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Magnoliophyta: Commelinidae (in part): Poaceae, part 1

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2. BAMBUSEAE Nees

Christopher M.A. Stapleton

Plants perennial; rhizomatous, shrubby to arborescent, self-supporting to climbing; **rhizomes** well developed, pachymorphic or leptomorphic, rarely both. **Culms** perennial, woody, to 30 m tall, internodes usually hollow, initially unbranched and bearing thickened overlapping culm leaves, subsequently developing foliage leaves on the complex branch systems from buds at the internode bases. **Culm** leaves thickened, usually early deciduous; **auricles** and/or **fimbriae** often present; **abaxial ligules** usually lacking; **adaxial ligules** present; **blades** poorly to well developed, erect or reflexed, the base as wide as or narrower than the sheath apex, sometimes pseudopetiolate. **Foliage leaves:** **auricles** and **fimbriae** present or absent; **abaxial** and **adaxial ligules** present; **pseudopetioles** nearly always present; **blades** deciduous, venation parallel, cross venation often evident, particularly at the base. **Inflorescences** determinate or indeterminate, bracteate or ebracteate, racemose to paniculate, composed of pseudospikelets or spikelets. **Spikelets** or **pseudospikelets** with 1 to many florets, the lower floret(s) often sterile, the others bisexual; **glumes** often subtending the buds; **lemmas** often unawned, usually multiveined; **lodicules** usually 3, with vascular tissue; **anthers** usually 3 or 6, sometimes fewer or up to 7, very occasionally many; **ovaries** glabrous or pubescent; **styles** or **style branches** 1–4; **Caryopses** with or without a thickened fleshy pericarp.

The *Bambuseae* include about 80–90 genera and around 1400 species. They are most abundant in Asia and South America, but are also found in Africa, Australia, Central America and North America. One genus, *Arundinaria*, is native to the *Flora* region, where it is represented by 3 species. Many other genera and species are cultivated in the region for their ornamental value. These often persist for decades; some have become established beyond the original planting. Identification of these introduced bamboos is hampered by the lack of taxonomic studies in their countries of origin, particularly studies of vegetative features, and the large number of taxa that have not yet been described. Identification is further hindered by their infrequent flowering.

Woody bamboos differ from all other grasses in the division of vegetative growth into two phases. Growth commences with the production of unbranched new culms which bear protective leaves called *culm leaves* (or *culm sheaths*) at their nodes. Later in the same season, or in the following season, buds at the nodes of the new culms develop into branches, which produce *foliage leaves* with photosynthetic blades. The leaves on the culms and foliage branches are homologous, each consisting of a sheath, adaxial ligule, and blade, but the culm leaves have less well-developed blades and quickly become non-photosynthetic or fall away, while the foliage leaves have more persistent, photosynthetic, well-developed blades.

Another feature characteristic of some, but not all, bamboos is the 'pseudospikelet', which differs from a determinate spikelet in its indeterminate growth from lateral buds in the axils of the basal glumelike bracts. This can lead to extensive ramification of the pseudospikelet into a capitate cluster [see McClure (1966) for a more detailed discussion].

Woody bamboos are also distinguished by perennial lignified culms which often have complex branch complements at the nodes, and often by cyclical flowering at intervals of up to 150 years. In cyclical flowering, an entire population or even species will flower in a given year, after which the parents usually die, regeneration being through slow-growing and vulnerable seedlings.

Most woody bamboos are tropical or subtropical in their distribution, but about 25 genera are found in temperate regions, mainly in eastern Asia. Two genera are native to North America; *Arundinaria* is the only genus native to the *Flora* region. It is thought to have crossed the Bering Strait from eastern Asia, and may represent the sole remnant of a much larger pre-glacial bamboo population. The other genus, *Oateia* (McClure & E.W. Sm.) C.E. Calderón & Soderstr., is probably a relatively recent entrant into Mexico from South America.

The taxonomy of woody bamboos has developed slowly because of the scarcity of flowering material, and the distribution of the species in predominantly inaccessible or less-developed parts of the world. Concentration on floral characters in earlier classification systems has made taxonomy and identification even more difficult. Cytological information has been of little value beyond the separation of two major Asian groups, one tropical with $2n = 56-72$ and the other temperate with $2n = 48$. There appears to be more variation among American bamboos.

Molecular data have thrown doubt upon the phylogenetic validity of many earlier attempts to classify the woody bamboos by floral characters alone. Nevertheless, they are illuminating interesting patterns of evolution and dispersal. A wider range of morphological characters is increasingly being studied and applied. Because many species have only been described in recent years, while many cultivated bamboos have been grown under misapplied or speculative names, the taxonomy of bamboos will require continued study for many years to come. Fieldwork, herbarium study, and laboratory investigations will all be necessary, along with extensive international collaboration. It is highly likely that a substantial proportion of forest bamboos will become extinct before they have been properly documented.

The American Bamboo Society lists over 450 taxa of bamboo, representing 240 species in 40 genera, as being commercially available in the United States. Although bamboos are increasingly widely cultivated in the *Flora* region, they are most common in the coastal and southern states. Most of the cultivated species are Asian in origin, but in recent years numerous Central and South American taxa have been introduced. Most introduced taxa will persist indefinitely without cultivation. In favorable climates, many will spread beyond the original plantings to become naturalized, especially those with long rhizomes. Wider dispersal occurs when sections of the rhizome are transported from one location to another, as may happen during floods. Clump-forming bamboos may eventually spread through seed dispersal.

Bamboos are multipurpose plants of immense utility to mankind. Traditional uses, such as building, basketry, and fodder, have been supplemented by industrial-scale paper-pulp production, the canning of edible shoots, and production of advanced board products, laminates, and cloth.

This treatment is limited to a full treatment of the native genus, *Arundinaria*, and descriptions and representative illustrations for the three genera and seven species thought to have become established in the *Flora* region.

