CHAPTER

5

The *Flora of China* Bambusoideae Project – problems and current understanding of bamboo taxonomy in China

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CONTENTS

Abstract
The *Flora of China* Project was initiated to revise the *Flora Reipublicae Popularis Sinicae* and to provide an English edition for it. This paper highlights some problem areas in producing the bamboo account. Special attention has been paid to the generic delimitation of the subtribes Arundinariinae, especially the *Thamnocalamus* group, and the Bambusinae. Morphological characters used in defining bamboo genera, i.e. inflorescence types, spikelets structure, ovary and fruit, underground systems, branching and culm foliage, are reviewed based on current understanding. A key is provided to recognize genera of bamboos in the *Flora*.

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INTRODUCTION

As the most diverse flora in the north temperate zone, the flora of China is among the richest in the world. There are about 30 000 species of vascular plants or one-eighth of the world's plant diversity in China. Several efforts were made in writing Chinese floras during the first half of this century, but all very incomplete. The *Flora Reipublicae Popularis Sinicae* (FRPS) project was initiated in 1959 and three volumes were published by 1966. This work was completely stopped by the Cultural Revolution until 1973. Some 75 out of 120 books in 80 volumes have been published up to now. The whole project is due to finish by the year 2000. This, when completed, will be the first comprehensive flora of China. Unfortunately, it is not readily accessible for foreign botanists because of the language barrier. Revision is needed as much type material housed outside China has not been easily available to the FRPS authors. A new, English-language and updated *Flora of China* (FoC) was started in 1988 to meet these requirements, and to provide a forum for international collaboration among Western and Chinese botanists. Co-ordinated through a series of editorial centres in China, USA and UK, the 25-volume work was planned to be completed within 15 years.

China is very rich in bamboo resources. As an important constituent of the *Flora*, bamboo is one of the most important plants to humans. Chinese civilization has had a close relationship with bamboos since ancient times. It is still important both culturally and economically in China (Lu, 1992), playing a major role in the daily life of villagers throughout the southern part of the country. In contrast, the taxonomy of bamboos, or the science of documenting bamboo diversity, is one of the most difficult fields. One reason is that the classification of flowering plants depends largely on the characteristics of their reproductive organs, but flowering is rare in most bamboo species. Some species flower at intervals of as long as 120 years. In addition, information on underground parts, branching and culm sheaths is also important to understand the differentiation of bamboos (Soderstrom & Young, 1983), and earlier herbarium collections of bamboos were mostly incomplete. All this has made bamboo taxonomy a puzzle for a long time.

European botanical discoveries in China can be dated back to the early 18th century, but the main ones were those in the second half of 19th century and early this century. The collections of H.F. Hance, M. Berezovski, E. Faber, P. Farges, A. Henry, E.H. Wilson, F. Handel-Mazzettii, W.P. Fang and F. Kingdon-Ward resulted in many new discovery of bamboos. Linnaeus (1753) himself named a bamboo species, *Arundo bambos*, which is now interpreted as *Bambusa bambos*. This bamboo is of Indian origin but with a long history of cultivation in China. *Arundo multiplex* (now *Bambusa multiplex*) was the first Chinese species of bamboo described in modern taxonomy, by Loureiro (1790) based on material from Vietnam. Ruprecht (1839) published the first bamboo monograph and included 67 species. This was followed by Munro's (1868) world-wide treatment of bamboos, which remains a classic of bamboo taxonomy, with 22 species of five genera of bamboos recorded from China. Further work includes that of Gamble (1897); his monograph primarily dealt with bamboos of Burma, India, Malaysia and Nepal and is another classic in taxonomy of bamboos in Asia. There were also several direct contributions on Chinese bamboos, such as Franchet (1893), Rendle's (1904) treatment of 44 bamboo species in seven genera, and Handel-Mazzettii's (1936) preliminary flora. Valuable data are also contained in treatments of bamboos of Assam by Bor (1938) and of those of the Malay Peninsula by Holttum (1958). McClure (1897–1970), a distinguished American bamboo taxonomist, spend 22 years at the Lingnan University in Canton (now Guangzhou) studying the bamboos of China, especially those of Guangdong and Guangxi areas. Along with

many of his publications on bamboos, McClure described 97 species of Chinese bamboos (Chao & Tang, 1993).

Earlier books on bamboos in Chinese history can be traced back to the Jing Dynasty (265–316 AD). During that time Dai Kai-Zhi wrote *Zhu Pu*, a treatise of bamboos, in which 61 species of bamboos were described (of which 34 species or varieties remain today). Modern taxonomy was not used for bamboos in China until the 1930s. Y.L. Keng was the Chinese botanist who made the earliest effort to classify Chinese bamboo in terms of modern taxonomy. He and his son, P.C. Keng (K.H. Keng), described many new bamboos and provided a preliminary key and enumeration of Chinese bamboos (e.g. Keng, 1948; Keng, 1957). An attempt was made at writing a bamboo Flora of China (Keng, 1959), in which 69 species of Chinese bamboo in 20 genera were described, with some illustrated. Since the 1950s, more extensive explorations and collections have been made by botanists in many botanical and forest research institutions and universities throughout China. If it had not been severely interrupted by the Cultural Revolution, the greatest expansion would have taken place earlier than the late 1970s. After 5 years of editorial processing, the volume for Bambusoideae of the FRPS was sent to press in 1992 and is due to be published soon.

PROBLEMATIC AREAS IN BAMBOO TAXONOMY IN CHINA

The revision of the bamboo account for the Flora is difficult at both the generic and specific levels. Generic delimitation in Bambusoideae is a universal problem, but is particularly difficult in Chinese examples. The estimated of the number of bamboo genera in the world ranges from 49 (Clayton & Renvoize, 1986) or 59 (Soderstrom & Ellis, 1987) to 77 (Dransfield & Widjaja, 1995). The estimated number of Chinese genera varies between 22 and 51, and the FRPS includes 37 (Table 1), along with seven new genera (Table 2) and one newly recorded genus since 1988. At the specific level, some 479 new species have been published (figures from Chao & Tang, 1993, updated) since 1976, together with 199 species published between 1753 and 1975, and 515 species were recognized in the FRPS (Table 1). The number of described bamboo species reached 683 by the end of 1995. One problem is that there is usually a piece of inflorescence on the type sheet of older names, while the newly described species are mostly based on sterile material. Here I attempt to highlight some problematic areas, and to explain a working list of genera.

