuhlmann 3138* (SP, US); 29-V-1969 (fl.), *J. Mattos 15444* (SP, US); São José do Barreiro, serra da Bocaina, Campos da Bocaina, rio das Pedras, Cachoeira das Meninas, 1,440 m, 4-III-1992, *L.G. Clark & P.G. Windisch 1060* (ISC, SJRP, SP, US); São Paulo, Parque Estadual da Serra do Mar, núcleo Curucutu, trilha do rio Ingazeiro, 16-VI-2000 (fl.), *R.F. Garcia et al. 2015* (PMSP); perto do limite com mun. Itanhaém, trilha do Campo, 799 m, 19-IX-1998, *J.R. Pirani et al. 4428* (PMSP, SPF).

Aulonemia fimbriatifolia is unique within the genus and possibly among woody bamboos in bearing fimbriae on the basal margins of the foliage leaf blades. The long fimbriae of the foliage leaf sheaths also help to distinguish this species from others in southeastern Brazil. There is a tendency for the southern populations of *A. fimbriatifolia* to have the fimbriae of the sheath fused with each other for nearly their entire length. This species is most similar to *A. ramosissima* (Hack.) McClure and *A. setigera* (Hack.) McClure (both known

Table 1. A morphological comparison of *A. fimbriatifolia* and allied species in Brazil.

Character	<i>A. fimbriatifolia</i>	<i>A. goyazensis</i>	<i>A. ramosissima</i>	<i>A. setigera</i>	<i>A. glaziovii</i>
Foliage leaf blade size (L × W, cm)	17.5-31 × 2.2-6	15-20 × 1.8-2.5	14.3 × 1.9	16-25 × 2.9-4.7	11-17 × 1.5-1.8
Foliage leaf blade base	rounded to rounded-attenuate, fimbriate	attenuate, glabrous	rounded-attenuate, glabrous	rounded, glabrous	rounded to rounded-attenuate, glabrous
Foliage leaf sheath summit, length of fimbriae (cm)	3-12	0.7-0.8	to 1.5	ca. 3	2-2.5
Foliage leaf sheath summit, morphology of fimbriae	flattened, apically wavy to curly; separate to totally connate	slender, apically curly; separate	slightly thickened, apically curly; basally connate	relatively slender, apically curly;	± broad, relatively straight to slightly basally connate wavy apically; basally connate
Inflorescence length (cm)	28-45	10-15	ca. 30	ca. 50	14-18
Spikelet length (cm)	3-4 (-5)	ca. 4	(3.5-)4-5	ca. 4	2.5-3.5
Glume number	3	2	3-4	5 (-6)	3
Glume I body length (mm)	1.7-3.2	4-5.5	2.5-3	2.5-3	2.5-3.5
Glume I apex	mucronate to more commonly awned	acute	acute to mucronate	mucronate to awned	acute to awned
Fertile floret number	5-7	4-5	7-9 (-10)	ca. 8	4-6
Lemma body length (mm)	6.5-9.5	10-12	7-7.5	(8-)9-10.5	6-7
Lemma apex	awned	acute to apiculate	awned	awned	awned
Lemma maculation	maculate	maculate	maculate	maculate	uniform, not maculate
Lemma indument	sparsely pubescent	glabrous	glabrous	scabrous	glabrous
Distribution	São Paulo, Paraná, Santa Catarina	Rio de Janeiro	Rio de Janeiro	Rio de Janeiro	Minas Gerais

from the state of Rio de Janeiro, and at least one of the two can be expected in the state of São Paulo), but it could also be confused with *A. goyazensis* (Hack.) McClure and *A. glaziovii* (Hack.) McClure. The five species are compared and contrasted in table 1. *Aulonemia ramosissima* has smaller foliage leaves, shorter fimbriae (1.5 cm long at the summit), an acute to mucronate glume I, and 7-9(-10) fertile florets, whereas *A. setigera* has fimbriae no more than 3 cm long, and scabrous fertile lemmas (8-)9-10.5 mm long (table 1).

Aulonemia fimbriatifolia occurs in Atlantic forest, cloud forests and secondary forests in the Serra do Mar from Santa Catarina to São Paulo at elevations from 770 to 1,500 m. This species was referred to as *Aulonemia* sp.1 in Clark (2001a).

Recent flowering collections from Paraná and São Paulo states indicate a probable mass flowering event for this species. The collections from Paranapiacaba in São Paulo suggest a cycle of about 20 years, assuming that both the 1948 and 1969 flowerings were gregarious.

Chusquea longispiculata L.G. Clark, *sp. nov.* Type: BRAZIL: SÃO PAULO: Sete Barras, XI-1977 (fl.), *D.M. Vital s.n.* (holotype SP217610, 3 sheets). Figure 1C-F.