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1. Rhizomes pachymorphic, short, thicker than the culms; culms forming separate, well-defined clusters 2.02 *Bambusa*
1. Rhizomes leptomorphic, long, thinner than the culms; culms solitary, loosely clumped, or both.
 2. Culm internodes grooved their whole length, often doubly sulcate above the branches; branches usually without compressed internodes at the base; spikelets sessile 2.03 *Phyllostachys*
 2. Culm internodes mostly terete, flattened or shallowly sulcate above the branches; branches usually with 1–5 compressed internodes at the base, sometimes without any compressed internodes; spikelets pedicellate.
 3. Culm leaves persistent or deciduous, usually with auricles; culms to 3 cm thick; culm buds open, margins not fused; plants native in the *Flora* region 2.01 *Arundinaria*
 3. Culm leaves persistent, usually without auricles; culms to 1.5 cm thick; culm buds closed, margins fused; plants cultivated in the *Flora* region, occasionally escaped 2.04 *Pseudosasa*

2.01 ARUNDINARIA Michx.

Lynn G. Clark

J.K. Triplett

Plants arborescent or subarborescent, spreading or loosely clumped; **rhizomes** leptomorphic. Culms 0.5–8 m tall, to 3 cm thick, erect; **nodes** not swollen; **supranodal ridges** not prominent; **internodes** terete to slightly flattened or shallowly sulcate above the branches. **Culm leaves:** sheaths persistent or deciduous, mostly glabrous, abaxial surfaces sparsely pilose towards the margins and apices, margins ciliate; **auricles** usually present; **blades** erect or becoming reflexed, narrowly triangular to strap-shaped, abaxial surfaces sparsely pilose; **leaves at tips of new shoots** crowded into distinctive fan-shaped clusters or *topknots*, blades expanded as on the foliage leaves. **Branch complements** of 1 primary branch and 0–2 subequal secondary branches on young culms, rebranching to produce to 40+ secondary branches on older culms. **Foliage leaves:** sheaths persistent on the lower branch nodes; **auricles** usually present; **fimbriae** to 10 mm; **blades** finely cross veined abaxially, acuminate, blades of the ultimate branchlets often smaller, crowded into flabellate clusters of 3–7 leaves. **Inflorescences** open racemes or panicles; **disarticulation** below and between the florets. **Spikelets** 3–7 cm, with 6–12 florets, basal floret occasionally sterile, laterally compressed. **Glumes** 1–2, shorter than the lowest lemmas; **lemmas** to 2 cm, sometimes awned, awns about 4 mm; **anthers** 3; **styles** 3; **paleas** 2-keeled, not exceeding the lemmas. $x = 12$. Name from the Latin *arundo*, 'reed'.

Arundinaria is a north-temperate genus with three native North American species. The most consistent differences among the North American species are seen in the vegetative characters, including the topknot leaf blades, foliage leaf blades, and features of the branch complements.

Arundinaria is sometimes taken as including several Asian species. Genera that used to be treated in *Arundinaria* include, for example, *Fargesia* Franch. and *Sasa* Makino & Shibata.

SELECTED REFERENCES McClure, F.A. 1973. Genera of bamboos native to the New World (Gramineae: Bambusoideae). Smithsonian Contr. Bot. 9:1–148; Judziewicz, E.J., L.G. Clark, X. Londoño, and M.J. Stern. 1999. American Bamboos. Smithsonian Institution Press: Washington, D.C., U.S.A. 392 pp.; Zhu, Z., C.-D. Chu, and C. Stapleton. 2006. *Arundinaria*. Pp. 113–115 in Z.-Y. Wu, P.H. Raven, and D.-Y. Hong (eds.). *Flora of China*, vol. 22 (Poaceae). Science Press, Beijing, Peoples Republic of China and Missouri Botanical Garden Press, St. Louis, Missouri, U.S.A. 653 pp. <http://flora.huh.harvard.edu/china/mss/volume22/index.htm>.

1. Primary branches with 0–1 compressed basal internodes; culm internodes usually sulcate; culm leaves deciduous 1. *A. gigantea*
1. Primary branches with 2–5 compressed basal internodes; culm internodes usually terete; culm leaves persistent to tardily deciduous.

2. Foliage blades coriaceous, persistent, abaxial surfaces densely pubescent or glabrous, strongly cross veined; primary branches usually longer than 50 cm, basal nodes developing secondary branches; topknot blades 20–30 cm long 2. *A. tecta*
2. Foliage blades chartaceous, deciduous, abaxial surfaces pilose or glabrous, weakly cross veined; primary branches usually shorter than 35 cm, basal nodes not developing secondary branches; topknot blades 9–22.5 cm long 3. *A. appalachiana*

1. *Arundinaria gigantea* (Walter) Muhl. [p. 19]
RIVER CANE, GIANT CANE



Rhizomes normally remaining horizontal, sometimes hollow-centered, air canals absent. Culms 2–8 m tall, to 3 cm thick; internodes typically sulcate distal to the branches. Culm leaves deciduous; sheaths 9–15 cm; fimbriae 2.2–7 mm; blades 1.5–3.5 cm. Topknots of 6–8

leaves; blades 16–24 cm long, 2–3.2 cm wide, lanceolate to ovate-lanceolate. Primary branches to 25 cm, erect or nearly so, with 0–1 compressed basal internodes, lower elongated internodes flattened in cross section. Foliage leaves: abaxial ligules usually ciliate, sometimes glabrous; blades subcoriaceous, persistent, evergreen, 8–15 cm long, 0.8–1.3 cm wide, bases rounded, abaxial surfaces glabrous or pubescent, strongly cross veined, adaxial surfaces glabrous or almost so. Spikelets 4–7 cm, greenish or brownish, with 8–12 florets. Glumes unequal, glabrous or pubescent, lowest glumes obtuse to acuminate or absent; lemmas 1.2–2 cm, usually appressed-hirsute to canescent, sometimes pubescent only towards the base and margins. Caryopses oblong, beaked, without a style branch below the beaks. $2n = 48$.

