

The genera of native bamboos of Costa Rica*

by

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Abstract: Taxonomic keys to the seven native and two introduced bamboos known from Costa Rica, based on vegetative characters, are presented in English and Spanish versions. Brief notes on the morphology and occurrence of each genus are included.

This brief treatment of the Costa Rican bamboos is based in part on the author's field experiences with these woody grasses in Central America, and in part on **McClure's** posthumous treatment, *The Genera of Bamboos Native to the New World* (1973). A new vegetative key to the native genera and a few of the commoner cultivated genera has been provided in the hope that its availability might stimulate further field study and collection of these puzzling grasses. Because of their gigantic stature, rarity of bloom, and difficulty of identification, the bamboos have not received their proper share of attention by botanists. The author urges that the field botanist look for the bamboos, particularly when they are in flower, and make copious specimens, including midculm sheaths from young culms, inflorescences, culm sections, and branch complements from the upper parts of the culms. The specimens should be supplemented by extensive notes on the growth habit of the plants, the nature of the culms, and the manner of rhizome growth. McClure distinguished two general types of rhizome growth: 1) Pachymorph, with short, thick internodes and restricted growth in length; and 2) Leptomorph, with slender, elongated internodes and extensive growth. Since no herbarium specimen can adequately represent such large plants as the bamboos, photographs of clump form would also be helpful additions to herbarium specimens.

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KEY TO THE GENERA OF BAMBOOS OF
COSTA RICA

- 1a. Culm internodes solid; montane bamboos, mostly growing above 1200 m *Chusquea*
- 1b. Culm internodes with a small or large lumen; bamboos of various elevations 2
- 2a. At least some of the culm branches bearing thorns 3
- 2b. Culm branches never thorny; rarely some nodes of main culms may bear rings of short root thorns 4
- 3a. Giant cultivated bamboos, the culms up to 10 cm thick and 30 m tall
 *Bambusa arundinacea*
- 3b. Wild bamboos of small to moderate stature; culms usually less than 10 m tall and 3 cm thick *Bambusa*, subgenus *Guadua*
- 4a. Plants barely woody, the slender culms green and soft (can be crushed with the fingers); branches solitary at the midculm nodes, divaricate, nearly as thick as the main culm; leaf blades broadly ovate, their bases strongly asymmetric
 *Aulonemia*
- 4b. Plants definitely woody, the culms of various diameters; branches more than 1 per node and definitely thinner than the main culm 5
- 5a. Bamboos of various habits, in forested or savanna habitats below 3000 m elevation; lumen of internodes usually large and with a definite limiting membrane; branches 2-many per node 6
- 5b. Small, shrubby bamboos, mostly on paramos above 3000 m; central lumen of the culm internodes small and irregular, lacking a definite boundary membrane; branches usually 3-5 per node, stiff and erect *Swallenochloa*
- 6a. Branches at midculm nodes numerous, arising from the edges of a flat, triangular plate-like meristem that is adnate to the main culm 7
- 6b. Branches at midculm nodes not arising from a flat plate; number of branches variable 8
- 7a. Sheaths at the middle culm nodes with a narrow reflexed blade that is constricted at its base and much narrower than the sheath apex *Merostachys*
- 7b. Sheaths at the middle culm nodes with an erect blade that is as wide as the sheath apex and not constricted at the base *Rhipidocladum*
- 8a. Primary midculm branches solitary, soon branched from near the base; auricular bristles very prominent, up to 8 cm long on main culm sheaths. . . . *Elytrostachys*
- 8b. Primary midculm branches 2-several per node; auricular bristles much shorter than in 8a 9
- 9a. Branches 3-many per node, arising above the nodes at the apex of a prominent bulge that continues down to the node; internodes cylindrical; clumps dense, the rhizomes pachymorph; wild plants *Arthrostyidium*
- 9b. Branches 2 per node; internodes flattened above the node, D-shaped in cross section; rhizomes slender, extensively spreading (leptomorph); cultivated bamboos, used for clipped hedges, banana props, fishing poles, etc. *Phyllostachys*

Arthrostylidium Ruprecht

This genus is little known from Costa Rica, and only from sterile material. The plants are caespitose and possess pachymorph rhizomes. They are distinguished vegetatively by the peculiar insertion of the leafy branches on the summit of a bulge a short distance above the nodes. The culms are hollow. Two species have been collected from Costa Rica. *Arthrostylidium pubescens* Rupr., an erect species with strongly scabrous culms, was obtained from Moravia de Chirripó. *Arthrostylidium venezuelae* (Steud.) McClure was collected at El Muñeco (San Francisco, Cartago), the specimen originally being described as *Arundinaria standleyi* Hitchc. The plants are weak and trailing, with slender culms up to 2-3 m long.

