

THE BAMBOOS OF NEPAL AND BHUTAN
PART III: *Drepanostachyum*, *Himalayacalamus*,
Ampelocalamus*, *Neomicrocalamus* and *Chimonobambusa
(Gramineae: Poaceae, Bambusoideae)

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This paper completes the systematic treatment of the bamboos of Nepal and Bhutan, covering five genera from subtropical to lower temperate zones. Three further genera from the subtribe Arundinariinae Benthams are included: *Drepanostachyum* Keng f., *Himalayacalamus* Keng f., and *Ampelocalamus* Chen, Wen & Sheng. They have semelauctant ebracteate inflorescences, pachymorph rhizomes, and 3 stamens. *Neomicrocalamus* Keng f. has semelauctant bracteate inflorescences and 6 stamens, and is in the new subtribe described here, Racemobambosinae. *Chimonobambusa* Makino has bracteate inflorescences and 3 stamens and is the only Himalayan genus in the subtribe Shibataeinae (Nakai) Soderstrom & Ellis. A new *Drepanostachyum* species from Bhutan is described as *D. annulatum*. *Himalayacalamus*, which was originally described as a monotypic genus, is enlarged by the description of five new species, *H. asper*, *H. brevinodus*, *H. cupreus*, *H. fimbriatus*, and *H. porcatus*, all from Nepal. A Himalayan representative of the genus *Ampelocalamus*, *A. patellaris*, is transferred from *Dendrocalamus*. *Neomicrocalamus andropogonifolius* from eastern Bhutan is transferred from *Bambusa*.

STATUS AND SEPARATION OF THE GENERA

These genera have all been considered to be part of *Arundinaria* Michaux at one time. The type species of the genera *Drepanostachyum* Keng f., *Ampelocalamus* Chen, Wen & Sheng, *Neomicrocalamus* Keng f., and *Chimonobambusa* Makino were originally described as species of *Arundinaria* Michaux, while the type species of *Himalayacalamus* was initially described as a species of *Thamnocalamus* Munro, before being transferred into *Arundinaria*.

The genera *Drepanostachyum*, *Himalayacalamus*, *Ampelocalamus*, and *Neomicrocalamus* all have pachymorph rhizomes, rather than the leptomorph rhizomes found in *Arundinaria* and *Chimonobambusa*. They also have simple open semelauctant inflorescences, without the enclosing spathes seen in *Thamnocalamus* and *Fargesia* Franchet or the pulvini common in *Yushania* Keng f. Their subtropical to lower temperate habitats are indicated by the absence of tessellation in their leaf venation, which distinguishes them readily from the temperate genera *Arundinaria*, *Thamnocalamus*, *Yushania*, and *Borinda* Stapleton, which all have strongly developed tessellation. They also have much shorter buds, and a larger number of branch initials.

Drepanostachyum and *Himalayacalamus* are principally Himalayan genera. They are closely related to each other, both having large numbers of bud initials and branches, and inflorescences with strong fasciculation and delicate glumes. They can be distinguished, however, on floral, vegetative, and ecological characteristics.

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Drepanostachyum species are forest understorey plants of warm broad-leaved subtropical forest types such as *Schima-Castanopsis*, although a few species are also cultivated. They will not survive below about 500m, where absolute maximum temperatures rise to c.40°C. They are progressively replaced by species of *Himalayacalamus* above 1850m, as their leaves are damaged by winter temperatures below c.-5°C, and by the higher UV content of strong insolation at higher altitudes.

Himalayacalamus species occupy a different altitudinal range, 1850–2800m rather than 650–2100m. Their leaves have greater frost tolerance, withstanding temperatures to c.-10°C, and greater tolerance of strong UV light, but they show less drought tolerance. Their culms are larger than those of *Drepanostachyum* species, up to 3.5cm dbh (diameter at breast height) rather than 2.5cm.

Drepanostachyum species have open falcate panicles with a few reduced bracts at the points of branching, and fasciculation of the basal branches of the inflorescence, which is caused by compression of the basal internodes. In *Himalayacalamus* species the inflorescence is similar, but is variously reduced. Spikelets are reduced to a single fertile floret in most of the spikelets in each inflorescence, with a rudimentary floret on a long rhachilla extension, although occasional spikelets may have two fertile florets. Basal branches are usually absent and represented only by clusters of empty sheaths. Secondary branches are also usually absent, and the inflorescence is often reduced to a raceme. Pedicels can be very short. In this way the inflorescence appears quite similar to that of a species of *Thamnocalamus* or *Fargesia*, and this has caused confusion in the past. The presence of only one fertile floret is the most obvious characteristic of *Himalayacalamus* species, and this serves to distinguish the genus from known species of *Thamnocalamus* and *Fargesia*. This particular manifestation of reduction is also a clue to the real character of the whole inflorescence, despite superficial similarities to those of *Thamnocalamus* and *Fargesia*. *Himalayacalamus* inflorescences differ more fundamentally in the relative scarcity of bracts at points of branching within the inflorescence, and by the total absence of vestigial buds in the axils of the glumes. Both these characteristics suggest the relatively derived state of the *Himalayacalamus* inflorescence. In addition the glumes, like those of *Drepanostachyum* species, are more delicate than the tough glumes of *Thamnocalamus* and *Fargesia* species, and they disintegrate rapidly.

Drepanostachyum and *Himalayacalamus* can also be separated by their vegetative characteristics. The upper region of the culm sheath interior adjacent to the ligule is glabrous in all *Himalayacalamus* species, while it is more or less scabrous in all Himalayan *Drepanostachyum* species seen so far. In addition the number of mid-culm branches is lower in *Himalayacalamus*, up to 40 rather than 80, and there is greater disparity in branch size within each complement, with a more dominant central branch in *Himalayacalamus* species. Leaf sheath ligules are pubescent, and new shoots are often edible, lacking the bitter flavour found in shoots of *Drepanostachyum* species. In addition the increase in internode length at the base of the culm is more gradual in *Himalayacalamus*, and there is a greater tendency for nodes towards the base to have no buds or branches. The leaves are usually smaller, and as they are borne on fewer branches from larger, more upright culms, this leads to the clumps having a more graceful appearance than those of *Drepanostachyum* species. Hardier forms are well suited to

cultivation as ornamental plants in Europe, the USA, Japan, and New Zealand, in areas with high rainfall and light frosts.

Ampelocalamus and *Neomicrocalamus* are not so well known. They are both semi-scandent genera, usually found in wetter subtropical forest types than *Drepanostachyum* and *Himalayacalamus*. They have non-tessellate leaves and are not frost-hardy.

Ampelocalamus has pendulous drooping inflorescences with large spikelets on long, slender, scabrous pedicels, and advanced bud structure with reduction of sheathing and fusion of many sheaths, including those forming the closed two-keeled bud-scale. The type species is from Hainan Province and most species are found in south-western China.

Neomicrocalamus retains several primitive characteristics, including possession of 6 stamens and a complete complement of sheaths subtending vegetative branch axes, as well as mid-culm bud prophylls with 2 keels. *Neomicrocalamus* species are known from eastern Bhutan, north-eastern India, south-eastern Tibet, south-western China and northern Vietnam. The presence of 6 stamens in a bracteate but semelauctant inflorescence, in conjunction with pachymorph rhizomes, distinguishes this genus from those of the subtribes Bambusinae and Arundinariinae, and the new subtribe Racemobambosinae is described to accommodate this and other tropical and subtropical genera that share these characteristics. This subtribe illustrates an important stage in the transition of the ancestral pseudospikelet prophyll inserted at the point of branching and subtending a viable bud, into the lower glume of the derived pedicellate spikelet, inserted away from the point of branching on an extended promontory, without a bud. Holttum (1958) assumed that complete loss of the prophyll occurred during development of derived grass panicles from ancestral bamboo 'spikelet tufts'. However, although progressive reduction in other sheaths is very common, no reduced prophylls or vestigial hair rings have ever been seen on the bamboo pedicel. Clayton & Renvoize (1986) envisaged incorporation of a vegetative prophyll into reduced ancestral determinate spikelets to give derived iterauctant bamboo pseudospikelets, but the iterauctant pseudospikelet is often assumed to be ancestral instead (Soderstrom & Ellis, 1988).

Chimonobambusa is the sole Himalayan representative of the subtribe Shibataeinae. This is the predominant subtribe in eastern China and Japan and includes the genus *Phyllostachys*, which has no indigenous Himalayan representative.

SYSTEMATIC TREATMENT

The numbering of genera continues from Part II (Stapleton, 1994). All specimens cited are at K unless otherwise indicated.

11. *Drepanostachyum* Keng f., J. Bamboo Res. 2(1): 15 (1983).

Type species: *Drepanostachyum falcatum* (Munro) Keng f.

Frost-tender bamboos from subtropical to lower temperate zones. Clumps unicaespitose, rhizomes pachymorph with necks less than 25cm long. Inflorescence semelauctant, in an open interrupted panicle, with frequent fasciculation and no pulvini, branches falcate, usually

subtended by rings of hairs or reduced sheaths. Spikelets predominantly with two or more fertile florets. Prophylls on the branches represented by the lower glumes of pedicellate spikelets, the glumes delicate and never subtending vestigial buds. Mid-culm branch buds with narrow single-keeled prophylls, the front of all culm buds open, with lateral branches not subtended by sheaths. Leaf veins not tessellated. Culm sheath interior scabrous below the ligule.

SPECIES ENCOUNTERED IN NEPAL AND BHUTAN

Drepanostachyum species are mainly found in subtropical forests. With the exception of *D. intermedium*, most species are not widely cultivated or harvested, and are not of great economic importance. They occupy a large but discontinuous and fragmented habitat, repeatedly interrupted by hot dry valleys and temperate ridges where they cannot survive. There is substantial variation within the known species, and it would appear that several undescribed taxa are also present, but the inadequacy of collected material prevents a thorough treatment of this difficult genus at this stage. Chao & Renvoize (1989) included collections from Pakistan to Darjeeling as well as Meghalaya and Tamil Nadu in a very broad interpretation of the type species, which they enumerated as *Sinarundinaria falcata* (Nees) Chao & Renvoize. A provisional treatment of the genus is given here, mainly following vegetative characteristics, in which four species are recognized, each species having a geographically restricted distribution. Further collections of fertile material are necessary, especially from the areas of India in which the type collections of *D. falcatum* (Nees) Keng f. and *D. khasianum* (Munro) Keng f. were made, before the status and the distribution of several taxa can be determined.

Around Pokhara (W Nepal) a species with very long leaf sheath ligules, similar to those of *D. falcatum* from north-western India, is cultivated. *D. polystachyum* (Gamble) R.B. Majumdar from Sikkim and Khasia also has long ligules, but it has pubescent or scabrous leaves and more florets. The syntypes of *D. polystachyum* from Meghalaya and Sikkim are quite different, and this species is still not properly lectotypified. The bamboo from West Nepal is included in *D. falcatum* here as it has glabrous leaves, but its flowers are not known.

In East Nepal *D. intermedium* is widely cultivated, and it is also frequent in the remaining natural warm broad-leaved forest. It is clearly distinguishable in Nepal by its large reflexed leaf sheath auricles with widely spreading setae. A cultivated form in eastern Nepal also has dense hairs on the leaf sheaths and abaxial leaf surfaces. The type collection from Sikkim is much less distinctive. This species has been seen as far east as Dagana in southern Bhutan.

In central Nepal several taxa have been encountered that have neither long ligules nor spreading oral setae on their leaf sheaths. These taxa are closer to *D. khasianum* in their vegetative characteristics, and key out as *D. khasianum* in this provisional treatment. *Arundinaria interrupta* Trin. was named from Nepalese material collected for Wallich in 1819 in flower without leaves, culm sheaths, or location. Similar material was collected in 1820 and 1821, and one collection bears the location Chisupong, probably referring to Chisapani, south of Kathmandu Valley. It has always been included in *D. falcatum*, but more comprehensive collections may demonstrate its claim to separate specific status.