Arundinaria gigantea forms extensive colonies in low woods, moist ground, and along river banks. It was once widespread in the southeastern United States, but cultivation, burning, and overgrazing have destroyed many stands.

2. *Arundinaria tecta* (Walter) Muhl. [p. 20]
SWITCH CANE



Rhizomes normally horizontal for only a short distance before turning up to form a culm, hollow-centered, air canals present. Culms usually shorter than 2.5 m tall, to 2 cm thick; internodes terete in the vegetative parts. Culm leaves persistent to tardily deciduous;

sheaths 11–18 cm; fimbriae 1.5–8.5 mm; blades 2.5–4 cm. Topknots of 9–12 leaves; blades 20–30 cm long, 1.8–3.2 cm wide, lanceolate to ovate-lanceolate.

Primary branches usually 50+ cm, basally erect and distally arcuate, terete, with 3–4 compressed basal internodes, basal nodes developing secondary branches, lower elongated internodes terete in cross section. Foliage leaves: abaxial ligules fimbriate to lacerate, sometimes ciliate; blades 7–23 cm long, 1–2 cm wide, coriaceous, persistent, evergreen, bases rounded, abaxial surfaces densely pubescent or glabrous, strongly cross veined, adaxial surfaces pubescent. Spikelets 3–5 cm, with 6–12 florets, the first occasionally sterile. Glumes unequal, glabrous or pubescent; lowest glume obtuse to acuminate or absent; lemmas 1.2–2 cm, glabrous or nearly so. Caryopses oblong, beaked, a rudimentary hooked style branch present below the beak. $2n =$ unknown.

Arundinaria tecta grows in swampy woods, moist pine barrens, live oak woods, and along the sandy margins of streams, preferring moister sites than *A. gigantea*. It grows only on the coastal plain of the southeastern United States.

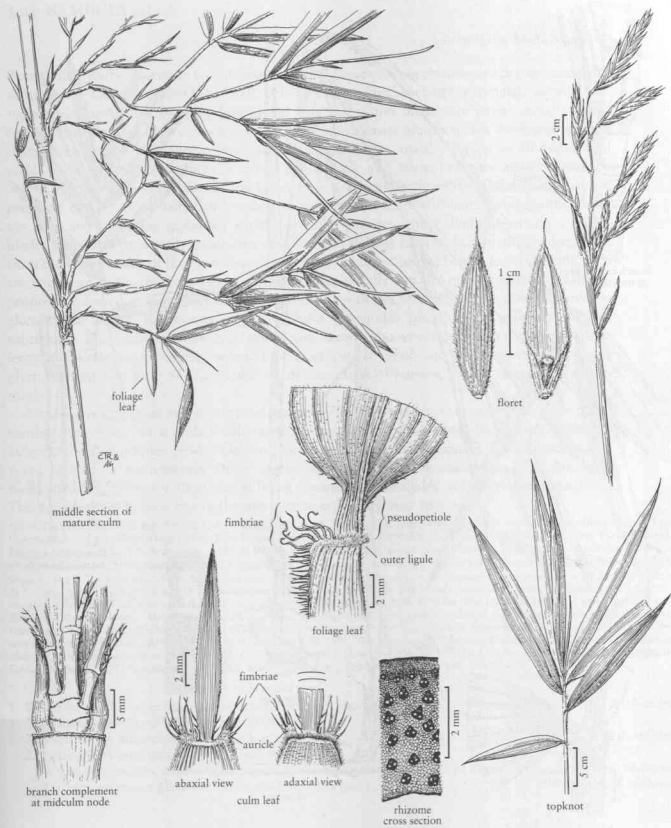
3. *Arundinaria appalachiana* Triplett, Weakley & L.G. Clark [p. 20]
HILL CANE

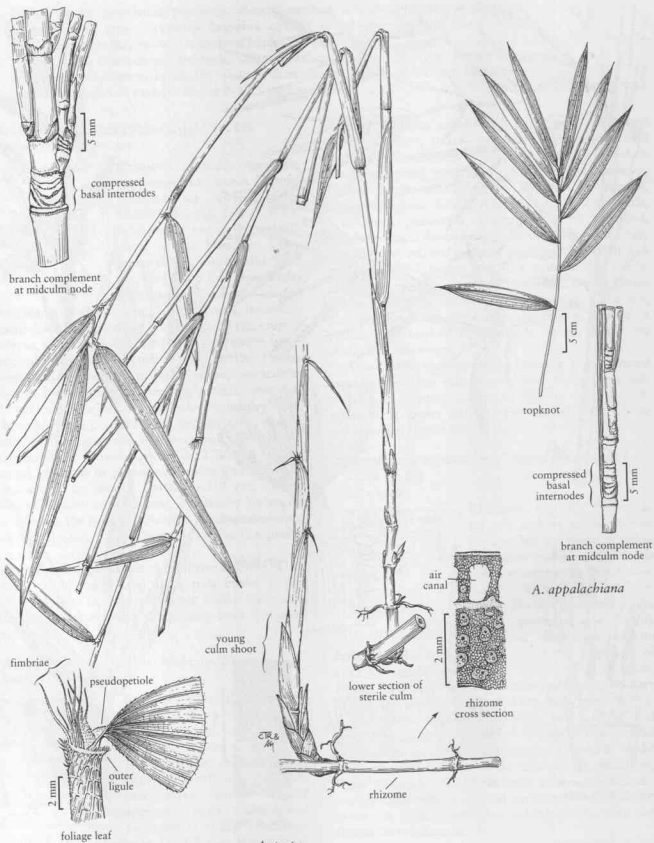


Rhizomes normally horizontal for only a short distance before turning up to form a culm, sometimes hollow-centered, air canals sometimes present. Culms 0.5–1 (1.8) m tall, 0.2–0.6 cm thick; internodes terete. Culm leaves persistent to tardily deciduous; sheaths 5.5–11 cm;