Aulonemia Goudot

The Costa Rican species of *Aulonemia* occur in small clumps of a few culms. The plants are the most "herbaceous" of all Costa Rican bamboos, the culms being soft and fleshy. The branching habit is unusual, in that the main culm and the solitary branch at middle nodes are about equal in diameter and diverge in a dichotomous fashion. The very broad asymmetric leaf blades resemble those of *Olyra latifolia*. We have collected two species in Costa Rica, but only in the vegetative condition. *Aulonemia viscosa* (Hitchc.) McClure, as its name implies, has viscid bands encircling the culm internodes just below the nodes. Similar bands also occur in other species. *Aulonemia viscosa* occurs rarely in small stands on the Cordillera de Talamanca at elevations above 2000 m in *Quercus* forests. Although it resembles the other Costa Rican species, *A. laxa*, it lacks auricular bristles and has narrower leaf blades, 5-6 times longer than wide. *Aulonemia laxa* (Maekawa) McClure, originally described from México and known previously only from the type, occurs in the canyon of the Río Las Vueltas at Alto Roble (San Rafael, Heredia). It differs from *A. viscosa* in possessing strong auricular bristles and much broader leaf blades, 2-4 times longer than wide. No recent bloom has been seen in either species, but early collections of *A. viscosa* from 1893 and 1898 were in flower.

Bambusa Schreber

The American species of this genus belong to the subgenus *Guadua* (Kunth) Hack. The plants form more or less open clumps and the culms are rather stiff and erect or arching. Usually, they can be recognized by the possession of straight or hooked branch thorns at some of the nodes. The branches usually are several per node, and of unequal size. The culm walls usually are thick, sometimes to the point of nearly occluding the central cavity. The native *Bambusa* species (formerly *Guadua*) are occasional at low elevations and seemingly most common on the savannas of Guanacaste. Flowering probably is very rare, and I have seen only one specimen from Costa Rican bearing spikelets.

In addition to the native species, two Asiatic species belonging to subgenus *Bambusa* are commonly cultivated in Costa Rica. *Bambusa vulgaris* Schrad., f. *vittata* A. & C. Riv. has thornless culms that are longitudinally striped with green and bright yellow. *Bambusa arundinacea* Willd. is a very large bamboo, the plants reaching a height of 30 m and a culm diameter of 10-15 cm. The lower branchlets are very thorny. This species is occasionally cultivated and has recently been blooming in Costa Rica.

Chusquea Kunth

This is the largest and most abundant genus of bamboos in Costa Rica. The species of *Chusquea* are immediately distinguished from those of other genera by their solid culms. The plants mostly form dense clumps from pachymorph rhizomes. Their size is quite variable, but the commonly seen species have culms up to 10-15 m long and 4-5 cm in diameter. The branch complements from middle and upper nodes of the culms consist of a number of slender, leafy branchlets, surrounding a central larger branch. When this branch does not develop, one can usually discern a large, flat bud mostly concealed by the slender branches. The inflorescences range from slender and virgate (*C. virgata* Hack.) to open paniculate (*C. tonduzii* Hack.). The spikelets have two minute glumes, followed by two empty lemmas and a terminal fertile floret. Fertility is apparently low and most of the spikelets are barren. However, I have seen seedlings of *C. tonduzii* growing on moss polsters beneath the dying plants. Blooming is rare or occasional, but is most common in *C. tonduzii*, a common species along the Carretera Interamericana at elevations above 2000 m on the Cordillera de Talamanca. Most species appear to be monocarpic; i.e. they bloom once and then die, the plants being replaced by seedlings.

The plants are primarily montane, at elevations of 1000-3000 m. They frequently form extensive dense colonies, the arching or dependent upper parts of the culms forming curtains on the walls of canyons. In the eastern portions of the Meseta Central on the flanks of Irazú, *C. pittieri* Hack., a large species, with light green foliage and a ring of short root-thorns at lower and middle nodes, is common.

McClure (1973) has separated the high-montane bamboos of the páramos as the genus *Swallenochloa*. They are distinguished by only slightly hollow culms, fewer branches, and much denser inflorescences.

