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THE BAMBOOS OF NEPAL AND BHUTAN
PART I: *Bambusa, Dendrocalamus, Melocanna, Cephalostachyum, Teinostachyum,* and *Pseudostachyum* (Gramineae: Poaceae, Bambusoideae)

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Bamboos encountered during extensive fieldwork in Nepal and Bhutan are enumerated in three papers. Fifteen genera are recognized, including several genera recently described in China and one new genus. In Part I delimitation of the Himalayan bamboo subtribes and genera is discussed, and a key to the genera is given. The systematic treatment begins with six tropical and subtropical genera which all have iterauctant inflorescences and 6 stamens. *Bambusa* and *Dendrocalamus* are in the subtribe Bambusinae Agardh, having solid styles. *Melocanna, Cephalostachyum, Teinostachyum,* and *Pseudostachyum* have elongated hollow styles and are in the subtribe Melocanninae Reichenbach. Five new taxa are described: *Bambusa nepalensis* from central and eastern Nepal; *Bambusa clavata* from Bhutan; *Bambusa alamii* from Nepal, Bhutan, and Bangladesh; *Bambusa nutans* Wall. ex Munro subsp. *cupulata* from Nepal, Bhutan, Bangladesh, and India; and *Dendrocalamus hamiltonii* Nees & Arn. ex Munro var. *undulatus* from Nepal.

INTRODUCTION

Bamboo taxonomy has suffered considerable neglect over the last century, largely because of the scarcity of flowering material arising from the peculiar flowering behaviour of the bamboos. Study of the Himalayan species has suffered from the additional problems of physical and political inaccessibility. Bamboos are acknowledged to be a difficult group, but their morphology includes several taxonomically useful characters which are not generally available in other grasses. These include specialized culm sheaths and well-developed branch complements. In addition, many genera have forms of iterauctant inflorescence, the spikelets of which have basal buds, which can lead to various degrees of ramification. Maximum use of these characters was not made in classic treatments of the bamboos, and neither vegetative nor floral morphology was well understood. There is now a better understanding of the different forms of rhizome, inflorescence, and vegetative branching pattern. This, along with more detailed descriptions of a wide range of material from China, has allowed a better appreciation of the wide range of morphological characters available.

The value of bamboos in supplying many basic rural requirements in under-developed countries, along with their inherent soil-conserving properties, has been appreciated more widely in recent years. This has led to their inclusion in development activities in many regions of the Indian subcontinent. Wetter subtropical and warm temperate areas of the monsoonal Himalayas are particularly well suited to bamboos, and to the east of longitude 83°E bamboos become increasingly important in rural land-use.

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Permission was granted to study the bamboos of Nepal and western Bhutan in order to provide information for forestry and agricultural development projects. This enumeration concentrates upon the bamboos of Nepal east of 83ºE, and those of Bhutan west of 91ºE. Much fieldwork remains to be undertaken in eastern Bhutan, India's north-eastern states, south-east Tibet, west of 83ºE in Nepal and in north-western India, but this account should provide a more reliable generic framework for future studies into most of the Himalayan taxa.

The bamboos of South Asia were researched comprehensively by Gamble (1896), building upon the extensive coverage of Indian bamboos in Munro's monograph (1868), and a system of subtribes formalized by Bentham (1883). Japanese and Chinese taxonomists began to study the morphology of their bamboos in more depth this century (Makino, 1901; Nakai, 1925, 1934–6; Keng, 1957; Usui, 1957). Western taxonomists with experience in the Far East added their own morphological insights (Holttum, 1956a, 1958; McClure, 1966). A dramatic increase in the study of bamboos has occurred in the last fifteen years, with several institutions in China investigating bamboo morphology and taxonomy, and describing large numbers of new taxa. However, knowledge of Himalayan taxa has remained inadequate, with only ten species from four genera recorded from Nepal, and lists of Bhutanese species still based essentially upon those known from Sikkim, West Bengal, and Assam.

The evolutionary position of the bamboos within the Gramineae remains controversial, but the retention of 6 stamens and 3 lodicules and the occurrence of indeterminate (iterauctant) prophyllate inflorescences are considered to be of phylogenetic significance, and the bamboos are usually considered to retain more ancestral traits than most other grasses.