The subtribe Arundinariinae

This subtribe, as defined by Soderstrom & Ellis (1987) includes the genera placed under two tribes in FRPS (Keng, 1992), Chusqueeae and Arundinarieae. They all produce semelauctant inflorescence and may be grossly divided into two groups on the differentiation of rhizome types and leaf anatomy. The *Arundinaria* group produces leptomorph rhizomes, and includes *Arundinaria, Bashania, Ferrocalamus, Gelidocalamus, Indocalamus, Oligostachyum, Pleioblastus, Pseudosasa, Acidosasa, Metasasa* and *Sasa*. The *Thamnocalamus* group has pachymorph rhizomes and appears to have very large microhairs, and dumb-bell-shaped silica bodies although some lack fusoid cells (Wu, 1960, 1962; Soderstrom & Ellis, 1982, 1987). It comprises *Borinda, Fargesia, Monospatha, Sinarundinaria, Thamnocalamus* and *Yushania*, and is closely related to *Ampelocalamus, Chimonocalamus, Drepanostahyum, Himalayacalamus* and *Gaoligongshania*.

Table 1 Genera of bamboos accepted in the FRPS

Tribe	Genus	Type	No. of spp.*	Distribution
Melocanneae	*Melocanna* Trin.	*M. bambusoides*	1	cultivated
	Schizhostachyum Nees	*S. blumii*	8 (+ 1)	South China
	Pseudostachyum Munro	*P. polymorphum*	1	South China
	Cephalostachyum Munro	*C. capitatum*	4	Yunnan and Tibet
	Thyrsostachys Gamble	*C. oliveri*	2	Yunnan
	Melocalamus Benth	*M. bambusoides*	2	Yunnan and Tibet
Bambuseae	*Neomicrocalamus* Keng f.	*N. prainii*	2	Yunnan and Tibet
	Bambusa (incl. *Lingnania* McClure)	*B. arundinacea*	60 (+ 1)	South China
Dendrocalameae	*Neosinocalamus* Keng f.	*N. affinis*	1	endemic
	Dendrocalamopsis Keng f.	*D. oldhamii*	8 (+ 2)	South China
	Dendrocalamus Nees	*D. strictus*	28	South China
	Gigantochloa Kurz ex Munro	*G. atter*	5	Yunnan
Shibataeeae	*Indosasa* McClure	*I. crassiflora*	15 (+ 3)	South China
	Sinobambusa Makino ex Nakai	*S. tootsii*	17	South China
	Brachystachyum Keng	*B. densiflorum*	1	endemic
	Phyllostachys Sieb. & Zucc.	*P. bambusoides*	52 (+ 2)	South-east and South China
	Shibataea	*S. kumasasa*	8	East China
	Semiarundinaria Makino	*S. fastuosa*	1	cultivated
	Chimonobambusa Makino	*C. marmorea*	18 (+ 6)	West China to Taiwan
	Qiongzhuea C.J. Hsueh & T.P. Yi	*Q. tumidissinoda*	4	South-west China
Chusqueeae	*Chimonocalamus* C.J. Hsueh & T.P. Yi	*C. delicatus*	9	Yunnan and Tibet
	Drepanostachyum Keng f.	*D. falcatum*	7	South-west China and Taiwan
Arundinarieae	*Fargesia* Franchet	*F. spathacea*	73 (+ 2)	South-west and East China
	Yushania Keng f.	*Y. niitakayamensis*	51	West China to Taiwan
	Thamnocalamus Munro	*T. spathiflorus*	1	Tibet
	Ampelocalamus S.L. Chen *et al.*	*A. actinotrichus*	2	Hainan and Guizhou
	Acidosasa C.D. Chu & C.S. Chao	*A. chinensis*	7	South China
	Oligostachyum Z.P. Wang & G.H. Ye	*O. sulcatum*	13	South China
	Pleioblastus Nakai	*P. communis*	20	South China
	Bashania Keng f. & T.P. Yi	*B. fargesii*	3	West China
	Gelidocalamus T.H. Wen	*G. stellatus*	9	endemic
	Pseudosasa Makino	*P. japonica*	33	East China
	Metasasa W.T. Lin	*M. carinata*	2	South-east China
	Sasa Mak. & Shib.	*S. veitchii*	10	East China
	Ferrocalamus C.J. Hsueh & Keng f.	*F. strictus*	1	endemic
	Indocalamus Nakai	*F. sinicus*	22	South-east and South China
Total	37 genera		503 (+ 17)	

* Numbers in parentheses indicate doubtful species or uncertain generic designation.

Table 2 New genera or new recorded genus of bamboos since 1988

Genus	Type	No. spp.	Distribution
Borinda Stapleton (1994)	*B. macclureana*	4	Tibet
Gaoligongshania D.Z. Li *et al.* (1995)	*G. megalothyrsa*	1	Yunnan
Himalayacalamus Keng f. (1983)	*H. falconeri*	1	Tibet (Stapleton, 1994)
Menstruocalamus T.P. Yi (1992)	*M. sichuanensis*	1	Sichuan
Monospatha W.T. Lin (1994)	*M. triloba*	1	Hunan
Patellocalamus W.T. Lin (1989)	*P. patellaris*	1	Yunnan
Polyanthus C.H. Hu (1991)	*P. longispiculatus*	1	Hunan
Sellulocalamus W.T. Lin (1989)	*S. bambusoides*	2	Yunnan

The Thamnocalamus group and allies

This is a group of bamboos found in the mountainous areas in China and the adjacent Himalayas, with some species in Africa, Sri Lanka, India and eastwards to the islands of Taiwan and the Philippines. Many of them are hardy with good horticultural prospects in Europe and America. The classification of this group is highly controversial. Soderstrom (1979a, b) was the first to propose merging *Fargesia* into *Thamnocalamus*. When transferring the African *Bergbambos* into *Thamnocalamus*, he clearly recognized two genera, *Thamnocalamus*, with bracteate racemiform inflorescence and *Sinarundinaria*, with open panicle (Soderstrom & Ellis, 1982). Chao *et al.* (1980) reached a similar conclusion, treating *Fargesia* as a synonym of *Thamnocalamus*, and *Yushania* as a synonym of *Sinarundinaria*. This was followed by Clayton & Renvoize (1986), Hsueh & Li (1987) and Chao & Renvoize (1989). Another totally different opinion was held by Wang & Ye (1980), who accepted *Fargesia* and *Yushania* as genera, and proposed treating *Sinarundinaria* as a synonym of *Fargesia*. This was supported by Keng (1983a) and by Yi (1985). Yi (1988) amended *Fargesia* greatly, putting species without enlarged spathe-like structures and bracteate inflorescences in it, mainly on the basis of shorter rhizome necks (shorter than 20 cm). *Fargesia* was enlarged to accommodate some 73 species, many of which are sterile (Yi, 1988), becoming the largest bamboo genus in China. The two opinions are summarized in Table 3.