Elytrostachys McClure

Caespitose bamboos with pachymorph rhizomes. The culms are cylindrical, weak and thin-walled, up to 8 cm thick. The primary branch at midculm nodes is solitary, but rebranches immediately above its base to produce a cluster of smaller branchlets. Auricular bristles on the apex of the leaf sheath are very prominent, quadrate in cross section, and often up to 6-8 cm long. Because of these bristles, young developing shoots appear very bristly. Leaf sheaths of large culms have narrow, strongly reflexed, reduced leaf blades, flanked with conspicuous dark, erect bristles. These features distinguish the genus from *Rhipidocladum* in the vegetative condition. *Elytrostachys clavigera* McClure was collected in fruit at Buenos Aires, in the Canyon of the Río Térraba in 1891, and at Tsáki in 1895. We have collected this species in vegetative condition at the Buenos Aires locality. A sizable clone occurs in the rain forest at La Selva. The plants there form a large, open clump of about 30-50 culms, their bases decumbent and trailing, the upper parts clambering and looping into trees. The culms were over 20 m long.

Merostachys Sprengel

Caespitose bamboos with pachymorph rhizomes. The plants are similar to those of *Rhipidocladum* in having numerous branchlets arising from a triangular flat meristematic plate just above the nodes. In vegetative condition, they can be

distinguished by the blades of culm sheaths, which are narrowed to the base and reflexed. The genus is little known in Central America. A single specimen in flower was collected from Zapotal, Montes de Oro in the Province of Puntarenas in May, 1961. It is fragmentary and probably cannot be determined beyond genus.

Phyllostachys Sieb. & Zucc.

This is an Asiatic genus, but several species are cultivated in the western hemisphere, and one is very common in Costa Rica as a hedge plant. The plants form open clumps from aggressively spreading leptomorph rhizomes. The culm internodes are hollow and round except at nodes where buds or branches are borne. At such nodes, the culm is flattened on the side adjacent to the bud, forming a D-shaped cross section. *Phyllostachys aurea* A. & C. Riviere is the common hedge bamboo with yellow culms. In some of the culms, a group of the internodes near the base may be much shorter and somewhat thicker than those above and below this zone. There are normally two branches per node, one of them often smaller than the other. When used for sheared hedges, *P. aurea* remains quite small, and the plants may bloom without dying. Untrimmed plants may reach 4-5 m in height and culm diameters of 2-3 cm. Such plants appear to die after flowering.

Rhipidocladum McClure

Caespitose bamboos with pachymorph rhizomes. The larger species of this genus form dense clumps of very slender culms (with the exception of *R. harmonicum*). The culms are quite elongated, up to 10 m long, but with very slender cylindrical internodes, usually not more than 1 cm thick. The upper portions of the culms arch gracefully or trail through the crowns of trees, forming delicate veils of foliage pendent over canyon walls. Like *Merostachys*, culms of this genus produce flat, triangular meristematic plates above the nodes, the numerous slender branchlets arising in fanlike fashion from the margins of these plates. The species apparently bloom more frequently than many bamboos. They are monocarpic, the old plants blooming and dying. A large population of *R. pittieri* (Hack.) McClure occurs in the valley of the Rio Virilla on several sides of San José. This population was blooming and dying in 1973, and new seedlings were developing by the end of 1974. A large stand occurred in the canyon at Puente de Mulas, near San Antonio. *Rhipidocladum racemiflorum* is common at low elevations in Guanacaste, where it also bloomed in 1973. Seedlings and dead plants were found in December, 1974. *Rhipidocladum maxonii* (Hitchc.) McClure is a delicate, vinelike species that occurs in brush at intermediate elevations on the Cordillera de Talamanca. It is known to have flowered in 1923, 1924, 1955, and 1972. The most recent flowering collection was from the canyon of the Rio Navarro, north of El Muñeco. We have also collected seedlings in the vegetative condition along the Carretera Interamericana, 21 km by road south of Cartago, at an elevation of 1880 m. The plants grew in dense brush on a steep hillside. Small seedlings only 30 cm tall were present, along with larger plants with short pachymorph rhizomes and slender culms up to 3 m long.

The presence of these seedlings in December of 1974 suggests very recent flowering, but no flowering or dying plants were seen. *Rhipidocladum harmonicum* (Parodi) McClure, a large species with thin, cylindrical culms up to 10 m long and 3-4 cm thick, occurs near the Rio Pacuare, east of Jicotea. Plants in vegetative

condition can be recognized by having erect, narrowly triangular rudimentary leaf blades on midculm sheaths.