In Bhutan three species are known. *D. intermedium*, with its prominent oral setae, extends from East Nepal and Sikkim into south-western Bhutan. In Chhukha district of southern Bhutan a different taxon is common, clearly distinguished by its ring of dense hairs around the

culm sheath base. This appears to represent a new species, probably closest to elements of *D. khasianum* or *D. intermedium*, and it is described here as *D. annulatum*. The flowers differ from those of *D. intermedium* in their partially glabrous rachilla segments, scabrous palea keels, and the more prominent ring of hairs between the glumes and the first fertile lemma.

In Wangdi, Punakha, and Gasa districts of central Bhutan a further *Drepanostachyum* species is common. It has neither the hairy leaves and leaf sheaths of *D. intermedium*, nor the ring of hairs of *D. annulatum*. It has small leaves, persistent but small leaf sheath auricles, a distinctively pubescent leaf sheath ligule, glabrous culm sheaths, and glabrous undersides to the leaves. Its flowers are not known, and it is enumerated under *D. khasianum* from Meghalaya. *D. suberectum*, also from Meghalaya, is very similar and is lectotypified here under synonymy.

KEY TO *DREPANOSTACHYUM* SPECIES FROM NEPAL AND BHUTAN

- 1a. Culm sheaths with basal ring of dense brown hairs _____ **D. annulatum**
 1b. Culm sheaths glabrous at base _____ 2
- 2a. Leaf sheath ligules >2mm long _____ **D. falcatum**
 2b. Leaf sheath ligules <2mm long _____ 3
- 3a. Leaf sheath auricles >2mm across _____ **D. intermedium**
 3b. Leaf sheath auricles 0–2mm across _____ **D. khasianum**

ENUMERATION OF SPECIES FROM NEPAL AND BHUTAN

1. *Drepanostachyum annulatum* Stapleton, **sp. nov.** Fig. 1.

Drepanostachyo khasiano (Munro) Keng f. *affinis*, sed annulatis pilosis circumcirca fundos vaginarum culmorum differt.

Type: Bhutan, Chhukha, Taktichhu, 27°02'N 89°35'E, 74km N of Phuntsholing, 1950m, 30 xi 1987, *Stapleton* 713 (holo. THIM).

Additional specimen:

BHUTAN: Chhukha dist., Chhukha, 27°04'N 89°35'E, *Stapleton* 898 (THIM).

Local names: *him* (Dzongkha), *nigalo* (Nepali).

Related to *Drepanostachyum khasianum* (Munro) Keng f. but differing in its ring of hairs around the base of the culm sheaths.

Clumps dense. *Rhizomes* pachymorph. *Culms* pendulous, maximum length 3m; at ¼ height diameter c.6mm, walls c.2mm thick; nodes substantially raised, with ring of deciduous 1mm long brown hairs pointing downwards on new culms, unarmed; maximum internode length 21cm; surface with uniform dense silvery wax at first, culms becoming dark glossy green with some purple coloration above and below node. New *culm sheath* from ¼ top height up to 25mm wide at base, deciduous; attenuation concave or convex, in distal ⅓ of sheath; height to ligule c.65mm; exterior glabrous except for dense ring of 1–2mm upright brown hairs around base, with irregular purple blotches especially in upper ⅓; interior scabrous for 1cm below

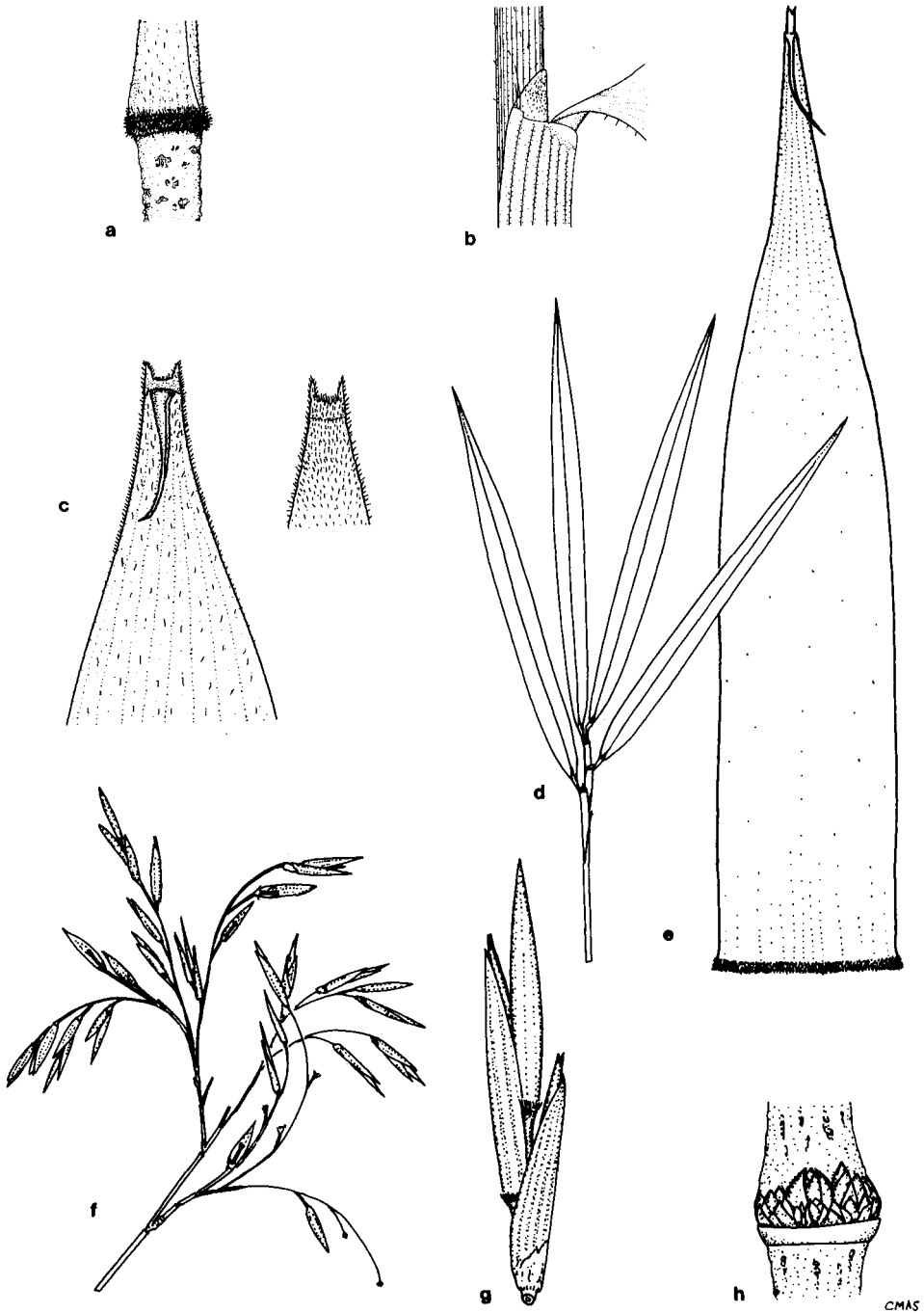


FIG. 1. *Drepanostachyum annulatum*. a, node of new culm, $\times 0.8$; b, leaf sheath apex, $\times 10$; c, culm sheath apex, exterior and interior, $\times 1.2$; d, leaves, $\times 0.8$; e, culm sheath, $\times 0.8$; f, flowering branches, $\times 0.8$; g, spikelet, $\times 4.5$; h, branch buds, $\times 2$.

ligule; shoulders very shortly ciliate; auricles absent; oral setae absent; ligule margin entire or shortly ciliate, interior scabrous, exterior puberulous or glabrous; edges with 1mm cilia on distal $\frac{1}{4}$ of overlapping side and distal $\frac{1}{8}$ of inner side. New *leaf sheath* glabrous; overlapping edge distally with 0.2mm cilia at first; external ligule pronounced, thin, with even cilia of c.0.1mm; auricles absent, shoulders ciliate, rising up to 2mm; oral setae absent; ligule 1–3mm long, rounded or pointed, glabrous. *Leaf blade* maximum length and breadth 160mm \times 18mm; abaxial proximally with c.0.5mm pubescence one side of midrib; adaxial glabrous; petiole glabrous; tessellation absent. *Branch bud* elliptical with up to 12 initials visible in 2 ranks; maximum diameter of mid-culm central branch 1mm; no aerial roots; maximum number of mid-culm branches 70. *Inflorescence* a fascicled panicle with small sheaths or hair rings subtending branches; pedicels 2–8mm long. *Spikelets* 8–12mm, with 2 empty glumes, 2(–3) fertile lemmas, terminating in a rudiment or incomplete floret on a 2–5mm rhachilla segment. Lower empty glume 4–7mm, slightly scabrous, membranous, edges distally ciliate, membranous, disintegrating rapidly. Upper empty glume 5–7.5mm, scabrous, edges distally ciliate, membranous, disintegrating rapidly. *Fertile lemma* 7–9.5mm, exterior distally scabrous, interior glabrous, margins membranous, darkened, edges distally bearing c.0.3mm cilia when young, glabrous when old. *Palea* 8.5–10mm, at maturity 1–2mm longer than flowering glume, exterior and margins scabrous all over, apex shortly bifid or truncate; keels scabrous, not pronounced. *Rhachilla sections* proximally glabrous, distally scabrous to puberulent, apically bearded with ring of 0.5mm hairs. *Anthers* yellow, 4–5mm, tips apiculate.

Distribution: Apparently endemic to southern Bhutan.

2. *Drepanostachyum falcatum* (Nees) Keng f., J. Bamboo Res. 2(1): 17 (1983).

Type: NW India, *Royle* (lecto. selected by Chao & Renvoize 1989, K).

Syn.: *Arundinaria falcata* Nees, Linn. 9: 478 (1834); *Chimonobambusa falcata* (Nees) Nakai, J. Arnold Arbor. 6: 151 (1925); *Sinarundinaria falcata* (Munro) Chao & Renvoize, Kew Bull. 44(2): 357 (1989).

Arundinaria interrupta Trin., Mém. Acad. Imp. Sci. Saint. Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 1: 620 (1835). Type: Nepal, 1819, Wall. Cat. 5035 (holo. BM).

Representative specimens:

NEPAL: Palpa, Bhairabsthan, *Stapleton* 369; Kaski, Naudanda, *Stapleton* 313.

Local names (Nepali): *diu nigalo*, *sano nigalo*.

Distribution: Uttar Pradesh to West Nepal.

3. *Drepanostachyum intermedium* (Munro) Keng f., J. Bamboo Res. 2(1): 18 (1983).

Type: Sikkim, *Hooker f.* s.n. (holo. K).

Syn.: *Arundinaria intermedia* Munro, Trans. Linn. Soc. London 26: 28 (1868); *Chimonobambusa intermedia* (Munro) Nakai, J. Arnold Arbor. 6: 151 (1925); *Sinarundinaria intermedia* (Munro) Chao & Renvoize, Kew Bull. 44(2): 357 (1989).

Representative specimens:

NEPAL: Dhankuta, Pakhribas, *Stapleton* 110.

BHUTAN: Wangdi, Chhusutsa, *Stapleton* 416 (THIM).

Local name: *tite nigalo* (Nepali).

Distribution: Central Nepal to southern Bhutan.

4. *Drepanostachyum khasianum* (Munro) Keng f., J. Bamboo Res. 2(1): 18 (1983).