One of the key questions is the status of *Sinarundinaria*. The type species of *Sinarundinaria, S. nitida* (Mitford) Nakai (*Arundinaria nitida* Mitford), has a confused history. This name was first proposed in an editorial review of Mitford's (1895) lecture, where there is no description but a statement (by the editor) that the name *A. khasiana* had been misapplied to the species, and that a corresponding description could be found in a paper by Bean (1894). No original material is likely to have been preserved, but the species described was that commonly called 'fountain bamboo'. Five months later, Stapf

Table 3 Two approaches in classifying *Thamnocalamus* group

Authors	Chao et al. (1980)	Wang & Ye (1980), amended by Yi (1988)
Genus 1	*Thamnocalamus* Munro (1868) including *Fargesia* Franch. (1893) 1. Rhizome sympodial 2. Inflorescence subtended by 1 – several enlarged spathes 3. Spikelets shortly stocked 4. Culm sheaths deciduous	*Thamnocalamus* Munro (1868) 1. Rhizome sympodial 2. Inflorescence panicle, comprising racemes each subtended by a spathe
Genus 2	*Sinarundinaria* Nakai (1935) including *Yushania* Keng f. (1957) 1. Rhizome sympodial, necks long or short 2. Inflorescence an open terminal panicle or raceme 3. Culm sheaths persistent	*Fargesia* Franch. (1893) including *Sinarundinaria* Nakai (1935) 1. Rhizome sympodial; necks shorter than 20 cm 2. Inflorescence, terminal, subtended by several enlarged or not enlarged spathes
Genus 3	None	*Yushania* Keng f. (1957) 1. Rhizome sympodial, necks longer than 20 cm 2. Inflorescence always not subtended by enlarged spathes

(1896) provided a detailed description of *Arundinaria nitida* and cited two specimens for it, both preserved: *Potanin s.n.* (K), sterile but obviously representing the fountain bamboo, and *Henry 6832* (K). Stapf described characters of the inflorescence and so based his description essentially on the second, fertile element. This was also what Nakai (1935) had in mind when describing his new genus *Sinarundinaria* and choosing *Arundinaria nitida* rather than *A. murielae* as the type. Additional evidence may be obtained from his citation of two drawings of *Arundinaria nitida* from Camus (1913), one with a spikelet and the other bearing details of the spikelet. The generic name is now in widespread use in this sense (McClure, 1957, 1966; Keng, 1959; Chao *et al.* 1980; Soderstrom & Ellis, 1982; Clayton & Renvoize, 1986; Hsueh & Li, 1987; Chao & Renvoize, 1989; Yang & Chao, 1993).

In fact, the two specimens cited by Stapf represent two different species, although they could hardly be distinguished by their vegetative features as both of them bear neither rhizomes nor culm sheaths. McClure (1940) realized this and renamed the Henry collection as *Indocalamus confusus*, accepting *Arundinaria nitida* was based on the Potanin collection. As he later keyed out *Sinarundinaria* by open inflorescence, presumably he thought the two would turn out to have the same inflorescence type (McClure, 1966, p. 290). The fountain bamboo has been cultivated in Britain since 1889. It was originated from seed allegedly collected by Potanin in North Sichuan (but perhaps in fact by Berezowski in South Gausu) and sent from St Petersburg (Mitford, 1896). This, when it first flowered in Britain in 1993 (Renvoize, 1993), proved to be florally similar to and perhaps conspecific with *Fargesia* (or *Thamnocalamus*) *spathacea*, which provides the type of *Fargesia* Franchet (Stapleton, 1995), rather than having an open inflorescence.

At this point, it is necessary to conserve the genus *Sinarundinaria* Nakai with a conserved type as proposed (Li, 1996), to clarify nomenclature for the *Thamnocalamus* group. *Sinarundinaria* may be treated synonymously with *Fargesia*, or if a broad taxonomic opinion is adopted, with *Thamnocalamus*. The first problem is that some 50 species presently assigned to *Sinarundinaria* will have to be transferred to *Yushania* Keng f. (1957), or to other genera. Further, as many as 70 species published under *Fargesia*, if they do not produce spathe-subtended inflorescences, will be affected, as discussed by Ohrnberger (1988), Campbell (1991) and McClintock (1992). These species will be distributed among *Thamnocalamus* Munro (1868) (e.g. Campbell, 1991), *Fargesia* Franchet (1893) (e.g. Li & Fu, 1994), *Yushania* Keng f., *Burmabambus* Keng f. (1982a, b), *Butania* Keng f. (1982a, b), *Borinda* Stapleton (1994b) and *Monospatha* W.T. Lin (1994), or even in a 'very broad' *Arundinaria* Michaux, as Soderstrom & Ellis (1988) suggested. One solution is to put these species into a newly described genus, *Borinda* (Stapleton, 1994b), typified by *B. macclureana*, with clear vegetative and floral status. However, the nomenclature problem of this group would not be satisfactorily resolved by doing so. Firstly, Keng's *Burmabambus* is typified by the poorly known Burmese species *Arundinaria elegans* Gamble (1897), which produces open non-bracteate inflorescences. According to Gamble (1897, p. 6), it is a 'tufted' bamboo, implying shorter rhizome necks. If so, it may be similar to *Borinda*. Secondly, although *B. macclureana* was first put in *Fargesia* (Stapleton, 1993), the delimitation between *Borinda* and *Yushania* is not always clear in south-west China where there are many more species in between them. The length of rhizome necks is variable, as observed in the field.

Soderstrom & Ellis (1987) recognized *Ampelocalamus*, *Chimonocalamus* and *Drepanostachyum* although they were all included in a broad interpretation of *Sinarundinaria* (Chao & Renvoize, 1989). *Ampelocalamus* and *Drepanostachyum* differ from *Sinarundinaria* in having a more drooping inflorescence with larger spikelets on more delicate pedicels, with stronger fasciculation of falcate inflorescence branches.

Vegetatively, *Ampelocalamus* is a scrambling bamboo with a reiterative central branch which is able to replace the main culm, while *Drepanostachyum* bears fascicled subequal branchlets at nodes. Both *Ampelocalamus* and *Drepanostachyum* are found in subtropical habitats, while *Sinarundinaria* is found in cold temperate areas up to alpine treelines. *Himalayacalamus* was published as a monotypic genus by Keng (1983a), and was adopted by Stapleton (1994c). As suggested by Soderstrom & Ellis (1987), it merges better with *Drepanostachyum*, given their similar nature of inflorescence and branching. This was supported by Campbell (1991). *Chimonocalamus*, a genus similarly distributed in the higher elevations in the mountains, is somewhat intermediate between *Sinarundinaria* and *Chimonobambusa* of the Shibataeinae, bearing three branches at nodes with a ring of spiny roots. It bears the same inflorescence type as *Sinarundinaria*, but has a similar vegetative nature to *Chimonobambusa*.