Swallenochloa McClure

Caespitose bamboos in dense, small clumps; culms erect or slightly arching, usually of small stature, rarely more than 3 m tall. The midculm nodes usually bear 2-5 erect primary branches. The terminal panicles are dense and elongated. *Swallenochloa subtessellata* (Hitcch.) McClure is abundant on the páramos of the Cerro de la Muerte above 3000 m, and occurs to a limited extent around the crater of Volcán Irazú. Some of the clumps can always be found in bloom, although the abundance of flowering varies from year to year. Another species, not yet formally described, occurs near Tres de Junio along the Carretera Interamericana, at Alto de Roble, and at Alto de Paloma. It is characterized by very elongated ligules.

Swallenochloa was separated from *Chusquea* by McClure primarily because of the smaller number of primary branches at the nodes, the somewhat hollow culms, and the slender, dense terminal panicles. It is to be expected that more species will be discovered.

RESUMEN

Este artículo contiene claves taxonómicas en inglés y español, basadas en la morfología vegetativa para los siete géneros de bambúes conocidos como nativos en Costa Rica, más dos géneros de bambúes exóticos, cultivados comúnmente en el país. También, hay notas breves sobre la morfología y ocurrencia de las especies en Costa Rica.

CLAVE DE LOS GENEROS DE BAMBUES DE COSTA RICA

- 1a. Entrenudos del culmo sólidos; bambúes montanos, generalmente de alturas superiores a 1200 m *Chusquea*
- 1b. Entrenudos del culmo con lumen de pequeño a grande; bambúes de diferentes elevaciones 2
 - 2a. Ramas del culmo a veces con espinas 3
 - 2b. Ramas del culmo sin espinas; raramente algunos nudos de los culmos principales con anillos de espinas radicales cortas 4
- 3a. Bambúes gigantes cultivados, culmos hasta 10 cm de grueso y 30 m de altura *Bambusa arundinacea*
- 3b. Bambúes silvestres de pequeña o moderada estatura, culmos generalmente de menos de 10 m de altura y 3 cm de grueso *Bambusa*, subgénero *Guadua*
 - 4a. Plantas ligeramente leñosas, culmos delgados, verdes y suaves (se pueden triturar con los dedos); ramas solitarias en los nudos de la mitad del culmo, casi tan gruesas como el culmo principal; láminas de las hojas anchas y ovadas, con las bases fuertemente asimétricas *Aulonemia*
 - 4b. Plantas definitivamente leñosas, culmos de varios diámetros, más de una rama por nudo, definitivamente más delgadas que el culmo principal 5

- 5a. Bambúes de varios habitats, de bosques o sabanas inferiores a 3000 m; lumen de los entrenudos generalmente grande y con una membrana limitante definida; de 2 a más ramas por nudo 6
- 5b. Bambúes pequeños arbustivos, generalmente de páramos superiores a 3000 m; lumen central de los entrenudos del culmo pequeño e irregular, sin membrana limitante definida; generalmente 3-5 ramas rígidas y erectas por nudo *Swallenochloa*
- 6a. Ramas de los nudos de la mitad del culmo numerosas, que salen de los bordes de un meristema plano y triangular en forma de placa adnata al culmo principal . . . 7
. 7
- 6b. Ramas de los nudos de la mitad del culmo no salen de una placa plana; número de ramas variable 8
- 7a. Vainas de los nudos de la mitad del culmo con una lámina refleja, angosta y constricta en su base, mucho más angosta que el ápice de la vaina *Merostachys*
- 7b. Vainas de los nudos de la mitad del culmo con una lámina erecta, no constricta en su base, tan ancha como el ápice de la vaina *Rhipidocladum*
- 8a. Ramas primarias a la mitad del culmo solitarias, que se ramifican cerca de la base; cerdas auriculares muy prominentes, hasta 8cm de largo, en las vainas del culmo principal *Elytrostachys*
- 8b. Ramas primarias a la mitad del culmo 2 o varias por nudo; cerdas auriculares más cortas que en 8a 9
- 9a. Tres a varias ramas por nudo, saliendo por encima de los nudos en el ápice de un abultamiento pronunciado que continúa hasta abajo del nudo; entrenudos cilíndricos; en macollas densas de rizomas paquimorfos; plantas silvestres *Arthrostylidium*
- 9b. Dos ramas por nudo; entrenudos aplanados por encima del nudo, en forma de D en corte transversal; rizomas delgados, muy extendidos (leptomorfos); bambúes cultivados usados para setos, puntales para matas de banano, cañas para pescar, etc. *Phyllostachys*

REFERENCIAS

McClure, F. A.

1973. *Genera of bamboos native to the New World (Gramineae: Bambusoideae)*. Smithsonian Contributions to Botany 9: xi + 148. Ed. by T. R. Soderstrom. Smithsonian Inst. Press. Washington, D. C.