Culmi (3-)5-10(-15) m longi, 0.5-2 cm diametro, erecti ad basim, scandentes vel dependentes apicem versus. *Folia culmorum* 9.6-19.4 cm longa; *vaginae* 7.7-14.3 cm longae, 2.2-3.6-plo longiores quam laminam, abaxialiter glabrae, marginibus glabris; *laminae* 3-5.2 cm longae, triangulares, erectae, persistentes, abaxialiter glabrae, apice apiculato vel mucronato; *cingulum* 2-5 mm latum, glabrum, fuscum vel brunneum, *junctura ad vaginam* notata per *cristam parvam suberosam*. *Ramificatio infravaginalis*; *rami subsidiarii cujusque nodi* (8-9)11-19(-21), 17-25(-30-36) cm longi, (0.7-)1-1.5 mm diam., ad basim valde deorsim geniculati. *Folia ramorum cujusque complementi* (4-)5-7(-8); *vaginae glabrae, marginibus glabris*; *laminae* (6-)7.7-14 cm longi, 0.7-1.2 cm latae, long./lat. = 8.6-14, glabrae, apice acuminato. *Inflorescentia* 4-7 cm longa, paniculata, aperta, *spathis duabus subtenta*. *Spiculae* (13.5-)14.5-19.2 mm longae; *glumae I et II squamiformes, obtusae, glabrae*; *gluma I* 0.2-0.3 mm longa; *gluma II* 0.4-0.5 mm longa; *glumae III et IV* 3/4-9/10 longiores quam *spiculam, naviculares, mucronatae vel aristatae, glabrae, arista* 1.3-2.8 mm longa; *gluma III* (7.5-) 10.8-13.9 mm longa; *gluma IV* (10.8-)15.3-17.7 mm; *lemmata* (13.1-)15-17.6 mm longa, *navicularia, mucronata vel aristata*.

Rhizomes unknown. Culms (3-)5-10(-15) m long, 0.5-2 cm in diameter, erect at the base then scandent or clambering and hanging; internodes 13-24 cm long, terete, glabrous, a white waxy band 4-5 mm wide present below the node and wearing away with age. Culm leaves 9.6-19.4 cm long, the juncture of the sheath and blade abaxially a faint line or obscure; sheaths 7.7-14.3 cm long, 2.2-3.6 times as long as the blade, abaxially glabrous, midrib obscure, margins glabrous, the overlapping one fused to the sheath at the base for 0.2-1 cm; blades 3-5.2 cm long, triangular, erect, persistent, abaxially glabrous, the midrib evident only toward the apex or less commonly for the upper half, the apex apiculate or mucronate, the margins glabrous; girdles 2-5 mm wide, brown to dark brown, glabrous, a small corky ridge present at the juncture with the sheath; inner ligules 0.5-1.5 mm long. Nodes at mid-culm with one triangular central bud subtended by ca. 12-15 smaller subsidiary buds in 1-2 rows, often with a small gap just beneath the central bud, seemingly dividing the buds into

two groups; nodal line horizontal but dipping below the bud/branch complement; supranodal ridge visible as a slightly raised line, not prominent. Branching infravaginal; central branch frequently developing, emerging more or less erect, then diverging up to 45-60° from the main culm; leafy subsidiary branches (8-9-)11-19(-21) per node, 17-25(-30-36) cm long, (0.7-)1-1.5 mm in diameter, strongly geniculate downward at the base, usually not rebranching. Foliage leaves (4-)5-7(-8) per complement; sheaths glabrous, uniform in color, keeled toward the summit, the margins glabrous, summit extension absent to 1 mm long; blades (6-)7.7-14 cm long, 0.7-1.2 cm wide, L:W = 8.6-14, lanceolate, glabrous, an abaxial tuft of hair at the base absent, abaxially weakly tessellate, midrib usually visible abaxially and prominent for nearly the full length, the base rounded to rounded-attenuate, the apex acuminate, the margins serrulate or one serrulate and the other glabrous or nearly so; pseudopetioles 2-2.5 mm long, glabrous, pulvinus usually developed; outer ligules 0.3-1 mm long, usually bilobed, erect, glabrous; inner ligules 0.5-1 mm long, more or less truncate to irregular, apically ciliate, abaxially usually finely pubescent. Inflorescences 4-7 cm long, open paniculate, subtended by 2(-3) spatheate bracts, the first (lower) with sheath 3-5 cm long, expanded, blade 1.2-2.5 cm long, the second (upper) with the sheath 3.9-6.2 cm long, expanded, the blade 0.8-2.4 cm long; rachis angular, glabrous; branches and pedicels angular, glabrous, the ridges scabrid, all subtended by a scar or rim or occasionally a scalelike subtending bract to 1.8 mm long, the primary branches pulvinate, spreading, the lowermost ones strongly divergent to reflexed at maturity and 3-3.5 cm long, the pulvini pubescent, secondary and higher order branches and pedicels appressed to the primary branches; pedicels 2-7 mm long. Spikelets (13.5-)14.5-19.2 mm long, more or less dorsally compressed; glumes I and II scalelike, obtuse, glabrous; glume I 0.2-0.3 mm long, < 1/33 the spikelet length; glume II 0.4-0.5 mm long, < 1/25 the spikelet length; glumes III and IV 3/4-9/10 the spikelet length, navicular, mucronate to awned, abaxially glabrous, awn 1.3-2.8 mm long; glume III (7.5-)10.8-13.9 mm long including the awn, 3-5-nerved; glume IV (10.8-)15.3-17.7 mm long including the awn, 3-, 5-, or 7-nerved; lemmas (13.1-)15-17.6 mm long including the awn, navicular, mucronate to awned, abaxially glabrous, 7- or 9-nerved, the awn ca. 2.2 mm long; paleas 11-16.2 mm long, shorter than the lemma, navicular, biapiculate, glabrous, 4- (or 8)-nerved, sulcate for nearly the full length, sulcus pubescent toward the apex. Lodicules 3, apically ciliate; anterior pair 1.6-2.5 mm