The newly discovered *Gaoligongshania* in north-west Yunnan is of phylogenetic significance in elucidating the relationships between the *Indocalamus* and *Thamnocalamus* groups (Li *et al.*, 1995). The type species, *G. megalothyrsa*, is distinct in several morphological characters and in its epiphytic habit. Although it is similar to the *Arundinaria hirsuta* group in the sense of Campbell (1991), which includes some species placed in *Yushania* by Yi (1986), *Gaoligongshania* cannot be placed in *Sinarundinaria* or *Yushania* because of its solitary mid-culm branch which is as thick as the culm. The similarity with *Monocladus* is superficial as they bear different inflorescence types, semelauctant in *Gaoligongshania* and iterauctant in *Monocladus*. *Gaoligongshania* can be easily distinguished from *Indocalamus* by its pachymorph rhizomes, and three stigmas in the florets.

The Arundinaria group

This group is defined here to include the genera with semelauctant inflorescence, three or six stamens and leptomorph rhizomes. It includes most of Soderstrom & Ellis's (1987) Arundinariinae, except the *Thamnocalamus* group and *Chimonobambusa*. Like the *Thamnocalamus* group, it also has its centre of diversification in China, at both generic and specific levels. The placement of *Perrierbambos* of Madagascar in the Arundinariinae by Soderstrom & Ellis (1987) is questionable, and it is better treated in another subtribe, possibly the Nastinae (Stapleton, 1994d).

There has been debate on whether the genus *Arundinaria* is distributed in China and east Asia. This was being debated at the time of Nakai, who created several general like *Pleioblastus*, *Pseudosasa* and *Yadakeya* to accommodate the majority of *Arundinaria* species in east Asia (Nakai, 1925, 1935), but in fact Nakai (1935) kept Himalayan species like *Arundinaria racemosa* as it stands. However, *Arundinaria* was limited to its type from North America, and all Asian species described under *Arundinaria* were treated as in different genera (e.g. Keng, 1959; Suzuki, 1978; Keng, 1982a, b, c). However, the majority of bamboo taxonomists recognize the distribution of *Arundinaria* in east Asia Ohwi, 1965; McClure, 1973; Chao & Chu, 1979; Chao & Renvoize, 1989; Stapleton, 1994b; Yang & Chao, 1993).

The Chinese and east Asian species published under *Arundinaria* by earlier authors, e.g. Munro (1868), Gamble (1897), Rendle (1904) and Camus (1913), need to be viewed critically. Those with a bracteate inflorescence should be placed in genera of the subtribe Shibatainae, such as *Chimonobambusa, Semiarundinaria, Shibataea* and *Sinobambusa*, with a minor part of the Racemobambosinae (*Racemobambos* and allies). The rest, with semelauctant, non-bracteate inflorescence type, are members of genera in the Arundinariinae, such as *Acidosasa, Indocalamus* and *Sasa*, depending on various characters, such as rhizome, number of stamens and branching. However, there are still dozens

of species in east Asia with leptomorph rhizomes, several branches at mid-culm, semelauctant inflorescence and three stamens, and they should be kept in *Arundinaria* even in the strict sense on the basis of the above-mentioned morphological similarities with the type species, *A. gigantea*. One difficult species is now placed in *Oligostachyum* (Wang & Ye, 1982), which was not placed in an appropriate subtribe by Soderstrom & Ellis, but synonymized by Chao & Renvoize (1989).

The Subtribe Bambusinae

Very few botanists follow Munro's system (in Bentham, 1883) in placing *Dendrocalamus* and *Bambusa* in different subgroups, except Keng (1992), whose treatment will appear in the FRPS bamboo volume, and Dahlgren *et al.* (1985). Holttum (1956 a) first recognized the close relationship of the two genera by analysing ovaries, and subdividing them into four groups, one being called *Bambusa–Dendrocalamus* type. More evidence from culm anatomy (Grosser & Liese, 1973) and embryology (Gopal & Ram, 1985) supported this point of view. The consensus is that these two genera should be kept within the same subtribe, the Bambusinae (Clayton & Renvoize, 1986; Soderstrom & Ellis, 1987).

This is an Old World tropical subtribe with its centre of diversification in south-eastern Asia including China. Eight genera were accepted in the Chinese version, being placed in four tribes (see Table 1). Two additional genera were published later on by Lin (1989). Again, there are two different opinions in viewing these genera. This was originated from McClure's (1940) two new genera, *Sinocalamus* and *Lingnania*. When publishing *Sinocalamus*, McClure suggested the new genus bore florets with two or three lodicules. The type species *S. latiflorus* (Munro) McClure bears no lodicules in florets. Chia & Fung (1980) formalized McClure's own intention by treating *Sinocalamus* synonymously with *Dendrocalamus* and transferred the other species into *Dendrocalamus* and *Bambusa*, respectively. However, those holding a narrow generic concepts attempted to limit *Dendrocalamus* to Gamble's (1897) first section, and to adopt not only *Lingnania* and *Sinocalamus*, but two more genera, *Dendrocalamopsis* and *Neosinocalamus* (Keng, 1982a, 1983a, b).

Munro (1868) and Gamble (1897) separated *Dendrocalamus* from *Bambusa* on fruit characters. Additionally, McClure (1966) keyed out *Dendrocalamus* on the basis of very short and disarticulating rachilla of spikelets. However, as pointed out by Holttum (1956a) and by Soderstrom & Ellis (1987), it is not easy to distinguish species of *Bambusa* and *Dendrocalamus* as there are some intermediate species. *Sinocalamus affinis* is such species. The rachillas are articulating but do not break apart between the florets; this indicates it may be a further link between *Bambusa* and *Dendrocalamus* (Li & Hsueh, 1988). However, this species is vegetatively similar to species of *Lingnania*, now treated as a subgenus of *Bambusa* (Chia and Fung, 1980), and better treated in this subgenus on account of their floral and vegetative similarities.

Although a 'broad sense' of *Dendrocalamus* was eventually accepted in FRPS, two new segregate genera, *Sellulocalamus* and *Patellocalamus*, were published (Lin, 1989). The type of *Patellocalamus* was Gamble's *Dendrocalamus patellaris*, whose flower was proved to be that of *D. hamiltonii* (Stapleton, 1994c). It could be dangerous to publish a 'new genus' without checking specimens and merely basing it on an unbelievable 'phylogenetic tree' which was the subject of two or three changeable vegetative characters (Li, 1994).

Recent study shows that the newly published *Monocladus* is a synonym of the poorly

known *Bonia* (N.H. Xia, personal communication), both having a distinctive elongation of the rachilla between glumes and the first floret and solitary branches. Chia *et al.* (1988) put their *Monocladus* in tribe Melocanneae while Keng (1992) placed it in Shibateaeae. Because of its short style and caryopsis, it is more appropriate to place *Bonia* in the subtribe Bambusinae.