fimbriae 1–4.6 mm; blades 0.8–1.4 cm. Topknots of 6–12 leaves; blades 9–22.5 cm long, 1.4–2.8 cm wide, linear, linear-lanceolate, or ovate-lanceolate. Primary branches usually shorter than 35 cm, erect, terete, with 2–5 compressed basal internodes, basal nodes not developing secondary branches. Foliage leaves: abaxial ligules glabrous or ciliate, fimbriate or lacerate; blades 5–20 cm long, 0.8–2 cm wide, chartaceous, deciduous, bases rounded, abaxial surfaces pilose or glabrous, weakly cross veined, adaxial surfaces pilose. Spikelets 3–5.5 cm, usually somewhat reddish purple, with 5–8 florets. $2n =$ unknown.

Arundinaria appalachiana grows on moist to dry slopes and in seeps. It is restricted to the southern Appalachians and upper piedmont.

*A. gigantea*



ARUNDINARIA

2.02 *BAMBUA* Schreb.

Christopher M.A. Stapleton

Plants usually arborescent, in well defined or rather loose clumps; **rhizomes** pachymorphic, with short necks. **Culms** 0.5–30(35) m tall, 0.5–18(20) cm thick; woody, perennial, usually self-supporting; **nodes** not swollen; **supranodal ridges** obscure; **internodes** terete, usually thinly covered initially with light-colored wax. **Branch complements** usually with a dominant primary central branch and 2 smaller co-dominant lateral branches, usually similar at all nodes; **bud scales** 2-keeled, thickened, initially closed at the back and front; **branches** all subtended by bracts, higher order branchlets at the lower nodes sometimes thornlike. **Culm leaves** usually promptly deciduous, initially lightly waxy, sometimes with short, stiff hairs, subsequently losing the wax and becoming glabrous; **auricles** usually well developed; **fimbriae** usually present; **blades** triangular to broadly triangular, usually erect. **Foliage leaves:** **sheaths** usually deciduous from the lower nodes of the branches, persistent at the distal nodes; **blades** to 30 cm long, to 6 cm wide, not distinctly cross veined. **Inflorescences** usually spicate, rarely capitate, bracteate; **prophylls** 2-keeled, narrow. **Pseudospikelets** 1–5 cm, with 3–12 florets; **disarticulation** above the glumes and below the florets, rapid; **rachilla internodes** usually long. **Glumes** several, subtending the buds; **lemmas** narrowly ovate, acute, unawned; **paleas** not exceeding the lemmas, 2-keeled, not winged; **anthers** 6; **ovaries** usually suboblong; **styles** short, with (2)3–4 plumose branches. $2n = 56-72$. Name a Latinized form of *bambu*, a local name of Malayan origin.

Bambusa is a tropical and subtropical genus of 75–100+ species. It is native to southern and southeastern Asia, but is widely cultivated and naturalized throughout the tropics. *Bambusa vulgaris* and *B. multiplex* grow widely in Florida and Texas, having spread to some extent after being planted as ornamentals. Other species are known only in cultivation. The American Bamboo Society lists over 40 species as being commercially available in North America in 2005. This treatment includes a few of the more commonly cultivated species.

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1. Branchlets of the lower branches recurved, hardened, thornlike 1. *B. bambos*
1. Branchlets of the lower branches not thornlike.
 2. Culm sheath auricles well developed, to 5 cm long 2. *B. vulgaris*
 2. Culm sheath auricles absent or poorly developed.
 3. Culm internodes antorsely hispid; culms 0.5–7 m tall, broadly arched above 3. *B. multiplex*
 3. Culm internodes glabrous; culms 6–15 m tall, erect 4. *B. oldhamii*

1. *Bambusa bambos* (L.) Voss [not illustrated]

GIANT THORNY BAMBOO

Plants densely clumped, with intertwined thorny branches. Culms to 20(35) m tall, 12–18 cm thick, thick-walled, sometimes almost solid; internodes 20–40 cm, green, waxy at first, becoming dull. Branches forming at the basal and upper nodes, central branches slightly dominant, branchlets of the lower branches recurved, hardened and thornlike. Culm leaves dark green, initially sparsely hairy, sometimes more densely hairy on the margins and auricles, hairs dark brown, deciduous; auricles subequal, wrinkled, wide; fimbriae absent; ligules to 2 mm, ciliate; blades erect or reflexed, merging into the auricles, adaxial surfaces densely brown-velvety. Foliage leaves: sheaths glabrous; ligules short, entire; auricles small; fimbriae few, erect; blades 6–22 cm long, 1–3 cm wide, glabrous. Inflorescences initially spicate, becoming dense globular clusters. Pseudospikelets 10–30 mm, with 3–7 florets. Lemmas 7–8 mm, glabrous; anthers to 5 mm. $2n = 70-72$.

Bambusa bambos is native to India and Indochina, but is cultivated throughout the tropics. It was the first bamboo species to be given a scientific name, being described as treelike, thorny, and a source of tabashir, lumps of pure silica that form in the internodal cavities. *Bambusa arundinacea* (Retz.) Willd. is a synonym of *B. bambos* that still appears in some listings of bamboos.

2. *Bambusa vulgaris* Schrad. ex J.C. Wendl.