Type: India, Khasia, Chillong [Shillong] Wood, 5800ft, *Griffith* Itin. 1058; K.D. 6741 (lecto. selected here, K).

Syn.: *Arundinaria khasiana* Munro, Trans. Linn. Soc. London 26: 28 (1868);
Chimonobambusa khasiana (Munro) Nakai, J. Arnold Arbor. 6: 151 (1925).

Arundinaria suberecta Munro, Trans. Linn. Soc. London 26: 32 (1868),
syn. nov. Type: India, Meghalaya, Mamlo, 27 x 1835, *Griffith* Itin 558,
(lecto. selected here, K); *Drepanostachyum suberectum* (Munro) R.B.
Majumdar, Bull. Bot. Surv. India 25(1–4): 235 (1985).

Representative specimen:

BHUTAN: Gasa, Geon Damji, *Stapleton* 808 (THIM).

Distribution: India (Meghalaya), Bhutan.

12. *Himalayacalamus* Keng f., J. Bamboo Res. 2(1): 23 (1983).

Type species: *Himalayacalamus falconeri* (Munro) Keng f.

Frost-tender or frost-hardy bamboos from middle to upper temperate zones. Clumps unicaespitose, rhizomes pachymorph with necks less than 25cm long. Inflorescence semelauctant, in an open interrupted racemose panicle or dense raceme, with strong fasciculation and no pulvini, branches usually subtended by reduced sheaths or rings of hairs, basal branches often absent while sheaths persist. Spikelets predominantly with only 1 fertile floret. Prophylls on the branches represented by the lower glumes of pedicellate spikelets, glumes lacking subtended vestigial buds. Mid-culm branch buds with narrow single-keeled bracts on each side, the front of all culm buds open, with lateral branches not subtended by sheaths. Leaf-vein tessellation absent or obscure. Culm sheath interior glabrous below ligule.

HIMALAYAN TAXA

Keng (1983) originally described *Himalayacalamus* as a monotypic genus. He transferred *Arundinaria hookeriana* Munro into *Drepanostachyum*, but this species has since been transferred to *Himalayacalamus* (Stapleton, 1993a), as it has solitary florets. In addition, five new taxa with strong similarities to *H. falconeri* have recently been discovered in the Himalayas. This gives a total of seven species. The flowers of several species described here are still not known, however, and some of them may be conspecific, although they are all clearly distinguishable from their vegetative characteristics, especially those of the culm sheaths.

The holotype of *Himalayacalamus falconeri* includes inadequate vegetative material for correlation with living plants, but the location in which the type collection was originally made is now known (Stapleton, 1993b). Comprehensive collections have been made from a nearby location (Phulchowki in Kathmandu Valley), and the taxon that is now assumed to be represented by the type material has culm internodes with average length of c.20–25cm, glabrous

culm sheaths that attenuate asymmetrically, convexly or slightly concavely, new shoots covered with a thick mucous and marked with purple and yellow stripes, and leaf sheaths with no auricles or oral setae. The local name in Kathmandu is *thudi nigalo*, while the thick mucous leads to the local name *singhane* in eastern Nepal. This species appears to extend at least from central Nepal to Sikkim, and possibly to central Bhutan. Young shoots are widely eaten.

Five previously undescribed Nepalese taxa are clearly differentiated from *H. falconeri*. *Himalayacalamus porcatus* comes from central Nepal to the north of the range of *H. falconeri*, and has finely ridged culms, erect leaf sheath setae, and scabrous flowering glumes. *Himalayacalamus asper* from western and central Nepal has scabrous or pubescent culm sheaths, and broader culm sheath blades. Collections of this species from central Nepal have no auricles or oral setae on the leaf sheaths, and pubescent rather than scabrous culm sheaths. This bamboo is not harvested in Kaski district as it occurs below the range of the third new species *H. cupreus*, which is the most favoured species for weaving, but in the Langtang Valley it is the best species available, and is widely harvested. *H. cupreus*, known only from the southern flanks of the Annapurna Mt. in West Nepal, is of larger stature with long internodes that provide valuable weaving material. It has prominent copper-coloured cilia on the margins of the tough culm sheaths, erect culm sheath blades, and faint leaf tessellation. Young shoots of this species are also eaten. The fourth new species, *Himalayacalamus fimbriatus*, is widely cultivated in western and central Nepal, where it is very intensively harvested from terrace risers and path-sides for weaving material and animal fodder. It has distinctive fimbriate culm sheath ligules and a dense ring of hairs around the culm sheath base. The prominent cilia on the culm sheath ligule merge into pubescence on its interior surface, which is unusual in *Himalayacalamus* species, but the interior of the sheath below the ligule is glabrous as in other species of *Himalayacalamus*, and not scabrous as in *Drepanostachyum* species.

The fifth taxon is common in East Nepal. It is cultivated in combination with *H. falconeri*, *Drepanostachyum intermedium* and *Ampelocalamus patellaris* in Terhathum and Taplejung districts, where its culms provide highly valued weaving material. It is distinguished by its short culm internodes and the delicate concavely attenuating culm sheaths with erect blades. It may have been confused with *Himalayacalamus hookerianus* in the past, but is clearly a separate taxon, described here as *Himalayacalamus brevinodus*.

Flowers are not known for the latter four taxa, so that it is not possible to place them in *Himalayacalamus* (rather than *Drepanostachyum*) with absolute certainty, but the characteristics of culms, culm sheaths, leaf sheaths, buds and branching strongly suggest that they belong in this genus.

Collections from Bhutan show substantial differences from the type collection of *H. falconeri*, but they are not comprehensive enough for the description of new taxa. Material from Chhukha district in south-western Bhutan appears to have thinner culm sheaths than the type variety with a ring of light hairs at the base. A collection from Moshi in eastern Bhutan (Stapleton 432) also has thin culm sheaths, but they are glabrous, and the central branches are large, often with aerial roots. Collections from Shemgang have prominent oral setae on the leaf sheaths, but the culm sheaths are not known.

Fargesia gyirongensis Yi and *Fargesia collaris* Yi, two species described from Tibetan material collected close to the border with Nepal, appear from their descriptions to be conspecific

with *Himalayacalamus falconeri*, apparently without additional characters that could justify even subspecific or varietal status.

KEY TO *HIMALAYACALAMUS* SPECIES KNOWN FROM NEPAL AND BHUTAN

- 1a. Culm sheath ligule tall and fimbriate, culm sheath densely pubescent at the base _____ **H. fimbriatus**
- 1b. Culm sheath ligule short and serrate, culm sheath glabrous at the base _____ 2
- 2a. Culm surface finely ridged _____ **H. porcatus**
- 2b. Culm surface smooth _____ 3
- 3a. Culm sheath densely scabrous or distally pubescent _____ **H. asper**
- 3b. Culm sheath glabrous or distally slightly scabrous _____ 4
- 4a. Culm sheath blades erect _____ 5
- 4b. Culm sheath blades reflexed _____ 6
- 5a. Culm sheaths tough, convexly attenuate; culm sheath margins with prominent copper-coloured cilia; culm internodes up to 40cm long _____ **H. cupreus**
- 5b. Culm sheaths thin, concavely attenuate; culm sheath margins without prominent cilia; culm internodes up to 20cm long _____ **H. brevinodus**
- 6a. Culm sheaths tall, concavely attenuate; new culms with glaucous wax ___ **H. hookerianus**
- 6b. Culm sheaths short, convexly attenuate, asymmetrical; new culms with white wax _____ **H. falconeri**

ENUMERATION OF THE SPECIES KNOWN FROM NEPAL AND BHUTAN

1. ***Himalayacalamus asper* Stapleton, sp. nov. Fig. 2.**

Type: Nepal, Kaski district, Karuwa, Pipar, 28°26'N 83°57'E, 2000m, 16 xi 1983, *Stapleton* 314 (holo. E).

Himalayacalamo falconero affinis, sed vaginis culmorum scabris vel superne pubescentibus, foliis eorum latioribus, vaginis foliorum interdum auriculis et setis oralibus instructis differt. Inflorescentia ignota.

Syn.: [*Drepanostachyum* sp. Type T29 Stapleton *pro parte* in Jackson, Manual of Afforestation in Nepal: 212 (1987)].

Representative specimens:

NEPAL: Rasuwa dist., Langtang khola, 28°12'N 85°28'E, *Stapleton* 328; Kaski dist., Khare, 28°18'N 83°50'E, *Stapleton* 312.

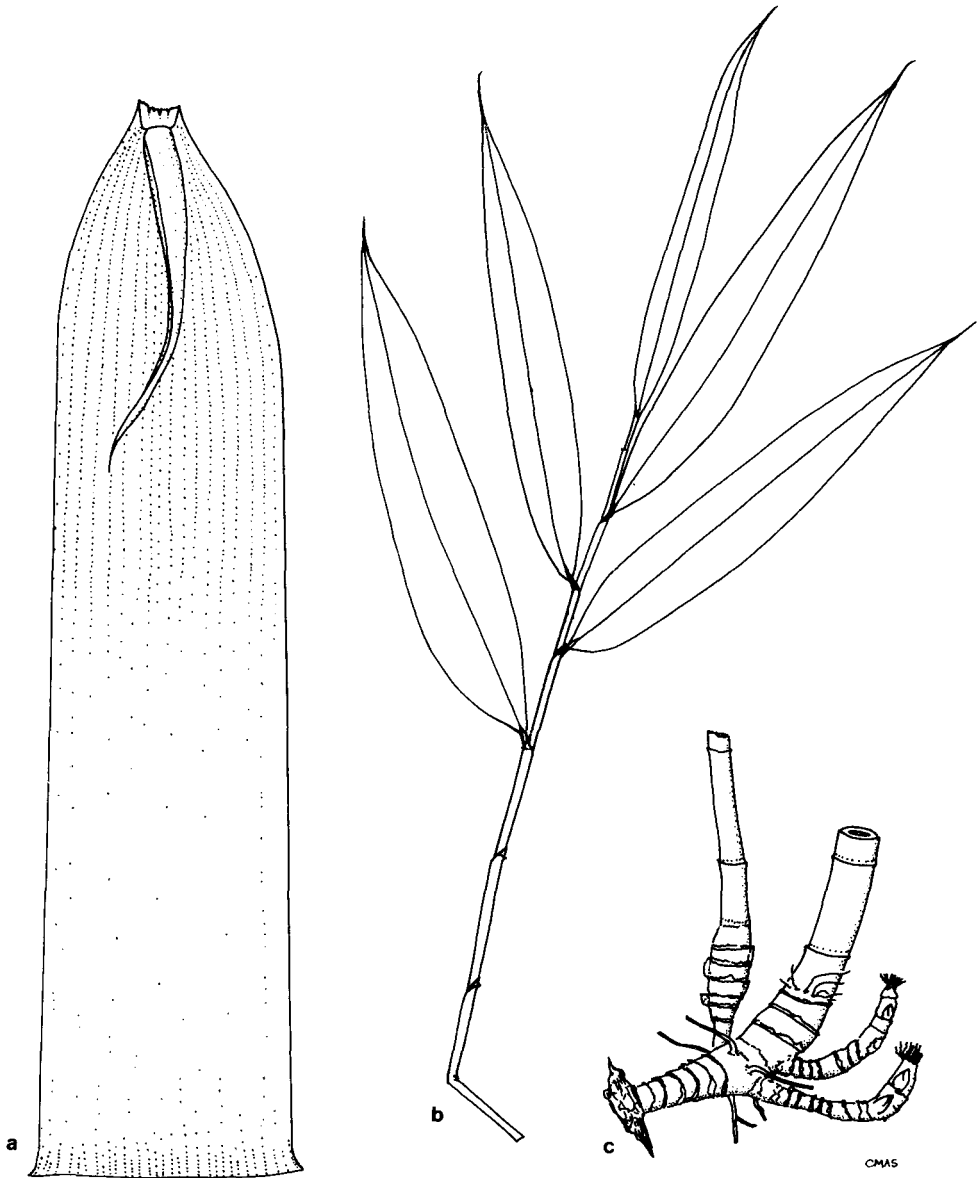


FIG. 2. *Himalayacalamus asper*. a, culm sheath, $\times 0.7$; b, leaves, $\times 0.7$; c, rhizome, $\times 0.3$.