The Subtribe Shibataeinae

This is essentially a Sino-Japanese subtribe with eight or nine genera producing bracteate inflorescences at the point of branching. All genera in the Shibataeinae have leptomorph rhizomes. The inflorescence was usually interpreted as iterauctant (McClure, 1966; Soderstrom & Ellis, 1987) but occasionally as semelauctant (Stapleton, 1994c). Evidence of leaf anatomy indicated this was a homogeneous group, characterized by lack of adaxial ribs and well-developed abaxial papillae and pricks (Metcalfe, 1960; Wu, 1962; Calderón & Soderstrom, 1973; Soderstrom & Ellis, 1987). The absence of fusoid cells may also be typical, except in *Chimonobambusa*, which may be a link with the Arundinariinae. Both subtribes bear somatic chromosome number $2n = 48$. *Indosasa*, a genus with six stamens, should be placed in this subtribe on the floral structure, which is very similar to that of *Sinobambusa* (Wang & Ye, 1980; Chao & Chu, 1983).

Vegetatively some genera in this subtribe are very similar to one another, even to the *Arundinaria* group of the subtribe Arundinariinae, as defined above. Those constituting the main problem are the species with three mid-culm branches, e.g. those of *Indosasa, Sinobambusa, Acidosasa* and *Arundinaria*. This is not just a superficial similarity, but has phylogenetic background, as discussed by Keng (1986). Revision of this subtribe should be extremely careful, as the same species may be described as different species in two genera. A good example is *Oligostachyum sulcatum* Wang & Ye (1982); based on flowering material, it was republished as a 'new species', *Sinobambusa parvifolia* by Wen & Chen 5 years later (Chao & Tang, 1993).

Because of such difficulties, some new bamboo species were published with two 'types', one vegetative, the other fertile. This is virtually against the Code (Greuter *et al.* 1994) and would therefore cause invalidity of the new species. In the case of the type species of a new genus, this may be a serious problem, e.g. the nomenclature problems of *Qiongzhuea*. This is a genus named after its type species, *Q. tumidissinoda*, or *qiong zhu* (*chiong tsu*) in Chinese. It was a famous bamboo in history, and is loved by many gardeners for its curious nodes. The first herbarium specimen of *qiong zhu* was gathered in 1942 and had only flowering branches. After comprehensive collection and study, *Qiongzhuea tumidinoda* was eventually published (Hsueh & Yi, 1980), with both the generic and specific names newly created and with *Q. tumidinoda* designated as the type of the genus. Unfortunately, two specimens, one with flowers and fruits and the other a vegetative specimen, were cited as types of the species in view of the difficulty of bamboo taxonomy. The result is that the specific name is not validly published under the provisions of the Code. The problem is exacerbated by the fact that *Q. tumidinoda* is designated as the type of the genus. Since *Q. tumidinoda* is not valid and has no status, it cannot accordingly provide the type of the genus. Therefore, *Qiongzhuea* shares its fate and by default of indication of its type, was not validly published although widespread. Conservation of names is impossible as no valid names are available. Recently, this matter was uncovered and the genus was finally validated (Hsueh *et al.* 1996).

The 'climbing bamboos'

This is not a taxonomic designation, but a conventional term for bamboos with climbing habits. There are large amounts of herbarium material, mostly sterile, of such bamboos in China, especially from the bamboo-rich province of Yunnan. This is another very difficult area in bamboo classification.

A dozen tropical and subtropical bamboo genera include climbing species, ranging from the Arundinariinae (e.g. *Ampelocalamus*) to the Bambusinae (e.g. *Bambusa* and *Dendrocalamus*), while the majority of these species are in the Melocanninae and the Racemobambosinae. It is not easy to find an appropriate genus to name such species in the vegetative state, and this made identification of these species virtually impossible because the time to flowering is so long. Many species of climbing bamboos remain unnamed in southern China because of unavailability of fertile material. If these are published with sterile material, their status cannot be confirmed until flowering. That is the reason why some genera or species are not included in the Flora. Three species of *Dinochloa* were published from Hainan (McClure, 1940), one *Neohouzuea* from Guangxi and Hainan (Wen, 1991), and one *Racemobambos* from Yunnan (Wen, 1986). These are all based on sterile specimens and remain uncertain.

CHARACTERS FOR DEFINING GENERIC BOUNDARIES

The morphological characters of bamboo are not clearly understood. The following attempts to explain further criteria in defining a working list of genera and their relationships based on current understanding.

Inflorescence type

Using inflorescence type to define genera was first suggested by McClure (1934). Based on his study of the inflorescences of Chinese species of *Schizostachyum*, he proposed the term 'pseudospikelet'. McClure (1966) further developed his idea on the different types of inflorescences, based on the two different type of spikelets (spikelets vs pseudospikelets) by creating another two terms, semelauctant and iterauctant, or determinate and indeterminate inflorescence. McClure's concept was widely accepted. Keng (1982 a,b,c,) proposed a system of bamboo classification, including two supertribes, in his concept of Bambusoideae (the woody bamboos), one with semelauctant and the other with iterauctant inflorescences. Although recent study shows that both semelauctant and iterauctant inflorescences may occur in most subtribes (Soderstrom & Ellis, 1987), it is accepted that different types of inflorescence are good criteria in defining bamboo genera.

In spite of that, it is not always easy to determine inflorescence types in some bamboos. The first example is the *Racemobambos* group. When publishing the genus, Holttum (1956b) stated that this genus was allied to *Bambusa*, because of the same ovary type. The inflorescence of *Racemobambos* was interpreted as semelauctant by Dransfield (1983, 1992), but as iterauctant by Chao & Renvoize (1989). The point is that in the inflorescence of *Racemobambos* each spikelet is subtended by tiny bracts. In an allied species originally called *Arundinaria prainii*, the bracts are well developed, and it was sometimes treated in its own genus, *Neomicrocalamus* Keng f. (1983b). Keng

himself first described the inflorescence of *N. prainii* as semelauctant, but later as iterauctant (in Wen, 1986). Dransfield (1992) holds the same view that in *Neomicrocalamus* it is iterauctant, while Stapleton (1994c) regarded it as semelauctant. The other group is usually treated in a separate subtribe, Shibataeinae (Soderstrom & Ellis, 1987; Keng, 1992), including *Phyllostachys, Semiarundinaria, Sinobambusa, Shibataea, Chimonobambusa* and *Indosasa*, all with bracteate inflorescence. It is easy to determine axillary buds in the bracts during the developing stages, like those in *P. nidularia* (McClure, 1966, p. 99), but not so easy in herbarium specimens. Soderstrom & Ellis (1987, p. 237) followed McClure (1966) who pointed out that inflorescences of *Phyllostachys* were iterauctant, but they placed *Chimonobambusa* in subtribe Arundinariinae, in which all other genera have semelauctant inflorescences. Stapleton (1994c) recognized the close relationship between *Chimonobambusa* and *Phyllostachys*, thus correctly treating both of them in Shibataeinae, but he described the inflorescence as 'semelauctant' (Stapleton, 1994c, p. 327). Other authorities treated it as 'weakly iterauctant' (Clayton & Renvoize, 1986, p. 48). In my opinion, these bracts imply an intermediate state between the two types of inflorescence. Evidence from leaf anatomy, chromosome numbers and ovary structure support a close relationship between the Shibataeinae and the Arundinariinae, although they produce different types of inflorescence. Further study is needed to elucidate this relationship between them, as there are many species which are superficially similar to one another at vegetative state, in *Acidosasa* and *Arundinaria* of the Arundinariinae and *Indosasa* and *Sinobambusa* of the Shibataeinae. Wang & Ye (1980) pointed out that similarities between *Indosasa shibateoides* and *Sinobambusa* might link the two inflorescence types. Keng (1986) supported this idea although he still weighted this character with great importance in his classification system (Keng, 1992).