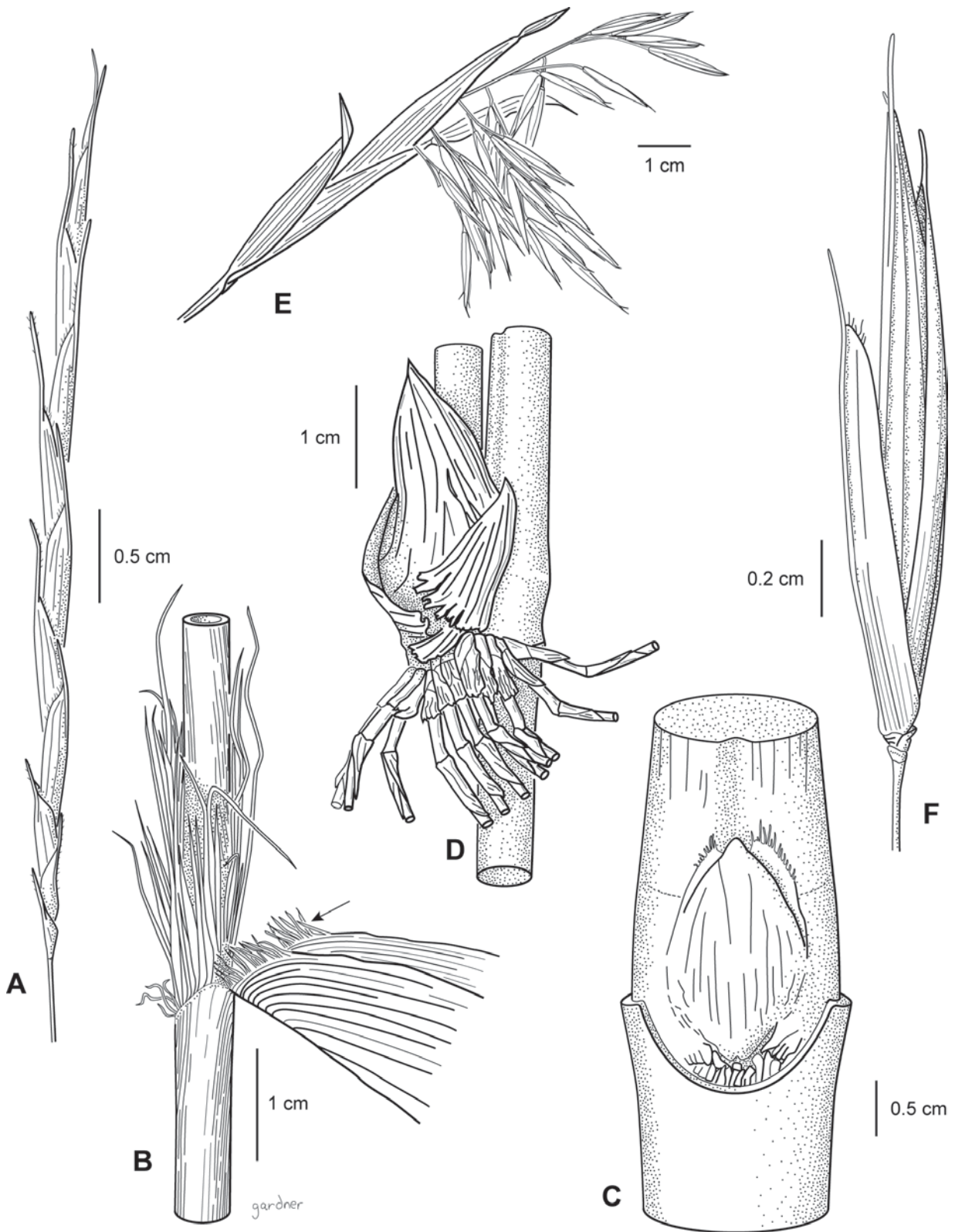


Figure 1. A-B. *Aulonemia fimbriatifolia*. A. Spikelet. B. Ligular area of the foliage leaf, showing well developed fimbriae on the sheath summit and the fimbriate base (arrow) of the blade. C-F. *Chusquea longispiculata*. C. Bud complement. D. Branch complement. E. Inflorescence with three subtending spathe bracts. F. Spikelet (A: *Hoehne & Gehrt s.n.*, US2926655; B: *Clark & Windisch 1060*; C: *Clark & Windisch 645*; D: *Sarahyba et al. 1064*; E: *Vital s.n.*, SP217610, and *Kuhlmann s.n.*, US1255438; F: *Vital s.n.*, SP217610).

long, the posterior one 1-2.2 mm long. Stamens 3; anthers 6.8-8.1 mm long. Ovary not seen. Fruit not seen.

Specimens examined: BRAZIL: RIO DE JANEIRO: Rio de Janeiro, Corcovado, 15-XI-1920 (fl.), *J.G. Kuhlmann s.n.* (US1255438); estrada Dona Castourina, caminho para Vista Chinesa, Parque Nacional da Tijuca, 410 m, 28-II-1994, *L.S. Sarahyba et al. 1064* (ISC, NY, RJ, SP, US); Paineiras Corcovado, above Rio de Janeiro, 18-XI-1964, *T.R. Soderstrom 1180* (K, US). SÃO PAULO: São Miguel Arcanjo, Serra de Paranapiacaba, Parque Estadual Carlos Botelho, SP-139, 65 km from BR-116 on road from Sete Barras to S. Miguel Arcanjo, 750 m, 16-II-1992, *L.G. Clark & W. Oliveira 1026* (ISC, MBM, MO, SJRP, SP, US); SP-139, km 78-79, Serra de Paranapiacaba, Reserva Florestal Carlos Botelho, just before rio Taquaral, 820 m, 28-I-1990, *L.G. Clark & P.G. Windisch 645* (ISC, MO, NY, SJRP, SP, RJ, US); Santo André, Alto da Serra, 700 m, 13-V-1916 (fl.), *P. Dusén 18105* (K, MO, US); Paranapiacaba, 29-IV-1948 (fl.), *M. Kuhlmann 3140* (SP); Paranapiacaba, Estação Biológica, Barroca das Onças e picada Washington Luiz, 10-VI-1948 (fl.), *M. Kuhlmann 3141* (SP, US).