Supra-generic taxa within the subfamily Bambusoideae have not been agreed upon. It has usually been divided into a woody tribe, Bambuseae, and tribes of herbaceous bambusoid grasses, most of which come from Central and South America. Calderón & Soderstrom (1980) attributed the Bambusoideae to Nees (1835), and Bambuseae to Kunth (1815). The bambusoid grasses are affiliated to woody bamboos largely because of similarities in leaf anatomy. Calderón & Soderstrom (1980) gave full descriptions for these two groups. Watson et al. (1985) later placed woody bamboos and bambusoid grasses in their supertribes Bambusanae and Oryzanae respectively, but the former would appear to be synonymous with Bambuseae Kunth.

The woody or true bamboos are characterized by lignification of culms supporting substantial branch systems, infrequent flowering, and rapid growth of culms from well-developed rhizome systems by synchronous intercalary growth of many pre-formed internodes supported by specialized sheaths. They are often divided into two taxa, given the status of supertribe: Bambusodae Keng & Keng f. ex L. Liou (1980) (Syn. Bambusateae Keng & Keng f. (1959) *nom. seminud.*), with indeterminate (iterauctant) inflorescences, and the Arundinarodae Keng & Keng f. ex L. Liou (1980) (Syn. Arundinariateae Keng & Keng f. (1959) *nom. seminud.*), with determinate (semelauctant) inflorescences. The recognition of these taxa at the supertribe level conflicts with other treatments and their usefulness is questionable, as the distinction between them is essentially based upon a single, poorly defined character.

Soderstrom & Ellis (1987) suggested that the semelauctant inflorescence may have evolved independently in different subtribes. They recognized a system of subtribes which relied principally upon characters of leaf anatomy. Keng (1982–3) had used a different system with a

larger number of tribes and subtribes, utilizing a wider range of characters, but his tribes and subtribes were not clearly defined. It may be more appropriate to compromise between the two taxa of Keng & Keng f. ex L. Liou, and the many small tribes and subtribes of Keng (1982–3) and to divide the tribe Bambuseae principally into four subtribes delineated by the development of semelauctant and/or ebracteate inflorescences, and reduction of stamen number to 3, with further subtribes for natural groupings such as the genera with elongated hollow styles in the subtribe Melocanninae Reichenbach, and other groups found in the southern hemisphere and South America. This arrangement is followed here, with a new subtribe Racemobambosinae described for a small group of genera with 6 stamens and semelauctant inflorescences, which appear to represent a morphologically intermediate stage between the larger subtribes Bambusinae and Arundinariinae.

Different authorities place different emphasis upon floral and vegetative characters, but it is now becoming accepted that they are both important and that a natural taxonomic system should incorporate characteristics of both floral and vegetative morphology. The importance of culm sheaths at the species level has long been appreciated, and this is now being followed by a realization of the need to place greater emphasis upon vegetative characters at the generic level as well. The practical benefits of this become apparent when identification of sterile material has to be undertaken, especially in plants such as these with flowering cycles of up to 150 years. However, further morphological studies are still necessary to clarify the relationships between vegetative and floral characters in the bamboos, and to arrive at a compromise between different approaches to their taxonomy.

In many taxa few collections have been seen, and the flowers of several taxa are not yet known. It is difficult to assess morphological variability within such species at this stage, and further fieldwork is required to investigate boundaries between closely related species more thoroughly. It is also necessary to refine generic and species concepts. Species within some genera, for example *Arundinaria*, are remarkably consistent in their morphology, while species from other genera, such as *Chimonobambusa*, seem highly variable. Some species are consistent in vegetative characteristics while varying greatly in floral details, and vice versa. The species concepts and to a lesser extent generic concepts of Chinese taxonomists have usually been narrower than those of western taxonomists. This may be because western systems have relied upon floral characters which are in short supply in most grasses, while Chinese taxonomists have exploited more vegetative characters, but the scarcity of infra-specific taxa in Chinese literature does suggest a narrower species concept.

Specimen citation is mainly restricted to collections made within Nepal or Bhutan, and these are few in number. Most bamboo specimens at KATH are duplicated at BM or K. Specimens at THIMPHU are often not duplicated in the United Kingdom, as severe restrictions are placed upon removal of plant material from the Kingdom of Bhutan at the present time. Study of the fauna and flora by non-nationals is strictly controlled, and special permission was granted by the relevant authorities for this work to be undertaken. THIMPHU is not yet included in the Index Herbariorum. However, the collections are curated and fully documented, and the Forest Department allows reference to the collections by all those involved in approved projects. All specimens cited are at K unless indicated otherwise, but further duplicates will be distributed. Terminology adopted follows the glossary in McClure (1973).