Spikelet structure

As members of the grass family, the bamboos reduce their flowers into 'florets' as part of a spikelet. The spikelet proper is a basic unit of a bamboo flower. There is no proper perianth in the floret, being substituted by lodicules. The origin of lodicules and other bracts (lemma and palea) is not clear. It is widely accepted that it is a monochlamydeous flower and the lodicules form a perianth. This is largely on the basis of comparative morphology. However, the 'pseudospikelets' of *Streptochaeta*, as interpreted by Soderstrom (1981), suggest it is reduced with a single terminal achlamydeous flower. The presence or absence of lodicules is generally used as a generic character, as in *Melocalamus* vs *Dinochloa* and *Bambusa* vs *Dendrocalamus*. It is suggested that modification of stamens may give rise to irregular numbers of lodicules and intermediate structure as in *Schizostachyum* (Arber, 1934).

Many tropical bamboos have six stamens. *Arundinaria* and its close allies have three. The number of stamens may be the major difference between some bamboo genera, e.g. *Sinobambusa* vs *Indosasa*, *Indocalamus* vs *Sasa* and *Arundinaria* vs *Acidosasa*. It is reported that in *Oligostachyum* there are usually three of four stamens, lying between *Arundinaria* and *Acidosasa* (Wang & Ye, 1982). This may be the reason why Soderstrom & Ellis (1987) did not place it properly in their subtribe divisions. Generally speaking, other detailed structures, such as state of the uppermost floret, presence or absence of rachilla extension, shape of uppermost palea, and number of stigmas, may also be considered as generic characters, but these characters should be used more critically.

Ovary and fruit structure

The fruit is among the most poorly known structures of the bamboos. Typical grass fruit or caryopsis can be found in species of the Arundinariinae, which have a short appendage, except those of *Ferrocalamus*, whose fruit is berry-like (Keng & Hsueh, 1982). The subtribe Bambusinae usually has fruit with a conspicuous appendage (persistent style) which is a growth of the pericarp at the tip of the ovary soon after fertilization. The pear-like fruit of *Melocanna* has attracted the attention of many botanists (e.g. Stapf, 1904; McClure, 1966). However, it is suggested that fleshy fruit may be derived independently in several subtribes (Soderstrom & Ellis, 1987).

Holttum (1956a) drew attention to the anatomy of ovary structure. His work is of fundamental importance in bamboo classification. This was the beginning of the revision of the traditional Bentham–Munro system. Early support was received from culm anatomy (Grosser & Liese, 1971, 1973). A marked change at the generic level was the delimitation of *Oxynanthera*. Holttum restricted the genus to its only African member (the type of the genus), *O. abbyssinica*, having a hollow style (ovary appendage) which is unlike that found in Asiatic species of that genus, all of which Holttum reassigned to *Dendrocalamus* or *Gigantochloa*.

Underground systems

Riviere & Riviere (1879) may have been the first to publish a clear distinction between 'two basic forms' assumed by the bamboo rhizome. They noticed that the growth of *Gigantochloa* and of *Phyllostachys* were of different types, one leading to caespitose habit, the other to spreading habit. In spite of the fact that he sometimes gave descriptions and excellent illustrations of rhizomes (underground part) of some species, Gamble (1897) did not pay attention to the underground part of bamboos. McClure (1925) proposed the terms sympodial and monopodial to describe the growth habit of the underground part of bamboos, corresponding to Riviere & Riviere's terms 'caespitose' and 'spreading'. This was followed and modified by Japanese and Chinese botanists, notably by Nakai (1935) and Keng (1948), the latter creating a new term 'amphipodial'. McClure (1966, 1973) redefined them as pachymorph and leptomorph and used them extensively in his revision of bamboo genera of the New World. The terms sympodial, amphipodial and monopodial were used in reference to the manner of the origin of culms rather than the habit of the associated 'rhizomes', although they have been widely used in describing the underground system (the rhizomes) (Holttum, 1958; Keng, 1959; Clayton and Renvoize, 1986; Soderstrom & Ellis, 1987; Chao, 1989).

It is not always easy to distinguish the two basic forms since those with pachymorph or sympodial rhizomes sometimes produce a very developed culm neck, up to several metres long in some species, which gives rise to culms not tufted at all and like those with monopodial or leptomorph rhizomes. The leptomorph rhizomes produce buds and roots at each node while the long-necked pachymorph ones, or McClure's (1966, p. 29) metamorph I, do not. Regardless of the terms, sympodial vs monopodial, or pachymorph vs leptomorph, there is a fundamental difference between them. The intermediate type, amphipodial, should be regarded as a subform of the monophodial or leptomorph rhizomes. It was suggested that the condition in *Chusquea fendleri* and the amphipodial condition of *Arundinaria* and *Indocalamus* are not quite the same ('tiller' in the latter genera) (Wong, 1986). In my opinion, there is no fundamental difference between the 'culm base' of *Arundinaria* and the rhizome proper in McClure's (1966) sense. The answer may be simple: those with sympodial or pachymorph 'rhizomes' are in fact different from the

underground stems of leptomorph 'rhizomes'. With or without running underground stem is a very distinctive character of bamboo plants. Every bamboo genus has a particular type of underground system. It is generally accepted that the exception is *Chusquea* of the New World. The underground system of this genus is still poorly understood. The species with both pachymorph and leptomorph rhizomes, like *C. fendleri*, illustrated in McClure's (1966, p. 33) book, in my own opinion, has in fact true rhizomes. Such species are very different from those with sympodial 'rhizome', e.g. *Chusquea culeou* and *C. quila*.

Buds and branching

No attention was paid to either the underground system or the branching in distinguishing bamboo genera until Nakai (1925). Several segregate genera were identified or validated by Nakai, primarily based on vegetative difference such as rhizomes and branching. Among them, *Indocalamus, Pseudosasa* and *Pleioblastus* were distinguished from *Arundinaria* mainly by the different branching, although later studies do not support the distinction of *Pleioblastus* (Chao & Chu, 1980; Soderstrom & Ellis, 1987). Later detailed study demonstrated the use of branching in separating bamboos in the New World (McClure, 1966, 1973). Chao *et al.* (1980) revised some Asian bamboo genera by their branching. Famous examples of this are *Phyllostachys* and *Sasa* with a fixed number of branches at each culm node, while usually only the mid-culm branch complement can be used since in most bamboos the branching at the uppermost culm nodes is not very distinctive.