[not illustrated]

COMMON BAMBOO

Plants forming moderately loose clumps, without thorny branches. Culms 10–20 m tall, 4–10 cm thick, erect, sinuous or slightly flexuous; nodes slightly inflated, flaring at the pubescent sheath scar; internodes 20–45 cm, glossy green, yellow, yellow with green stripes, or green with yellowish green stripes, all similar or the basal internodes swollen and shorter than those above. Branches developing from the midculm nodes and above, occasionally also at the lower nodes, several to many branches per node, branchlets of the lower branches not thornlike. Culm leaves promptly deciduous, with dense, appressed, brown pubescence, lower sheaths broader than long, apices broader than the base of the blades; auricles well developed, to 5 cm long and 1.5 cm wide, equal, ovoid to falcate-spreading, dark; fimbriae to 15 mm, dense, wavy, light; blades 4–5 cm long, 5–6 cm wide, appressed to the culm, usually persistent, triangular, abaxial surfaces glabrous, adaxial surfaces densely dark pubescent towards the base, basal margins ciliate or with stiff hairs; ligules about 3 mm, shortly ciliate. Foliage leaves: sheaths glabrous to sparsely hispidulous; ligules 0.5–1.5 mm, glabrous, truncate, entire; auricles 0.5–1.5 mm, falcate, hardened,

persistent; fimbriae few, 0.5–1.5 mm, spreading; blades 6–30 cm long, 1–4 cm wide, glabrous, abruptly acuminate. Pseudospikelets 12–35 mm, with 5–10 florets, always strongly grooved along the center, appearing 2-cleft. $2n = 64$.

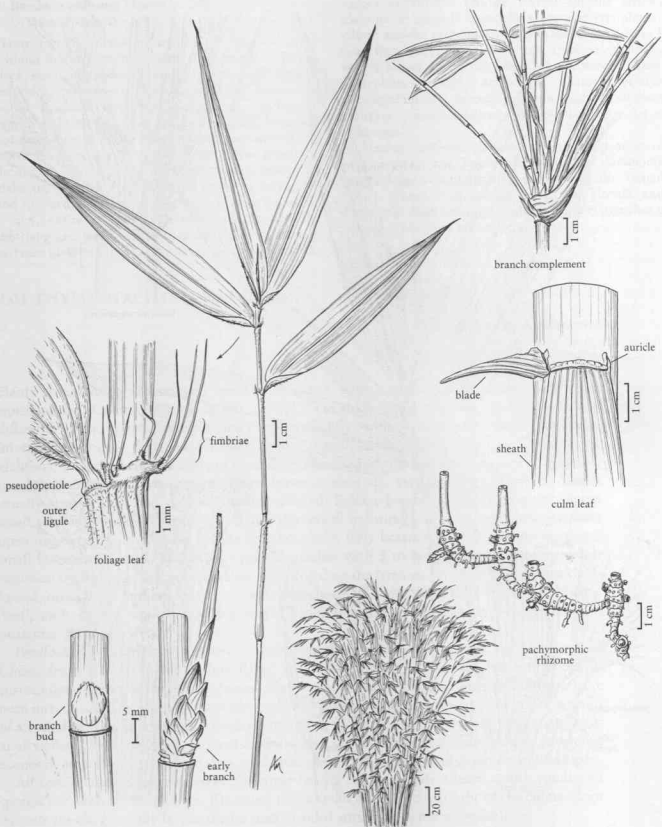
Bambusa vulgaris probably originated in tropical Asia. It is now the most widely cultivated tropical bamboo, largely because of the ease with which the branches and culm sections take root. Many different cultivars exist, including forms with variously green and yellow-striped culms which are sometimes placed in distinct varieties or even species. 'Wamin' is a cultivated form with ventricose to very short, concertina-like internodes. Like *B. tuldoidea* 'Buddha's-Belly', plants of *B. vulgaris* 'Wamin' can develop abbreviated internodes when grown in pots or under extreme environmental conditions; they readily return to normal growth when these conditions are ameliorated.

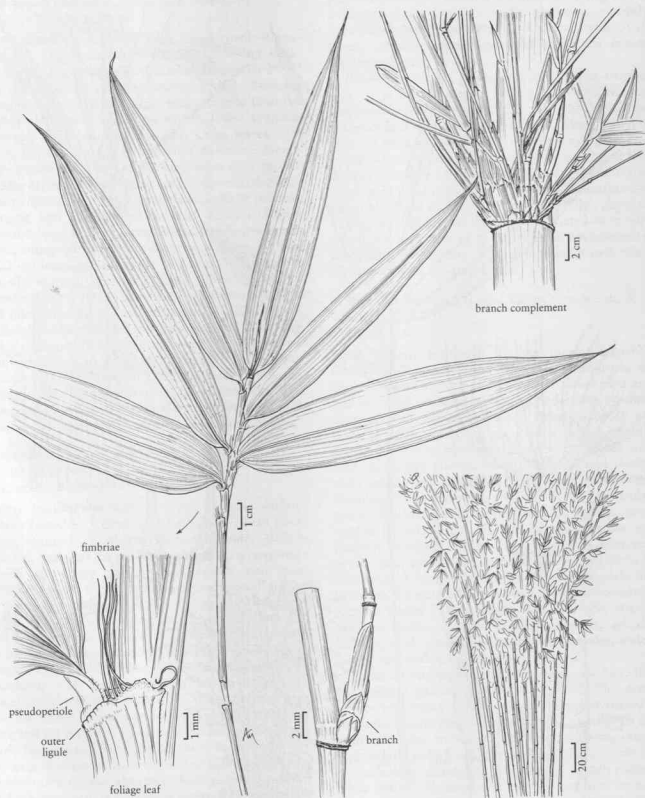
3. *Bambusa multiplex* (Lour.) Raeusch. ex Schult. & Schult. f. [p. 23]

HEDGE BAMBOO

Plants densely clumping, without thorny branches. Culms 0.5–7 m tall, 1–2.5 cm thick, emerging at an angle, broadly arching above, usually thin-walled and hollow, solid in some cultivars; nodes not swollen; internodes all similar, 3–60 cm. Branches to 20 per node, erect to spreading, the central branch slightly dominant, often becoming densely congested and forming tangled clusters of rhizomes, aborted shoots, and stunted roots, branchlets of the lower branches not thornlike. Culm leaves 12–15 cm, narrowly triangular, tardily deciduous, initially light green, becoming reddish brown to stramineous, glabrous; auricles and fimbriae developed; blades 1–2 cm, initially appressed to the culm, initially antrorsely hispid on both surfaces, becoming glabrous. Foliage leaves: sheaths glabrous; ligules to 0.5 mm; auricles absent; fimbriae sometimes present; blades 7–15 cm long, 1–2 cm wide, abaxial surfaces glaucous and slightly pubescent, adaxial surfaces dark green and glabrous. Pseudospikelets 30–40 mm, with up to 10 florets. $2n = 72$.