Local names: *malinge nigalo* (Nepali, Langtang), *baa ma* (Tamang), *gorey nigalo* (Nepali, Kaski).

Similar to *H. falconeri*, but with scabrous or apically pubescent culm sheaths with broader blades, leaf sheaths sometimes furnished with auricles and oral setae. Its flowers are not known.

Clumps unicaespitose, dense. *Rhizome* pachymorph, up to 25cm long. *Culms* drooping, maximum length 6m; at $\frac{1}{4}$ height diameter up to 2cm, walls up to 3mm thick; nodes scarcely raised on small culms but substantially raised on larger culms, unarmed; internodes up to 30cm long, surface covered with thin wax, smooth with no ridges. New *culm sheath* from $\frac{1}{4}$ height c.65mm wide at base, attenuating convexly in distal $\frac{1}{4}$ to neck 6–12mm wide, deciduous, coriaceous with veins lightly raised; height to ligule c.25cm; blade reflexed, 5–7cm long, 4–6mm wide, persistent; exterior bearing clear retrorse bulbous-based spines or short hairs, especially towards the apex, shoulders glabrous, rising steeply beside ligule; auricles absent; oral setae absent; ligule up to 15mm broad, up to 6mm tall, glabrous both sides, margin lacerate; edges both with sparse c.0.5mm cilia in distal $\frac{1}{2}$, cilia clear or white. New *leaf sheath* surface and edges glabrous; external ligule pronounced, very shortly ciliate; auricles absent or small, reflexed, deciduous; oral setae none to many, short; ligule rounded, c.1mm long, densely puberulous. Leaf blade maximum length and breadth 170 × 20mm; abaxial glabrous but with light hairs beside base of midrib; adaxial glabrous; petiole glabrous; tessellation absent. *Branch buds* present at c.3 basal nodes then absent for several nodes, bud shape broadly ovate; branches up to 30 at mid-culm; no aerial roots. *Inflorescence* unknown.

Distribution: Apparently endemic to central Nepal.

2. *Himalayacalamus brevinodus* Stapleton, sp. nov. Fig. 3.

Type: Nepal, Dhankuta district, Pakhribas, 27°03'N 87°17'E, 1500m, 11 i 1990, *Stapleton* 908 (holo. E).

Himalayacalamo falconero affinis, sed internodiis brevioribus, vaginarum foliorum tenuioribus, superne angustioribus, laminis eorum erectis differt. Inflorescentia ignota.

Syn.: [*Drepanostachyum* species T3/2B Stapleton in Jackson, Manual of Afforestation in Nepal: 212 (1987)].

Local name: *malinge nigalo* (Nepali, East Nepal).

Differs from *H. falconeri* in having shorter internodes, thinner culm sheaths that are narrower at the top, and erect culm sheath blades. Its flowers are not known.

Clumps unicaespitose, dense. *Rhizomes* pachymorph, up to 25cm long. *Culms* drooping; maximum length 9m; at $\frac{1}{4}$ height maximum diameter 25mm, walls up to 3mm thick; nodes slightly to distinctly raised, with purple coloration around node, unarmed; internodes short, up to 19cm, covered with very thin wax when young, becoming distinctly yellow. New *culm sheath* from $\frac{1}{4}$ height c.8cm wide at base, deciduous, interior and exterior glabrous, exterior often with distinct purple-brown lines, distal $\frac{1}{3}$ very thin with impression from superior node evident and tessellation distinct; attenuation convex in distal $\frac{1}{4}$; neck c.5mm wide, rolled at junction with blade; height to ligule c.25cm; blade erect, c.8cm long × 4mm wide, curving, rolled, glabrous, persistent, firmly attached; auricles absent; oral setae absent; ligule c.2mm tall × 5mm wide, serrated, exterior puberulous, interior glabrous; edges glabrous. New *leaf sheath*

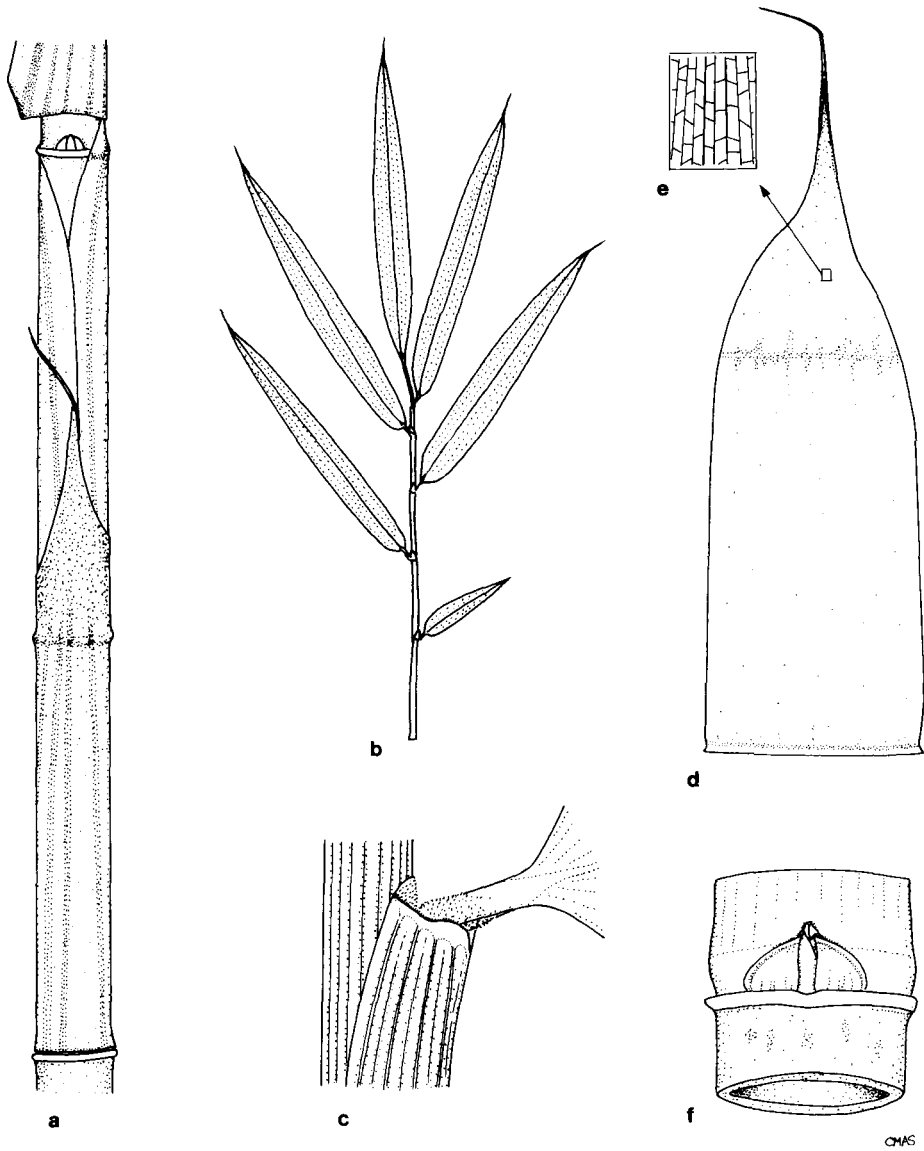


FIG. 3. *Himalayacalamus brevinodus*. a, culm with sheaths, $\times 0.4$; b, leaves, $\times 0.4$; c, leaf sheath apex, $\times 10$; d, culm sheath, $\times 0.4$; e, venation in distal $\frac{1}{4}$, $\times 2.5$; f, culm bud, $\times 2$.

surface and margins glabrous; external ligule not pronounced, very shortly ciliate; auricles absent; oral setae absent; ligule obliquely truncate, up to 1mm long, puberulous. *Leaf blade* maximum length and breadth 200mm × 25mm, both surfaces glabrous; petiole glabrous or basally very shortly pubescent; tessellation absent. *Branch buds* absent at basal 4–6 culm nodes, broadly ovate, only 3 initials visible; mid-culm branches up to 15 in first year, up to 30 later; central branch up to 2mm in diameter, with no aerial roots. *Inflorescence* unknown. Distribution: Eastern Nepal, Sikkim.

3. *Himalayacalamus cupreus* Stapleton, sp. nov. Fig. 4.

Type: Nepal, Kaski district, Karuwa, Pipar, 28°26'N 83°57'E, 2500m, 12 xi 1983, Stapleton 306 (holo. E).

Ab *Himalayacalamo falconero* internodis longioribus, laminis vaginarum culmorum erectis, ciliis margine eorum cupreis, nervillis transversis foliorum distinguitur. Inflorescentia ignota.

Syn.: [*Drepanostachyum* species type T24 Stapleton in Jackson, Manual of Afforestation in Nepal: 212 (1987)].

Local name (Nepali, Kaski district): *malinge nigalo*.

To be distinguished from *H. falconeri* by its longer internodes of up to 40cm, its culm sheaths with erect blades and copper-coloured marginal cilia, and the presence of discernible transverse veinlets on the leaves. *Inflorescence* not known.

Clumps dense. *Rhizomes* pachymorph, up to 25cm long. *Culms* drooping to pendulous; maximum length 8m; at ¼ height diameter up to 30mm, walls c.0.5mm thick; nodes slightly raised, unarmed; maximum internode length 40cm, with uniform light covering of glaucous wax. *New culm sheath* from ¼ height c.75cm wide at base, deciduous, glabrous; attenuation in distal ¼ convex to a 10–13mm wide neck, texture tough and smooth with raised veins only on distal ⅙; height to ligule up to 34cm; blade erect, 10–15mm long, 7–8mm wide, glabrous, persistent; shoulders c.2mm wide, glabrous, level; auricles absent; oral setae absent; ligule short, broad, 0.5–1mm long, 5–7mm across, interior and exterior glabrous; edges with uniform 1–1.5mm glossy quite persistent copper-coloured cilia on distal ⅙ of overlapping edge and distal ⅙s of inner edge; surface smooth. *New leaf sheath* surface and edges glabrous; external ligule not pronounced, with cilia of 0.1–0.2mm; auricles absent, shoulders with cilia of 0.1–0.2mm; oral setae absent; ligule 1–1.5mm tall, densely puberulous or tomentose. *Leaf blade* maximum length and breadth 200mm × 25mm; both surfaces and petiole glabrous; tessellation barely distinguishable. *Branch buds* broadly ovate, mid-culm branches up to 30, central branch up to 2mm in diameter with no aerial roots. *Inflorescence* not known.

Distribution: Apparently endemic to central Nepal. Known only from the type.

4. *Himalayacalamus falconeri* (Munro) Keng f., J. Bamboo Res. 2(1): 24 (1983).

Type: Nepal, Kathmandu, Sheopore [Shivapuri], 8000ft, Wallich 5040 (holo. K, iso. E).

Syn.: *Thamnocalamus falconeri* Munro, Trans. Linn. Soc. London 26: 34 (1868); *Arundinaria falconeri* (Munro) Benth. & Hook. f., Gen. Pl. 3: 1208 (1883).

Fargesia collaris Yi, J. Bamboo Res. 2(2): 21 (1983), syn. nov.