Efforts have been made to explore the taxonomic value of prophylls of mid-culm buds, and the inflorescence buds and variation in prophyll structure may be taxonomically useful at the species level (McClure, 1966; Stapleton, 1991, 1994a). A larger number of genera should be examined before this is used as a generic character.

Culm foliage

The unusually developed branching and fast growth make bamboos unique in the plant kingdom. During this development, the culm foliage has become specialized as protection rather than a photosynthetic organ. It is widely accepted that culm foliage is of great taxonomic importance in bamboos. According to Holttum (1958), Kurz was the first to describe and illustrate the culm foliage (culm sheath) for diagnostic purposes. Gamble (1897) comprehensively used it as a specific feature in his descriptions. Nakai (1925) used it in his generic diagnosis. In a given species of bamboo, the characters of mid-culm sheaths are constant and may be used as a tool to distinguish species, and even genera. *Chimonobambusa* and *Qiongzhuea* are among those in which the blades of culm sheaths are reduced to needle-like points.

CONSPECTUS OF BAMBUSOIDEAE IN CHINA

Subfamily Bambusoideae Ascherson & Graebner, Syn. Mittleleurop. *Fl.* 2: 769. 1902.
Supertribe Bambusodae Keng & Keng f. ex L. Liou in *Acta Phytotax. Sin.* 18: 323. 1980.
Tribe Bambuseae Nees, *Agrost. Bras.* 520. 1829.
Subtribe *Bambusinae* Agardh, Aphor., g. 153. 1823.: *Bambusa, Thyrsostachys, Dendrocalamus, Gigantochloa, Melocalamus, Bonia.*

Subtribe *Melocanninae* Reichenbach, *Deutsch. Fl.* 6: 6. 1846.: *Schizostachyum, Leptocanna, Cephalostachyum, Pseudostachyum, Melocanna.*

Subtribe *Racemobambosinae* Stapleton in *Edin. J. Bot.* 51: 323. 1994: *Racemobambos.*

Subtribe Arundinariinae Bentham in *J. Linn. Soc. Bot.* 19: 31. 1881.: *Sinarundinaria, Thamnocalamus, Drepanostachyum, Ampelocalamus, Chimonocalamus, Gaoligongshania, Acidosasa, Sasa, Oligostachyum, Arundinaria, Gelidocalamus, Ferrocalamus, Indocalamus.*

Subtribe *Shibateainae* (Nakai) Soderstrom & Ellis in *Grass. Syst. Evol.* 238. 1987: *Indosasa, Sinobambusa, Semiarundinaria, Chimonobambusa, Qiongzhuea, Shibataea, Phyllostachys*

KEY TO GENERA OF BAMBUSOIDEAE IN CHINA

1. Rhizome pachymorph, i.e. without running underground stems 2
   Rhizome leptomorph, i.e. with running underground stems 19
2. Inflorescence iterauctant, stamens 6 3
   Inflorescence semelauctant, stamens 3 14
3. Spikelets (1–) many flowered; ovary with conspicuous apical appendage 4
   Spikelets single-flowered; ovary appendage long, stiff, tapering 10
4. Culm necks short, culms unicaespitose 5
   Culm necks up to 1 m long, culms pluricaespitose . . . . . 12. *Racemobambos*
5. Mid-culm branches many at nodes, much smaller than culms 6
   Mid-culm branch 1 at nodes, as thick as culms . . . . . 6. *Bonia*
6. Fruit a caryopsis 7
   Fruit a fleshy berry . . . . . 5. *Melocalamus*
7. Palea shortly cleft 8
   Palea cleft to 1/3 of its length . . . . . 3. *Thyrsostachys*
8. Rhachilla internodes distinct and articulated; lodicules 3 . . . . . 1. *Bambusa*
   Rhachilla internodes obscure and disarticulated; lodicules absent 9
9. Palea of sole of uppermost floret rounded; filaments usually free 2. *Dendrocalamus*
   Palea of all florets double-keeled; filaments a tube . . . . . 4. *Gigantochloa*
10. Fruit a caryopsis 11
    Fruit a berry . . . . . 11. *Melocanna*
11. Culm necks short; culms unicaespitose 12
    Culm necks up to 3 m long; culms pluricaespitose . . . . . 10. *Pseudostachyum*
12. Glumes 2–3; lodicules 3 13
    Glume 0; lodicules 0; rhachilla internodes disarticulated . . . . . 7. *Schizostachyum*
13. Rhachilla internodes articulated; spikelets not in heads . . . . . 9. *Leptocanna*
    Rhachilla internodes disarticulated; spikelets in dense heads . . 8. *Cephalostachyum*
14. Mid-culm branch 1, as thick as culms . . . . . 18. *Gaoligongshania*
    Mid-culm branches 3 to very many, much smaller than culms 15
15. Inflorescence falcate, interrupted; spikelets delicate 16
    Inflorescence open or condensed; spikelets robust 17
16. Erect plant; branches subequal; culm sheath blades tiny . . . . 15. *Drepanostachyum*
    Scandent plant; main branches developed; culm sheath blades leafy, developed . . . . . 16. *Ampelocalamus*
17. Inflorescence condensed, subtended by 1–several spathes . . . . 14. *Thamnocalamus*

Inflorescence open, not subtended by bracts 18
18. Mid-culm branches 5–9, on promontory; nodes without thrones . . . . . 13. *Sinarundinaria*
Mid-culm branches 3, not on promontory; nodes with thrones . . . . . 17. *Chimonocalamus*
19. Inflorescence semelauctant, without bracts subtended 26
Inflorescence iterauctant, with well-developed bracts 20
20. Mid-culm branch 1; leaves large 21
Mid-culm branches 3–several; leaves small to medium 23
21. Stamens 6 . . . . . 20. *Sasa*
Stamens 3 22
22. Fruit a caryopsis . . . . . 25. *Indocalamus*
Fruit a berry . . . . . 24. *Ferrocalamus*
23. Stamens 6 . . . . . 19. *Acidosasa*
Stamens 3 24
24. Mid-culm branches 7–12, without secondary branching . . . . . 22. *Gelidocalamus*
Mid-culm branches 3–7, developed 25
25. Inflorescence a panicle; stamens 3; culm cylindrical . . . . . 21. *Arundinaria*
Inflorescence a raceme; stamens 3 (–4); culm flattened on one side . . . . . 23. *Oligostachyum*
26. Stamens 6 . . . . . 26. *Indosasa*
Stamens 3 27
27. Mid-culm branches 2 or many; culm flattened on one side 28
Mid-culm branches 3; culm cylindrical 29
28. Mid-culm branches 2, unequal; developed . . . . . 32. *Phyllostachys*
Mid-culm branches several; subequal; without secondary branching . . 31. *Shibataea*
29. Culm sheath blades reduced 30
Culm sheaths with developed blades 31
30. Inflorescence with small bracts; culm nodes with root thorns . . 29. *Chimonobambusa*
Inflorescence with a large bracts; culm nodes without root thorns . . 30. *Qiongzhuea*
31. Inflorescence with small bracts; spikelets cylindrical . . . . . 27. *Sinobambusa*
Inflorescence with leafy bracts; spikelets laterally compressed . . 28. *Semiarundinaria*

A SYNONYMIZED LIST OF GENERA OF BAMBUSOIDEAE IN CHINA

Acidosasa C.D. Chu & C.S. Chao ex Keng f. in *J. Bamboo Res.* 1(2): 31. 1982; Chu & Chao in *J. Nanjing Coll. Forest. Prod.* 1979: 142. 1979. Type: *A. chinensis* Chu & Chao ex Keng f. – *Metasasa* W.T. Lin in *Acta Phytotax. Sin.* 26: 144. 1988. Type: *M. carinata* Lin.