Bambusa multiplex is native to southeast Asia. It is now widely planted around the world. The dense foliage with many leaves on each branchlet makes it well suited to hedging. A large number of cultivars are available, some with striped culms and leaves, others with greatly reduced stature and leaf size suitable for bonsai culture or hedging. The tangled branch clusters allow natural dispersal and easy propagation in hot, humid climates. Plants listed as *B. glaucescens* (Willd.) Sieb. ex Munro in North America probably belong to *B. multiplex*.

*B. multiplex*



BAMBUSA

B. oldhamii

4. *Bambusa oldhamii* Munro [p. 24]

OLDHAM'S BAMBOO

Plants forming dense to moderately loose clumps, without thorny branches. Culms 6–15 m tall, 3–13 cm thick, erect; internodes all similar, hollow, walls about 1 cm thick, pale green, glabrous, glaucous below the nodes. Branches very short, not thorny, the central branch at each node often tardily developed, branches not developing from the lower nodes, branchlets of the lower branches not thornlike. Culm leaves promptly deciduous, oblong, initially brown-sericeous, becoming glabrous, rounded distally; auricles absent or very small and rounded; fimbriae few, to 3 mm, curved; ligules to 2 mm, entire or finely serrulate; blades broadly subtriangular, usually with concave margins, abaxial surfaces glabrous, adaxial surfaces antrorsely hispid,

apices acuminate. Foliage leaves: sheaths striate, glabrous or sparsely hispidulous, margins very shortly ciliate; auricles very small, rounded; fimbriae many, to 5 mm, fine, wavy; ligules to 1 mm, truncate, glabrous, entire; blades 15–30 cm long, 3–6 cm wide, oblong-lanceolate, abruptly acuminate, abaxial surfaces pubescent initially, becoming glabrous, adaxial surfaces glabrous. Pseudospikelets with 6–10 florets. $2n =$ unknown.

Bambusa oldhamii is native to low-lying areas of eastern China and Taiwan. It is the most commonly grown large, clump-forming bamboo in the United States, where it is grown mostly in Florida and California. With its upright culms and short branches it makes an excellent tall hedge.

2.03 PHYLLOSTACHYS Siebold & Zucc.

Christopher M.A. Stapleton

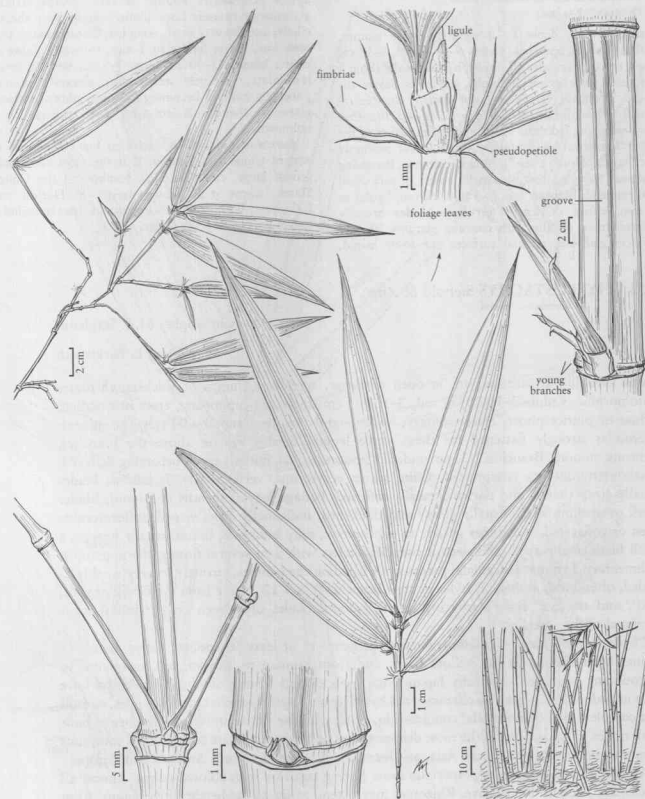
Mary E. Barkworth

Plants shrublike to arborescent, in open or dense, spreading clumps or thickets; rhizomes leptomorphic. Culms 3–10(20) m tall, 3–10(15) cm thick, self-supporting, erect or nodding, diffuse or pluricespitose, rarely solitary; nodes slightly swollen; supranodal ridge prominent; internodes strongly flattened for their whole length, doubly sulcate above the branches, glabrous, smooth. Branches 2(3) per midculm node, unequal, initially erect, becoming deflexed, basal internodes not compressed. Culm leaves coriaceous, very quickly deciduous; blades usually strap-shaped and narrow, usually reflexed. Foliage leaves: sheaths deciduous; blades small to medium-sized, usually glossy and thickened, indistinctly cross veined. Inflorescences open or congested, sometimes spicate to subcapitate, fully bracteate, bracts usually bearing a small blade at the apex. Spikelets or pseudospikelets with 2 to several florets, the uppermost rudimentary. Lemmas lanceolate; paleas not exceeding the lemmas, strongly to very weakly 2-keeled, often bifid; anthers 3; styles or style branches 3. $x = 12$. Name from the Greek *phyllos*, 'leaf', and *stachys*, 'spike', referring to the reduced blades often seen on persistent bracts proximal to the spikelets.