Chusquea longispiculata is named for its long spikelets, but it is also distinguished vegetatively by its strongly downwardly geniculate subsidiary branches, foliage leaf blades 0.7-1.2 cm wide lacking an abaxial tuft of hairs at the base, and glabrous foliage leaf sheaths. It occurs in Atlantic forest in the Serra do Mar of São Paulo and Rio de Janeiro states. This is the species referred to as *Chusquea* sp. 2 in Clark (2001b). *Clark & Morel 657*, cited as *Chusquea* sp. 2 in that treatment, actually represents a closely related, as yet undescribed species. *Chusquea* sp. 1 in the same treatment has now been identified as *Chusquea attenuata* (Döll) L.G. Clark, which occurs in São Paulo, Rio de Janeiro, and Minas Gerais (the type is from the Pico do Itacolomi, Ouro Preto). *Chusquea longispiculata* and *C. attenuata*, along with *C. anelytroides* Döll, *C. anelythra* Nees, *C. meyeriana* Döll, and a number of other species (both described and undescribed), belong to an informal group defined by extremely reduced glumes I and II and

reflexed lower inflorescence branches. As far as is known, this group of species is restricted to Brazil. This group shares the presence of one to a few spatulate bracts subtending the inflorescences with the species of *Chusquea* subg. *Rettbergia*, but recent analyses indicate that this feature is either symplesiomorphic or homoplasious within *Chusquea* (L.G. Clark, unpublished data).

The flowering specimens from 1916 and 1948, which may have come from the same population, or at least geographically proximate populations, indicate a possible cycle of 32 years, always assuming that both flowerings were gregarious. The type specimen, collected in flower in 1977, is consistent with an approximately 30-year cycle, but it is definitely from a different population than the other flowering collections, and there is no indication as to whether this was a gregarious flowering event.

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