Ampelocalamus S.L. Chen, T.H. Wen & G.Y. Sheng in *Acta Phytotax. Sin.* 19: 332. 1981. Type: *A. actinotricha* (Merr. & Chun) Chen *et al.* – *Patellocalamus* W.T. Lin in *J.S. China Agric. Univ.* 10(2): 45. 1989. Type: *P. patellaris* (Gamble) W.T. Lin.

Arundinaria Michaux in *Fl. Bor. Am.* 1: 73. 1803. Type: *A. macrosperma* Michaux (= *A. gigantea*). – *Pleioblastus* Nakai in *J. Arn. Arb.* 6: 145. 1925. Type: *P. communis*. – *Bashania* Keng f. & Yi in *J. Bamboo Res.* 1: 171. 1982. Type: *B. fargesii* (Rendle) Keng f. & Yi. – *Omeiocalamus* Keng f. in *J. Bamboo Res.* 2: 20. 1983, sub *A. fangiana*, nom. nud. – *Clavinodum* T.H. Wen in *J. Bamboo Res.* 3: 23. 1984. Type: *C. oedogonatum*

(Wang & Ye) Wen. – *Polyanthus* C.H. Hu in *J. Bamboo Res.* 10(3): 28. 1991. Type: *P. longispiculatus* (Yang) Hu.

Bambusa Schreber, *Gen. Pl.* 1: 236. 1789, *nom. cons.* Type: *B. arundinacea* Retz. – *Leleba* Nakai in *J. Jap. Bot.* 9: 9. 1933. Type: *L. floribunda* (Buse) Nakai. – *Lingnania* McClure in *Lingnan Univ. Sci. Bull.* 9: 34. 1940. Type: *L. chungii* (McClure) McClure. – *Dendrocalamopsis* (Chia & Fung) Keng f. in *J. Bamboo Res.* 2: 11. 1983. Type: *D. oldhamii* (Munro) Keng f. – *Neosinocalamus* Keng f. in *J. Bamboo Res.* 2: 148. 1983. Type: *N. affinis* (Rendle) Keng f.

Bonia Balansa in *J. Bot. Paris* 4: 29. 1890. Type: *B. tonkinensis* Balansa. – *Monocladus* L.C. Chia, H.L. Fung & Y.L. Yang in *Acta Phytotax. Sin.* 26: 212. 1988. Type: *M. saxatilis* Chia *et al.*

Cephalostachyum Munro in *Trans. Linn. Soc. London* 26: 138. 1868. Type: *C. capitatum* Munro.

Chimonobambusa Makino in *Bot. Mag. Tokyo* 28: 153. 1914. Type: *C. marmorea* (Mitford) Mak. – *Oreobambos* Keng in *Sunyatsenia* 4: 146. 1940. Type: *O. szechuanensis* (Rendle) Keng.

Chimonocalamus Hsueh & Yi in *Acta Bot. Yunnan.* 1(2): 76. 1979. Type: *C. delicatus* Hsueh & Yi. – *Sinarundinaria* Sect. *Chimonocalamus* (Hsueh & Yi) Chao & Renvoize in *Kew Bull.* 44: 353. 1989.

Dendrocalamus Nees in *Linnaea* 9: 476. 1835. Type: *D. strictus* (Roxb.) Nees. – *Sellulocalamus* W.T. Lin in *J.S. China Agric. Univ.* 10(2): 43. 1989. Type: *S. bambusoides* (Hsueh & D.Z. Li) W.T. Lin. – *Patellocalamus* W.T. Lin in *J.S. China Agric. Univ.* 10(2): 45. 1989, p. p. Type: *P. patellaris* (Gamble) W.T. Lin, p. p.

Drepanostachyum Keng f. in *J. Bamboo Res.* 2(1): 15. 1983. Type: *D. falcatum* (Munro) Keng f. – *Himalayacalamus* Keng f. in *J. Bamboo Res.* 2(1): 23. 1983. Type: *H. falconeri* (Munro) Keng f.

Ferrocalamus Hsueh & Keng f. in *J. Bamboo Res.* 1(2): 3. 1982. Type: *F. strictus* Hsueh & Keng f.

Gaoligongshania D.Z. Li, Hsueh & N.H. Xia in *Acta Phytotax. Sin.* 33: 600. 1995. Type: *G. megalothyrsa* (Hand.-Mazz.) Li et al.

Gelidocalamus T.H. Wen in *J. Bamboo Res.* 1(1): 21. 1982. Type: *G. stellatus* Wen.

Gigantochloa Kurz ex Munro in *Trans. Linn. Soc. London* 26: 123. 1868. Type: *G. atter* Munro.

Indocalamus Nakai in *J. Arn. Arb.* 6: 148. 1925. Lectotype: *I. sinicus* (Hance) Nakai.

Indosasa McClure in *Lingnan Univ. Sci. Bull.* 9: 28. 1940. Type: *I. crassiflora* McClure.

Leptocanna Chia & Fung in *Acta Phytotax. Sin.* 19: 212. 1981. Type: *L. chinensis* (Rendle) Chia & Fung.

Melocalamus Benth. in Benth. & Hook., *Gen. Pl.* 3: 1212. 1883. Type: *M. compatiflorus* (Kurz) Benth.

Melocanna Trin. in Spreng., *Neue Ent.* 2: 43 (1820). Type: *M. bambusoides*.

Oligostachyum Z.P. Wang & G.H. Ye in *J. Nanjing Univ. Nat. Sci.* 1982: 95. 1982. Type: *O. sulcatum* Wang & Ye.

Phyllostachys Sieb. & Zucc. in *Abh. Math. Phys. Kon. Bayer. Akad.* 3: 745. 1843, *nom. cons.* Type: *P. bambusoides* Sieb. & Zucc.

Pseudostachyum Munro *Trans. Linn. Soc. London* 26: 141. 1868. Type: *P. polymorphum* Munro.

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