Phyllostachys is a hardy, temperate, Asiatic genus of at least 50 species, native mainly to China, from Hainan to the Yellow River, and from Yunnan to Taiwan, but introduced to surrounding countries, especially Japan. Many species and a large number of cultivars have been introduced. The genus is characterized by the two unequal branches at most nodes, a result of a complete lack of internodal compression, along with the almost universal presence of buds at all nodes. *Phyllostachys* is the most distinct genus of hardy temperate bamboos, of enormous economic importance in eastern Asia, and increasingly valued in North America and Europe.

All species are ornamental, especially those having cultivars with colored culms. Almost all species are likely to be invasive. Rhizomes may extend as far as the height of the culms. Root barriers should generally be installed if uncontrolled spreading is not acceptable.

SELECTED REFERENCES McClure, F.A. 1957. Bamboos of the Genus *Phyllostachys* Under Cultivation in the United States. U.S. Department of Agriculture, Agricultural Research Service, Agriculture Handbook No. 114. U.S. Government Printing Office, Washington, D.C., U.S.A. 69 pp.; Wang, C.-P., Z.-H. Yu, and G.-H. Ye. 1980. A taxonomical study of *Phyllostachys* in China [parts 1 & 2]. Acta Phytotax. Sin. 18:15–19, 168–193.

*P. bambusoides*

PHYLLOSTACHYS

1. Neither auricles nor fimbriae present on any culm leaves 1. *P. aurea*
 1. Auricles present on the upper culm leaves; fimbriae present on all culm leaves 2. *P. bambusoides*

1. *Phyllostachys aurea* Carrière ex Rivière & C.
 Rivière [not illustrated]

FISHPOLE BAMBOO, GOLDEN BAMBOO

Culms to 10 m tall, 1–4 cm thick, straight; **internodes** glabrous, initially green, becoming gray, glaucous soon after sheath-fall, some culms in every clump with 1 to several short internodes; **nodal ridges** moderately prominent; **sheath scars** not flared, fringed with short, persistent, white hairs. **Culm leaves:** sheaths with a basal line of minute white hairs, otherwise glabrous, pale olive-green to rosy-buff, with a sparse scattering of small brown spots and wine-colored or pale green veins, not glaucous; **auricles** and **fimbriae** absent; **ligules** short, slightly rounded, ciliate; **blades** lanceolate, somewhat crinkled below, upper blades pendulous. **Foliage leaves:** **auricles** and **fimbriae** well developed or lacking; **ligules** very short, glabrous or sparsely ciliate; **blades** 4–15 cm long, 5–23 mm wide. $2n = 48$.

Phyllostachys aurea is native to China, but it is widely cultivated in temperate and subtropical regions. In North America, it grows as far north as Vancouver, British Columbia, in the west and Buffalo, New York, in the east. The young shoots are very palatable, even when raw, but the mature culms are very hard when dried. They are sometimes used for fishpoles. This species differs from other species of *Phyllostachys*, including those with brighter yellow culms, in having a raised collar below the nodes and irregularly compressed basal culm nodes.

2. *Phyllostachys bambusoides* Siebold & Zucc. [p. 26]

GIANT TIMBER BAMBOO, MADAKE

Culms to 22 m tall and 15 cm thick, erect or leaning towards the light, base sinuous in some cultivars; **internodes** glabrous, usually green, in cultivars golden yellow, or with yellow and green stripes, lustrous; **nodal ridges** usually prominent (scarcely discernible in 'Crookstem' forms); **sheath scars** thin, not strongly flared, glabrous. **Culm leaves:** sheaths glabrous or pubescent, greenish to ruddy-buff, more or less densely dark-brown-spotted; **auricles** absent from the basal sheaths, narrow to broadly ovate or falcate on the upper sheaths; **fimbriae** greenish, crinkled; **ligules** rounded and ciliate to truncate and ciliate with coarse hairs; **blades** short, lanceolate, reflexed and crinkled on the lower leaves, those above longer and recurved, green or variously striped. **Foliage leaves:** **auricles** and **fimbriae** usually well developed; **ligules** well developed; **blades** to 20 cm long and 3.2 cm wide, usually puberulent to subglabrous. $2n = 48$.

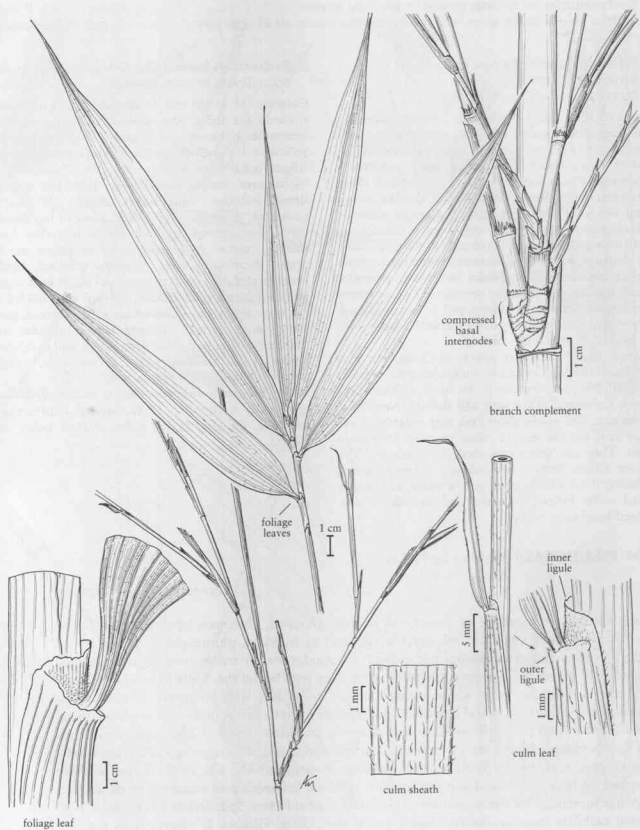
Phyllostachys bambusoides, a widely cultivated species, is hardy to -17°C . Several cultivars are available, differing in the color of their culms and leaves.