Fargesia gyirongensis Yi, J. Bamboo Res. 2(2): 37 (1983), syn. nov.

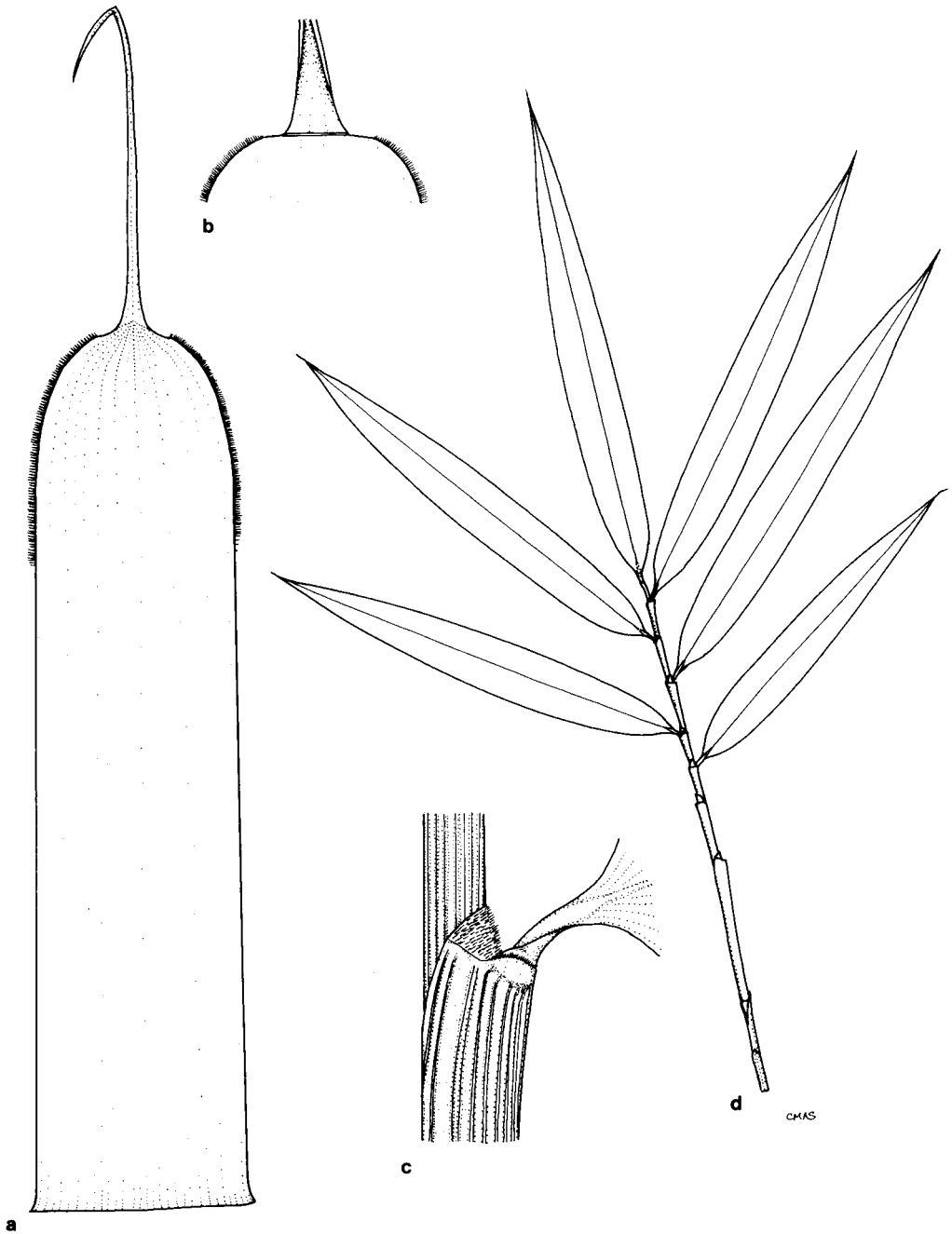


FIG. 4. *Himalayacalamus cupreus*. a, culm sheath, $\times 0.5$; b, interior of culm sheath apex, $\times 0.7$; c, leaf sheath apex, $\times 10$; d, leaves, $\times 0.4$.

[*Drepanostachyum* species type T24 Stapleton in Jackson, Manual of Afforestation in Nepal: 212 (1987)].

Representative specimens:

NEPAL: Kathmandu, Phulchowki, *Schilling* 781; Kathmandu, Phulchowki, *Stapleton* 322; *ibid.*, *Stapleton* 325; Dolakha, Marbhu, 27°50'N 86°21'E, *Stapleton* 356; Kaski dist., Karuwa, Pipar, 28°24'N 83°58'E, 2500m, *Stapleton* 306.

BHUTAN: Chhukha dist., Gedu, 26°55'N 89°32'E, *Stapleton* 905 (THIM); Tashigang, Moshi, 27°05'N 91°32'E, 2400m, *Stapleton* 432 (THIM).

Local names (Nepali): *thudi nigalo* near Kathmandu, *gorey nigalo* in Dolakha district, *malinge nigalo* in Kaski district, and *singhane* in eastern Nepal.

5. Himalayacalamus fimbriatus Stapleton, sp. nov. Fig. 5.

H. falconero (Munro) Keng f. *affinis*, sed ligulis vaginis culmorum fimbriatis, vaginis culmorum basibus cinnamomeis pubescentibus, ligulis vaginis foliorum longioribus, vaginis foliorum juvenorum interdum auriculis et setis oralibus instructis differt.

Type: Nepal, Kathmandu, 1200m, 16 i 1990, *Stapleton* 910 (holo. E).

Syn.: [*Drepanostachyum khasianum* Type T21 Stapleton in Jackson, Manual of Afforestation in Nepal: 212 (1987).]

Additional specimen:

NEPAL: Sindhu Palchowk, Chautara, 27°47'N 85°42'E, *Stapleton* 337.

Local name (Nepali): *tite nigalo*.

Similar to *H. falconeri*, but with fimbriate culm sheath ligules, cinnamon-coloured hairs at the base of the culm sheaths, longer leaf sheath ligules, and sometimes with setaceous auricles on the young leaf sheaths.

Clumps unicaespitose, dense. *Rhizomes* pachymorph, up to 25cm long. *Culms* drooping, up to 7m long; at ¼ height diameter up to 18mm; nodes substantially raised, unarmed, persistent sheath base bearing dense ring of retrorse cinnamon-orange hairs; internodes up to 27cm long, basal length increment gradual, surface uniformly thinly to densely white-waxy, smooth with no lines; supra-nodal ridge purple. New *culm sheath* from ¼ height c.55mm wide at base, attenuation convex and asymmetrical in distal ⅓ to c.8mm wide neck, mostly glabrous but proximally with persistent ring of erect dense cinnamon-orange 3–5mm hairs, blotched purple especially distal ½ and proximal 1cm; height to ligule c.19cm; blade usually erect, up to 50mm long × 4mm wide, deciduous; shoulders shortly pubescent, rising steeply both sides, up to 8mm tall; auricles absent; oral setae absent; ligule c.5mm broad × 4mm wide, concavely depressed, with 6–8mm fimbriation, outer surface lightly pubescent, inner with dense pubescence merging into fimbriation extending c.2mm below ligule, edges both bearing cilia of 2–3mm in distal ⅓. New *leaf sheath* surface glabrous; distal 2cm of overlapping edge with cilia of 0.5mm, inner edge ciliate beside shoulder only; external ligule inconspicuous; auricles small, quickly deciduous or persistent, c.1mm long, falcate, reflexed; oral setae up to 20 each side, 2mm long, stout, glabrous, spreading, deciduous with auricle; ligule rounded to acute, up to 5mm long, very shortly pubescent. *Leaf blade* maximum length and breadth 200 × 20mm, abaxial surface mostly glabrous with 1mm hairs beside base of midrib, adaxial glabrous; petiole glabrous or adaxial proximally short pubescent, venation prominent; tessellation absent. *Mid-culm branches* up to 20 at each node, basal 2 nodes followed by 1–3 nodes without

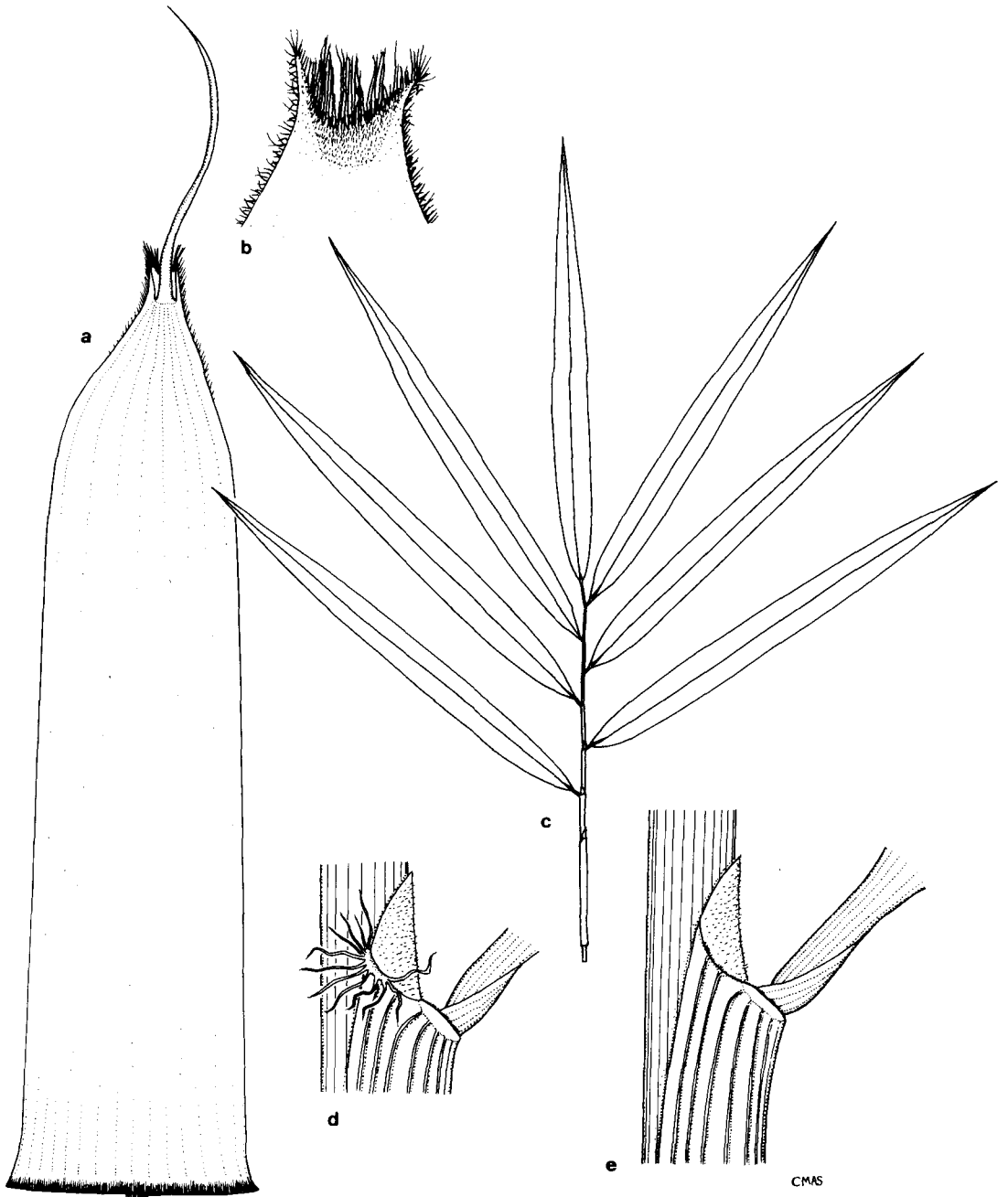


FIG. 5. *Himalayacalamus fimbriatus*. a, culm sheath, $\times 0.6$; b, interior of culm sheath apex, $\times 1.5$; c, leaves, $\times 0.4$; d, apex of leaf sheath with oral setae, $\times 10$; e, apex of leaf sheath without oral setae, $\times 10$.

branches or buds; buds broadly ovate, c.3 initials visible in bud from breast height; mid-culm central branch up to 2.5mm in diameter, with no aerial roots. *Inflorescence* unknown.

Distribution: Endemic to western and central Nepal.

6. *Himalayacalamus hookerianus* (Munro) Stapleton, *Bamboo Soc. Newsl.* 17: 21 (1993).

Type: India, Sikkim [Neongong, 6800ft, xii 1848 (Hooker, 1854)], 'Praong, 4000–6000ft, eaten seed', *Hooker f.* s.n. (lecto. selected here, K).

Syn.: *Arundinaria hookeriana* Munro, *Trans. Linn. Soc. London* 26: 29 (1868); *Chimonobambusa hookeriana* (Munro) Nakai, *J. Arnold Arbor.* 6: 151 (1925); *Drepanostachyum hookerianum* (Munro) Keng f., *J. Bamboo Res.* 2(1): 17 (1983); *Sinarundinaria hookeriana* (Munro) Chao & Renvoize, *Kew Bull.* 44(2): 358 (1989).

Representative specimens:

NEPAL: Dhankuta dist., Hile, 27°02'N 87°19'E, *Stapleton* 117.

INDIA: Sikkim, Yoksun, *Praong*, 13 i [1849], *Hooker f.* s.n. 'A'.

Local name (Nepali): *padang*.

Distribution: East Nepal to central southern Bhutan. Cultivated in Koshi and Mechi zones of East Nepal, and Chirang district of Bhutan.

Nomenclatural note: Munro (1868) confused annotations from two collections in his apparent citation of a single holotype. He clearly intended the flowering specimens from Neongong to represent the species, and considered the leaves from Yoksun to be dubious.

7. *Himalayacalamus porcatus* Stapleton, **sp. nov.** **Fig. 6.**

Type: Nepal, Rasuwa district, Syabru, 28°08'N 85°21'E, 7500ft, 8 x 1984, *Stapleton* 332 (holo. E).

Himalayacalamo falconeri (Munro) Keng f. affinis sed internodiis tenuiter porcatis, setis oralibus erectis, vaginis foliorum ciliatis, lemmatibus scabris differt.

Syn.: [*Drepanostachyum* species Type T29 Stapleton *pro parte* in Jackson, *Manual of Afforestation in Nepal*: 212 (1987)].

Additional specimen:

NEPAL: Rasuwa dist., Syabru, 28°08'N 85°21'E, 7500ft, 8 x 1984, *Stapleton* 331.

Local name: *seto nigalo* (Nepali), *bra ma* (Tamang).

A species that differs from *H. falconeri* in its finely ridged culms, erect oral setae, ciliate leaf sheaths, and scabrous lemmas.

Clumps unicaespitose, culms dense. *Rhizomes* pachymorph, up to 25cm long. *Culms* drooping, maximum length 6m; diameter at ¼ height up to 2.5cm; walls up to 4mm thick; nodes substantially raised, unarmed; internodes up to 30cm long, surface uniformly covered in dense persistent wax and clearly marked with prominent longitudinal ridges, no purple coloration. New *culm sheath* from ¼ height c.6cm wide at base, deciduous, completely glabrous, height to ligule up to 30cm, distal ¼ chartaceous with prominent transverse veins on interior surface, proximal ¾ coriaceous and smooth, attenuation in distal ¼ convex to a c.5cm wide neck; blade erect or reflexed, persistent, 2–5cm long, c.2mm wide, basal 5mm of adaxial surface shortly pubescent, otherwise scabrous, abaxial surface glabrous; shoulders with cilia of c.0.1mm, auricles absent; oral setae initially up to 8 each side, weak, up to 6mm long, white, glabrous, erect,

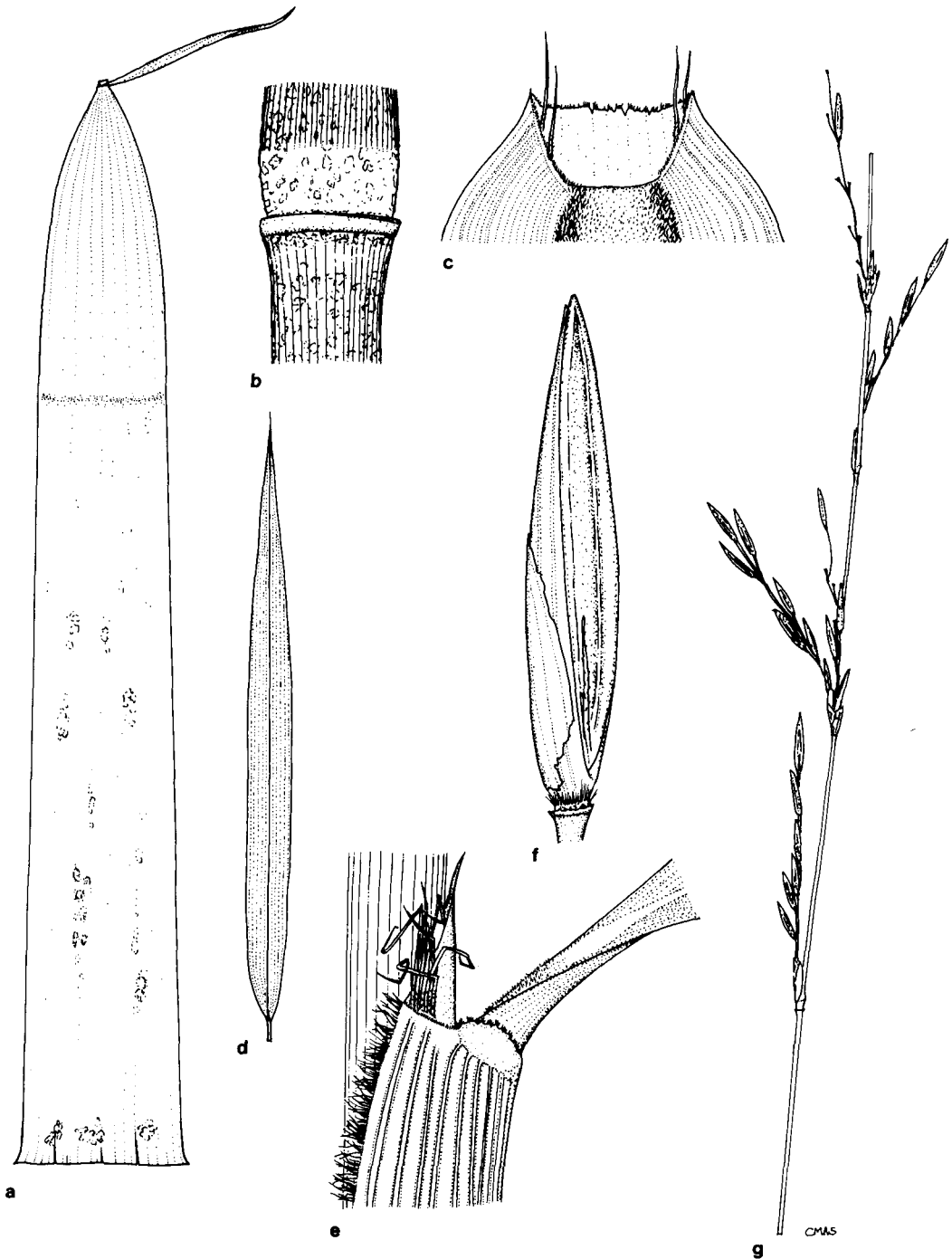


FIG. 6. *Himalayacalamus porcatum*. a, culm sheath, $\times 0.6$; b, culm node, $\times 2$; c, interior of culm sheath apex, $\times 4$; d, leaf, $\times 0.8$; e, apex of leaf sheath, $\times 10$; f, spikelet, $\times 10$; g, branch with inflorescences, $\times 0.7$.

deciduous, arising from shoulder and edge of ligule; ligule 2–4mm wide, 1–4mm tall, glabrous both sides, margin lacerate; edges largely glabrous. New *leaf sheath* delicate with prominent venation, surface glabrous but covered in persistent wax; edges glabrous or overlapping edge with 1mm white cilia to base on proximal sheaths; external ligule pronounced, delicate, with cilia of c.0.1mm, often serrate; auricles absent or minute; oral setae variable, (0–)4–8 each side, weak, white, erect, 2–4mm long, glabrous, deciduous; ligule variable, 1–4mm tall, truncate to acutely rhomboid, often strongly asymmetrical, exterior glabrous to puberulous, interior glabrous, delicate. *Leaf blade* maximum length and breadth 190mm × 12mm; adaxial surface glabrous; abaxial usually glabrous, or proximally sparsely pubescent one side of midrib, or sparsely shortly pubescent all over (small leaves); petiole abaxial glabrous, adaxial 0.1–0.5mm pubescent; tessellation absent. Mid-culm branches up to 30; central branch with no aerial roots. *Inflorescence* a reduced fascicled panicle, semelauctant; pedicels 3–9mm long, smooth; *spikelet* length 9–11mm, with 2 empty glumes, 1(–2) complete florets, terminating in a rudiment or incomplete floret on 2–4mm rhachilla segment; empty glumes 7–9mm long, membranous; *fertile lemma* 8–10mm long, exterior shortly scabrous all over, interior distal 2mm scabrous to shortly pubescent, edges mainly glabrous, but with cilia of c.0.5mm at tip; *palea* longer than flowering glume, 9–11mm, glabrous, apex blunt; keels not distinguishable, glabrous; *rhachilla* densely scabrous. *Caryopsis* c.6.5 × 1.5mm, persistent style base glabrous.

An occasionally cultivated species that produces larger weaving material than *H. asper* from the nearby Langtang Khola, but it is not popular as it cuts the hands when it is split for weaving. It may also occur in forest towards Gosainkund.

Distribution: Apparently endemic to central Nepal.

13. *Ampelocalamus* Chen, Wen & Sheng, Acta Phytotax. Sin. 19(3): 332 (1981).

Type species: *Ampelocalamus actinotrichus* (Merr. et Chun) Chen, Wen & Sheng.

Syn.: *Patellocalamus* W.T. Lin, J. S. China Agric. Univ. 10(2): 45 (1989). Type species: *Patellocalamus patellaris* (Gamble) W.T. Lin.

A description of this genus is given, but it is based mainly upon the single Himalayan species, and may not apply to all Chinese species.

Tender to hardy bamboos from warm-temperate to cool-temperate zones. Clumps unicaespitose, rhizomes pachymorph with necks less than 25cm long. Culms pendulous with flexible apices, nodes thickened. Inflorescence semelauctant, in an open racemose panicle or raceme, with pendulous spikelets on long slender pubescent to scabrous pedicels, with some fasciculation and no pulvini; branches usually subtended by reduced sheaths or occasionally by rings of hairs. Prophylls on the branches represented by the lower glumes of pedicellate spikelets, upper glumes often subtending long rudimentary axes. Mid-culm branch bud enclosed by a broad two-keeled bud-scale, the front of all culm buds usually closed, with lateral branches not subtended by sheaths, and several sheaths fused together.