2.04 PSEUDOSASA Makino ex Nakai

Christopher M.A. Stapleton

Plants shrublike, spreading or loosely to densely clumped; **rhizomes** leptomorphic. **Culms** 0.5–13 m tall, to 4 cm thick, self-supporting, erect or nodding, pluricepitate; **nodes** not or slightly swollen; **supranodal ridge** not evident; **internodes** mainly terete, only slightly flattened immediately above the branches, glabrous, with light wax below the nodes. **Branches** initially 1–3, erect to arcuate, often short, central branch dominant, with compressed basal nodes, branches fully sheathed, lateral branches arising either from the basal nodes or from more distal nodes, sheaths and prophylls more or less glabrous, persistent, tough. **Culm leaves** coriaceous and very persistent; **blades** erect or reflexed, narrowly triangular to strap-shaped. **Foliage leaves:** sheaths persistent; **blades** cross veined, medium to large for the size of the culm, without marginal necrosis in winter, their arrangement random. **Inflorescences** racemose or panicleate; **branches** subtended by much reduced or quite substantial bracts. **Spikelets** 2–20 cm, with 3–30 florets; **rachillas** sinuous; **disarticulation** below the florets. **Glumes** 2, shorter than the first lemma; **lemmas** to 1 cm; **anthers** 3; **styles** 3; **paleas** 2-keeled. Named for the similar, but 6-anthered genus *Sasa* Makino & Shibata, in which it had been included.

Pseudosasa includes about 36 species, all of which are native to China, Japan, and Korea.

*P. japonica*

PSEUDOSASA

1. *Pseudosasa japonica* (Siebold & Zucc. ex Steud.)

Makino ex Nakai [p. 28]

JAPANESE ARROW BAMBOO, METAKE, YADAKE

Culms 1–3(5) m tall, to 1.5 cm thick, erect or nodding, finely ridged; **nodes** slightly raised; **sheath** scar large; **internodes** long, finely mottled, with a light ring of wax below the nodes. **Culm sheaths** to 25 cm, basally glabrous, distally appressed-hispid, persistent; **auricles** and **fimbriae** absent; **blades** 2–5 cm, erect, abaxial surfaces glabrous. **Branches** usually 1 per node, with no basal buds or branches, sometimes rebranching from more distal nodes. **Foliage leaves:** **sheaths** glabrous, edges membranous; **auricles** absent or small and erect; **fimbriae** absent or scarce, erect; **ligules** long, oblique, crose, slightly pubescent, abaxial ligules glabrous to finely ciliate; **blades** 15–35 cm long, 1.5–5 cm wide,

glabrous or abaxial surfaces sporadically shortly red-brown tomentose, light green to glaucous, adaxial surfaces dark green, glossy, glabrous. **Spikelets** 3.5–10 cm, narrowly cylindrical, curved, with 5–20(25) florets. **Lemmas** 1.2–1.5 cm, glabrous, often mucronate, mucros about 2 mm; **paleas** nearly equaling the lemmas, glabrous, keels finely ciliate.

Pseudosasa japonica is a widely cultivated ornamental species that used to be grown for arrows in Japan. There are no known wild populations. It forms a tough and effective screen, and has become naturalized in British Columbia and the eastern United States. A shorter cultivar with partially ventricose culms, 'Tsumiana', and cultivars with variegated leaves are also available.

3. OLYREAE Kunth

Mary E. Barkworth

Plants usually perennial; caespitose, stoloniferous. **Culms** perennial, 3–350 cm or climbing, not woody; **nodes** often with 2 thick circumferential ridges, with more elastic tissue between; **branches** usually not developed at the middle and upper nodes. **Leaves** often crowded towards the culm tips; **abaxial ligules** absent; **adaxial ligules** membranous; **pseudopetioles** 1–2 mm, not twisted; **blades** usually persistent, usually folding at night or when stressed, venation parallel, cross venation sometimes evident, particularly at the base, the bases and apices often asymmetric. **Inflorescences** spicate or paniculate, usually produced at the middle and upper nodes of the leafy culms; **disarticulation** above or below the glumes. **Spikelets** unisexual and dimorphic, usually mixed within an inflorescence, with 1 floret. **Pistillate spikelets** on clavate pedicels; **glumes** usually exceeding the floret, many-veined; **lemmas** usually coriaceous to indurate, pale when immature, mottled with dark spots or uniformly dark when mature, glabrous or with non-uncinate hairs, unawned; **paleas** usually shorter than and enclosed by the lemmas; **lodicules** 3; **style branches** 2(3). **Caryopses** dry; **embryos** small relative to the caryopses; **hila** usually linear. **Staminate spikelets** deciduous; **glumes** usually lacking; **lemmas** membranous or hyaline; **lodicules** 3 or absent; **anthers** 3, 2, or multiples of 6. $x = 7, 9, 10, 11$.

The *Olyrae* is primarily a New World tribe that extends from Mexico to Argentina and southern Brazil. It includes about 20 genera and 110 species. One species has been found in tropical Africa and Sri Lanka; it is not clear whether it is native or introduced to those regions. One species is sold as an ornamental in the United States. It is included here as a representative of this fascinating group of grasses.

SELECTED REFERENCE Judziewicz, E.J., L.G. Clark, X. Londoño, and M.J. Stern. 1999. *American Bamboos*. Smithsonian Institution Press, Washington, D.C., U.S.A. 392 pp.