This genus has only one Himalayan representative, *A. patellaris*, a species that is generally self-supporting rather than scandent, although the culms have long flexible apices that may sprawl over tree branches, and each culm node bears a projecting corky collar, which can assist in supporting the culms on tree branches. Branches are strongly geniculate at nodes close to the

culm to facilitate orientation towards variable sources of light in the tree canopy. Mid-culm branches bear aerial roots, which may allow the use of culm cuttings for vegetative propagation. Mid-culm branch buds of this species are closed at the front, while other genera in the subtribe have open mid-culm buds.

ENUMERATION OF SPECIES

1. *Ampelocalamus patellaris* (Gamble) Stapleton, **comb. nov.** Fig. 7.

Type: Sikkim, Jungat, 4000ft, xi 1881, *Gamble* 10045 (lecto. selected here, K).

Syn.: *Dendrocalamus patellaris* Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 86 (1896), *pro parte, floribus excl.*; *Patellocalamus patellaris* (Gamble) W. T. Lin, J. S. China Agric. Univ. 10(2): 46 (1989).

Chimonobambusa jainiana Das & Pal, J. Econ. & Tax. Bot. 4(3): 1023 (1983), **syn. nov.** Type: India, West Bengal, Kalimpong, CNH 12178 (CAL); *Drepanostachyum jainianum* (Das & Pal) R. B. Majumdar, Bull. Bot. Surv. India 25: 235–238 (1985).

[*Arundinaria* sp. Type T3 Stapleton, Bamboo in East Nepal, Forest Research & Information Centre Report, Department of Forest, Kathmandu (1982): 50, pl. 6, tab. 1].

Representative specimens:

INDIA: Simonbong, 1868, *Kurz* s.n.; Ramti, 1889, *Gammie* s.n.; Assam, Massang Parbat, Naga Hills, *Sri Gopal Bannerji* 22655 (not flowers); Kalimpong, *Pradhan* s.n. (THIM).

NEPAL: Terhathum, path to Basantapur, 27° 10'N 87° 29'E, 1800m, *Stapleton* 132; Dhankuta, Pakhribas, 27° 03'N 87° 17'E, 1750m, *Stapleton* 190; Ilam, *Stapleton* 195.

Local names: *nibha* (East Nepal), *ghopi bans* (Pokhara), *lewas bans* (Palpa).

The Himalayan bamboo *Dendrocalamus patellaris* was incorrectly included in *Dendrocalamus* by Gamble (1896), because of flowers of *Dendrocalamus hamiltonii* erroneously included with culm sheaths, leaves, and branches of *A. patellaris* (*Sri Gopal Bannerji* 22655). The correct flowers were found near Terhathum in East Nepal in 1981, and briefly described and illustrated as *Arundinaria* sp. Type T3 (Stapleton, 1982). In India flowers were also found during this gregarious flowering, and a new species was described in *Chimonobambusa*, later to be transferred to *Drepanostachyum*. Illustrations of flowers of *Ampelocalamus luodianensis* and culm sheaths of *A. scandens* (Xue & Yi, 1985) drew attention to the similarities between the genus *Ampelocalamus* and *Dendrocalamus patellaris* Gamble. Comparison with the type collection of *Ampelocalamus actinotrichus* (Merr. & Chun) Chen, Wen, & Sheng at Kew and duplicates of other species kindly sent to Kew from Nanjing showed that *Ampelocalamus* is indeed the correct genus for this species. The genus *Patellocalamus* W.T. Lin was recently erected (Lin, 1989) on the grounds that *Dendrocalamus patellaris* Gamble differed substantially from other *Dendrocalamus* species in both vegetative and floral characteristics. Lin (1989) had unfortunately repeated Gamble's mistake (1896), and he described his new genus from the vegetative parts of *Ampelocalamus patellaris* and the flowers of *Dendrocalamus hamiltonii* erroneously collected by Bannerji. Although he found no less than five floral characters by which to distinguish his new genus from *Dendrocalamus*, it would seem he was actually describing flowers of *D. hamiltonii*.



FIG. 7. *Ampelocalamus patellaris*. a, spikelet, $\times 3$; b, filament, $\times 10$; c, flowering branch, $\times 0.5$; d, lodicule, $\times 25$; e, palea with contents, $\times 6$; f, gynoeceium, $\times 25$. Reproduced from Stapleton (1982).

Gamble (1896) clearly was intending to apply the name *Dendrocalamus patellaris* to the plant he knew in vegetative growth rather than to the dubious flowers he had been sent. After the description he wrote:

‘This remarkable species, distinguished at once by the curious ring at the nodes and the fringes of the culm sheath, has long been known in the Darjeeling hills by the name *Pagjiok*, *pagjiok-pao* (Lepcha), but in leaf only.’ . . . ‘The flowering specimens now received are said by G. Mann to be doubtful’ . . . ‘until further specimens come to hand, those sent by him should be considered as belonging to this species.’

I therefore select Gamble’s own collection of vegetative material as the lectotype of this species. As *Patellocalamus patellaris* (Gamble) W.T. Lin is the type species of *Patellocalamus* W.T. Lin, and *Patellocalamus patellaris* is now typified by Gamble’s vegetative material, *Patellocalamus* becomes a synonym of *Ampelocalamus*, rather than *Dendrocalamus*.

Subtribe **Racemobambosinae** Stapleton, **subtribus nov.**

Type species: *Racemobambos* Holttum, Gard. Bull. Singapore 15: 267 (1956).

Bambusinis Agardh inflorescentiis semelauctantibus distinguitur. Ab Arundinariinis Benthama staminibus sex inflorescentiis plus minusve bracteatis differt.

Inflorescence semelauctant with no buds at base of spikelet, branches of the inflorescence subtended by sheaths or bracts but prophyll often not at the point of branching, spikelets sessile or shortly pedicellate with 1–3 glumes, florets with six stamens. Mid-culm branch bud prophyll margins not fused, leaf blades with abaxial keel, rhizomes pachymorph. Sub-scandent bamboos of small or intermediate size.

Species of *Racemobambos* have been considered to be intermediate between the Bambusinae and the relatively more derived Arundinariinae (Holttum, 1958), and they clearly cannot be placed in either of those two subtribes as currently interpreted. Two other genera share similar characteristics and are included in this subtribe: *Racemobambos* and *Vietnamosasa*. *Neomicrocalamus* has been considered a synonym of *Racemobambos* (Chao & Renvoize, 1989), but it has also been recognized as a separate genus (Dransfield, 1982). *Vietnamosasa* has recently been described for three species from Vietnam (Nguyen, 1990). The Sino-Japanese genera such as *Sasa* with iterlauctant inflorescences and six stamens are placed either in the Arundinariinae or sometimes in their own subtribe, the Sasinae Keng f. *Sasa* has much more reduced, ebracteate inflorescences than genera in the Racemobambosinae, with long pedicels and very small glumes, as well as solitary branches and leptomorph rhizomes, both of which are often considered to be derived characters.

The Racemobambosinae may be related to scrambling genera with open culm buds in the Bambusinae, such as *Holttumochloa*, which are probably the most primitive members of that subtribe. Relationships with bamboos from Madagascar and South America are not clear. The subtribe Hickelinae A. Camus also has 6-stamened semelauctant inflorescences, but the spikelets of the 6 genera included by Dransfield (1995, in prep.) all have single florets and several empty transitional glumes at the spikelet base. The subtribe Nastinae Soderstrom & Ellis

was described purely on details of leaf anatomy. It would appear to be a synonym of the earlier subtribe Hickelinae, as it included *Hickelia* (Soderstrom & Ellis, 1988). The principal characteristic of the Nastinae is the presence of an adaxially projecting midrib. This, however, is only seen in a few species of *Nastus*, and is not seen in the type species. As bamboo subtribes from the Old World and the New World are distinguished using different sets of characters, while the apparently intermediate bamboos from Madagascar are not at all well known, it may be difficult to give a comprehensive treatment of woody bamboo subtribes for some time.

14. *Neomicrocalamus* Keng f., J. Bamboo Res. 2(2): 10 (1983).

Type species: *Neomicrocalamus prainii* (Gamble) Keng f.

Syn.: *Microcalamus* Gamble, J. Asiatic Soc. Bengal 59(2): 207 (1890) *nom. illeg.*, non Franchet, J. Bot. (Morot) 3: 282 (1889).

Slightly hardy bamboos from lower to upper temperate zones. Clumps pluricaespitose, rhizomes pachymorph with necks up to 1m long. Inflorescence semelauctant, in an open panicle; branches usually subtended by sheaths, with prophylls inserted at the point of branching. Mid-culm branch buds enclosed in a broad two-keeled prophyll, the front of all culm buds open, with lateral branches subtended by sheaths. Leaf-vein tessellation absent. Culm sheath blade continuous with the sheath, often acicular.

This semi-scandent genus retains 6 stamens in a relatively derived semelauctant inflorescence. In this way it is similar to the Malaysian genus *Racemobambos* Holttum, but *Neomicrocalamus* differs from *Racemobambos* in several vegetative and floral characteristics. It has much broader mid-culm bud-scales with two keels instead of one, and a lower number of lateral branches enclosed in much broader sheaths. In addition the prophyll on branches of the *Neomicrocalamus prainii* inflorescence (Naga Hills, Pulinabadza, *Prain* s.n., K) is inserted at the point of branching, while the prophyll in *Racemobambos* is reported as being absent, (Dransfield, 1982), and is represented by the lower glume in the spikelet. Campbell (1988) keyed the two genera out on the grounds of glume number, with *Neomicrocalamus* having one glume, while *Racemobambos* has two to three, reflecting the different insertion of the prophyll described above. Although the prophyll in *Neomicrocalamus prainii* is inserted at the point of branching as in iterlauctant inflorescences, neither it nor the single glume subtend an axillary bud. Consequently the inflorescence is semelauctant, being incapable of development of further axes after an initial phase of growth.

HIMALAYAN TAXA

The type species, *Neomicrocalamus prainii* (Gamble) Keng f., was described from a collection by Prain in Nagaland of a bamboo known locally as *sampit*, which has solid culms.

Collections by Rollo in Nagaland of a similar bamboo with the local name *kevva* were included in *Arundinaria prainii* by Gamble, although they differ in having hollow culms, longer leaf sheath ligules, and longer, broader, more papery leaves. This bamboo had been collected by Griffith in Bhutan 53 years earlier in 1838, and the name *Bambusa andropogonifolia* was published in his Itinerary Notes (Griffith, 1848), with a brief diagnosis. The specific epithet would appear to be derived from the distinctive ovate acuminate leaves that are reminiscent of

a small oriental beard, and the diagnosis succinctly described the delicate leaf texture and the narrow culms. Together these details were sufficient to identify the bamboo at that time. Moreover, the holotype of this species is preserved at Kew with Griffith's original itinerary number attached, so there is no question as to the identity of the species he was describing. The delicacy of the papery crinkled leaves was echoed by Mann in his notes on Rollo's collections from Nagaland, in which he expressed his doubt as to the inclusion of the specimens in *Arundinaria prainii* Gamble. Griffith's collection was determined by Munro as belonging to the vaguely similar Burmese species *Cephalostachyum pallidum* Munro, presumably after publication of that species, as he did not cite Griffith's Bhutan collection. *Bambusa andropogonifolia* is transferred to *Neomicrocalamus* below, with a more comprehensive description. This attractive bamboo is highly valuable, having hard shiny flexible culms. The surface strips are stained and woven into ornamental food containers in Bhutan.

Neomicrocalamus microphyllus Hsueh & Yi has been described from material collected in South-east Tibet. It has nearly solid culms and very rough hispid culm sheaths as well as smaller leaves.

A further species, *Neomicrocalamus mannii* (Gamble) R. B. Majumdar, is known from Meghalaya (Jaintia). It has solid culms, and can easily be distinguished from *N. prainii* and *N. andropogonifolius* by its narrow leaves, the oral setae on its leaf sheaths, and also by its very distinctive culm sheaths. These are very rough, and have much broader, longer blades than the culm sheaths of *N. prainii* or *N. andropogonifolius*. The blades are up to 20cm long and 1cm wide, and pubescent within, densely so above the well-developed dentate ligule. *N. mannii* was also reported as occurring in Arunachal Pradesh (Burkill, 1924, cited in Campbell, 1988), and therefore it may possibly occur in eastern Bhutan. If it is encountered, it would be very easy to distinguish it from *N. andropogonifolius*, because of its narrower, thicker leaves with short ligules and oral setae, its much longer, broader, pubescent blades on very rough culm sheaths, and its solid culms.

The identity of *Neomicrocalamus clarkei* (Gamble ex Brandis) R. B. Majumdar from Manipur is obscure. It has been considered synonymous with *N. mannii* (Gamble) R. B. Majumdar (Campbell, 1988). No collections were cited when it was first described, no specimens have been located in British herbaria, and it was transferred into *Neomicrocalamus* (Majumdar, 1989) without reference to any specimens. The original description was totally inadequate, and consequently this name has never been validly published, and should be ignored unless specimens that Gamble and Brandis would have seen are located.

Thus a total of four species of *Neomicrocalamus* are now known from the eastern end of the Himalayas, Tibet and NE India.

ENUMERATION OF SPECIES

1. *Neomicrocalamus andropogonifolius* (Griffith) Stapleton, **comb. nov.**

Neomicrocalamo prainii affinis, sed culmis fistulosis, vaginis culmorum glabris, nodis ramulorum geniculatis tumidis differt.

Type: Bhutan, Tashigang district, Diri Chhu, [27° 10'N 91° 26'E], 3500ft, *Griffith* Itin. 417 (holo. K).

Syn.: *Bambusa andropogonifolia* Griffith, Itin.: 124 (1848).

[*Microcalamus prainii* Gamble, J. Asiatic Soc. Bengal 59: 207 (1890) *pro parte, nom. illeg.*]; *Arundinaria prainii* Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7: 21 (1896) *pro parte*; *Racemobambos prainii* (Gamble) Keng f. & Wen, J. Bamboo Res. 5(2): 13 (1986) *pro parte*.

[*Neomicrocalamus ringshu* Stapleton, unpublished PhD thesis, University of Aberdeen: 169 (1991)].

Representative specimens:

INDIA: Nagaland, Zullah Valley, 10 miles W of Konom, 5400ft, *Rollo* s.n. (K).

BHUTAN: Bhutan, Tashigang dist., Deothang, Narphung La, 26° 59'N 91° 32'E, 1700m, 8 i 1987, *Stapleton* 454a (THIM); 'Boutan', *Griffith* K.D. 2679 (BM); *ibid.* *Griffith* K.D. 2479.

Local names: *ringshu* (E Bhutan), *ula* (Kengkha), *langma* (Nepali), *kevva* (Naga).

Similar to *Neomicrocalamus prainii* (Gamble) Keng f., and included by him in that species, but differing in its hollow culms, glabrous culm sheaths, and swellings on the geniculate branchlet nodes.

Clumps small, open, spreading. *Rhizomes* pachymorph, up to 2m long. *Culms* semi-scandent, maximum length 12m, maximum diameter 1cm, hollow; walls up to 3mm thick; nodes raised substantially; internodes up to 40cm long; surface extremely smooth, shiny and tough, with no hairs or wax, becoming dark glossy green. New *culm sheath* from breast height up to 2.5cm wide at base; height to ligule c.14cm, persistent, tough, surface completely glabrous and smooth, mottled with purple spots and darker at the base; blade up to 1cm long, <1mm wide, persistent but delicate, acicular; shoulders glabrous; auricles absent; oral setae absent; ligule barely distinguishable, very short. New *leaf sheath* surface and edges glabrous; external ligule pronounced, glabrous or very shortly ciliate; auricles absent; oral setae absent; ligule 1–3mm long, rhomboid or acute, glabrous, very shortly (0.1mm) ciliate. *Leaf blade* maximum length and breadth 120 × 13mm, chartaceous, ovate-acuminate to broadly linear-lanceolate, surfaces and petiole completely glabrous. *Branches* up to 20 at mid-culm; central branch often strongly dominant, up to 1cm in diameter, without aerial roots; branch nodes strongly geniculate and swollen. *Inflorescence* not known.

Distribution: Bhutan, India (Nagaland).

Subtribe **Shibataeinae** (Nakai) Soderstrom & Ellis, Soderstrom et al. (eds.), Grass Systematics and Evolution: 238 (1988).

Inflorescence semelauctant, fully bracteate with prophylls at the point of branching, florets with 3 stamens. Rhizomes leptomorph.

15. Chimonobambusa Makino, Bot. Mag. (Tokyo) 28: 153 (1914).

Type species: *Chimonobambusa marmorea* (Mitford) Makino.

Tender to frost-hardy bamboos from lower temperate zones. Stands diffuse, rhizomes leptomorph. Culms erect, surface smooth, with moderate sulcation above buds. Inflorescence semelauctant, with no buds at the base of the inflorescence. Panicle branches subtended by large sheaths, often with blades, branch prophylls present. Mid-culm branch buds enclosed by two

single-keeled bracts, always open at the front. Mid-culm branch axes usually 3, always subtended by sheaths. Leaf venation strongly tessellated.

Chimonobambusa species are quite closely related to the better-known Chinese and Japanese bamboos in the genus *Phyllostachys*. They have similar grooving on one side of the culm, although this is much more marked in *Phyllostachys*, and a branch complement of three branches at most mid-culm nodes. *Phyllostachys* species usually have only two branches.

The inflorescence in the Shibataeinae has been interpreted as iterarctant (Soderstrom & Ellis, 1988; Chao & Renvoize, 1989). Examination of the inflorescence in *Phyllostachys* and *Chimonobambusa* species would suggest, however, that in this subtribe it is actually semelauctant, with no buds at the base of the spikelets. Soderstrom & Ellis (1988) strangely excluded *Chimonobambusa* from this subtribe, placing it in the Arundinariinae instead.

Only one species has been found in the Himalayas: *C. callosa* (Munro) Nakai. This thorny species is mainly known from Mizoram, Manipur and Meghalaya. It is also common in high rainfall areas of southern Bhutan, and occurs in the upper Mo Chhu Valley in northern Bhutan.

ENUMERATION OF SPECIES

1. *Chimonobambusa callosa* (Munro) Nakai, J. Arnold Arbor. 6: 151 (1925).

Type: India, Meghalaya, Myrung, 6 vii 1850, *Hooker f. & Thomson* 1504 (lecto. selected by Chao & Renvoize, 1989, corrected here, K).

Syn.: *Arundinaria callosa* Munro, Trans. Linn. Soc. London 26: 30 (1868);
Chimonocalamus callosus (Munro) Hsueh & Yi, Acta Bot. Yunnan 1(2):
 84 (1979).

Representative specimens:

BHUTAN: Chhukha, Gedu, 26°55'N 89°32'E, *Stapleton* 881 (THIM); Tashigang, Riserboo, 2200m, 27°05'N 91°25'E, *Grierson & Long* 2258 (THIM, K, E); Chhukha, Jumdag, 2210m, 26°55'N 89°33'E, *Grierson & Long* 3065 (THIM, E).

Local names: *u* (Dzongkha), *rawa* (Kengkha), *khare bans*, *khare maling* (Nepali).

Nomenclatural note: Munro (1868) cited two syntypes for this species. Both were collected by Hooker f. and Thomson in the area then known as Khasia: no. 1504 in Myrung on July 6th 1850, the other in Moflong on August 2nd 1850. The Myrung collection is the better, as it contains culm sheaths as well as leaves, and it clearly shows the callus on the base of the petiole from which the specific epithet was derived. Moreover, it comes from Munro's herbarium and has his handwritten description attached. When publishing their selection of lectotype, Chao & Renvoize (1989) gave the citation 'India: Meghalaya, Khasia Hills, 6000ft, 1850, *Hooker, K*'. Munro (1868) gave the altitude of 6000ft for the collection from Moflong, while he gave an altitude of 5650ft for the Myrung collection. However, there are no altitudes on the actual specimens, and Munro may have estimated them from Hooker (1854), in which the altitude of Moflong was given as 6062ft, while Myrung was described as being reached after dropping 400ft. Therefore the altitudes are not reliable and they cannot accurately identify a lectotype. Moreover, Chao & Renvoize did in fact attach a slip stating 'Hooker in 1850 lectotype' to Munro's Myrung specimen. Thus the published lectotypification of Chao & Renvoize (1989) is rather unsatisfactory, and I correct it here, giving fuller details of the collection that they probably intended as the lectotype, which is clearly the more appropriate of the two syntypes.

CHECKLIST OF THE BAMBOOS OF NEPAL AND BHUTAN

Subtribe **Bambusinae** Agardh

- Bambusa alamii** Stapleton
Bambusa balcooa Roxb.
Bambusa clavata Stapleton
Bambusa multiplex (Lour.) Raeusch. ex J.A. & J.H. Schult.
Bambusa nepalensis Stapleton
Bambusa nutans Wall. ex Munro
 subsp. **nutans**
 subsp. **cupulata** Stapleton
Bambusa tulda Roxb.
Dendrocalamus giganteus Munro
Dendrocalamus hamiltonii Nees & Arn. ex Munro
 var. **hamiltonii**
 var. **edulis** Munro
 var. **undulatus** Stapleton
Dendrocalamus hookeri Munro
Dendrocalamus sikkimensis Gamble ex Oliver
Dendrocalamus strictus (Roxb.) Nees

Subtribe **Melocanninae** Reichenbach

- Melocanna baccifera** (Roxb.) Kurz
Cephalostachyum latifolium Munro
Teinostachyum dullooa Gamble
Pseudostachyum polymorphum Munro

Subtribe **Arundinariinae** Bentham

- Arundinaria racemosa** Munro
Thamnocalamus spathiflorus (Trin.) Munro
 subsp. **spathiflorus**
 subsp. **nepalensis** Stapleton
 subsp. **occidentalis** Stapleton
 var. **bhutanensis** Stapleton
 var. **crassinodus** (Yi) Stapleton
Borinda chigar Stapleton
Borinda emeryi Stapleton
Borinda extensa (Yi) Stapleton
Borinda farcta (Yi) Stapleton
Borinda glabrifolia (Yi) Stapleton
Borinda grossa (Yi) Stapleton
Borinda macclureana (Bor) Stapleton

Borinda setosa (Yi) Stapleton
Yushania hirsuta (Munro) R.B. Majumdar
Yushania maling (Gamble) R.B. Majumdar
Yushania microphylla (Munro) R.B. Majumdar
Yushania pantlingii (Gamble) R.B. Majumdar
Drepanostachyum annulatum Stapleton
Drepanostachyum falcatum (Nees) Keng f.
Drepanostachyum intermedium (Munro) Keng f.
Drepanostachyum khasianum (Munro) Keng f.
Himalayacalamus asper Stapleton
Himalayacalamus brevinodus Stapleton
Himalayacalamus cupreus Stapleton
Himalayacalamus falconeri (Munro) Keng f.
Himalayacalamus fimbriatus Stapleton
Himalayacalamus hookerianus (Munro) Stapleton
Himalayacalamus porcatus Stapleton
Ampelocalamus patellaris (Gamble) Stapleton

Subtribe ***Racemobambosinae*** Stapleton

Neomicrocalamus andropogonifolius (Griffith) Stapleton

Subtribe ***Shibataeinae*** (Nakai) Soderstrom & Ellis

Chimonobambusa callosa (Munro) Nakai

– FINIS –

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