CONSPECTUS OF THE HIMALAYAN SUBTRIBES AND GENERA

Bambusinae Agardh

1. **Bambusa** Schreber
2. **Dendrocalamus** Nees

Melocanninae Reichenbach

3. **Melocanna** Trinius
4. **Cephalostachyum** Munro
5. **Teinostachyum** Munro
6. **Pseudostachyum** Munro

. . . . . Part I

Arundinariinae Bentham

7. **Arundinaria** Michaux
8. **Thamnocalamus** Munro
9. **Borinda** Stapleton
10. **Yushania** Keng f.

. . . . . Part II

11. **Drepanostachyum** Keng f.
12. **Himalayacalamus** Keng f.
13. **Ampelocalamus** Chen, Wen, & Sheng

Racemobambosinae Stapleton

14. **Neomicrocalamus** Keng f.

Shibataeinae (Nakai) Soderstrom & Ellis

15. **Chimonobambusa** Makino

. . . . . Part III

KEY TO INDIGENOUS GENERA (AS REPRESENTED IN THE HIMALAYAS)

1a. Inflorescence fully bracteate; all axes within the inflorescence subtended by a sheath and bearing a prophyll borne close to the point of branching _____ 2

1b. Inflorescence partially ebracteate; inflorescence axes with some or all of the subtending sheaths or prophylls reduced or absent _____ 8

2a. Inflorescence semelauctant, basal bracts of spikelets not subtending buds capable of development into further spikelets; stamens 3, rhizomes leptomorph (length of internodes greater than diameter, culm axes well differentiated from rhizome axes); culm nodes prominently swollen, often bearing thorns _____ 15. **Chimonobambusa**

2b. Inflorescence iterauctant, basal sheaths of spikelets subtending buds normally capable of development into further spikelet axes; stamens 6, rhizomes pachymorph (diameter of

root-bearing internodes greater than length, rhizome axes normally developing directly into culm shoots); culm nodes not prominently swollen ____ 3

3a. Style short and solid, culm sheath blade broadly triangular, mainly giant bamboos 12–30m in height ____ 4

3b. Style elongated and hollow, culm sheath blade narrowly triangular to lanceolate, mainly bamboos of medium height, 8–20m tall ____ 5

4a. Inflorescence bud enclosed by single broad 2-keeled prophyll, new culms usually covered with thin waxy deposits ____ 1. **Bambusa**

4b. Inflorescence bud enclosed by two narrow single-keeled bracts, new culms covered with thick dark waxy deposits ____ 2. **Dendrocalamus**

5a. Maximum length of rhizome neck more than 50cm, culms diffuse or pluricaespitose ____ 6

5b. Maximum length of rhizome neck less than 50cm, culms unicaespitose ____ 7

6a. Fruit more than 5cm long, pear shaped, culms up to 7cm in diameter, culm sheath lanceolate ____ 3. **Melocanna**

6b. Fruit less than 1cm long, culms up to 4cm in diameter, culm sheath triangular ____ 6. **Pseudostachyum**

7a. Inflorescence dense ____ 4. **Cephalostachyum**

7b. Inflorescence open ____ 5. **Teinostachyum**

8a. Rhizomes leptomorph (length of internodes greater than diameter, culm axes well differentiated from rhizome axes) ____ 7. **Arundinaria**

8b. Rhizomes pachymorph (diameter of root-bearing internodes greater than length, axes normally developing into culm shoots) ____ 9

9a. Stamens 6 ____ 14. **Neomicrocalamus**

9b. Stamens 3 ____ 10

10a. Mid-culm branch prophylls 2-keeled, no replication of lateral branches ____ 8. **Thamnocalamus**

10b. Mid-culm branch prophylls single-keeled, lateral branch axes often replicated side by side without subtending sheaths ____ 11

11a. Front of mid-culm bud-scale closed by fusion of margins ____ 13. **Ampelocalamus**

11b. Front of mid-culm bud-scale open with free margins ____ 12

12a. Mid-culm buds tall, < 10 branches in the first year ____ 13

12b. Mid-culm buds short, >10 branches in the first year ____ 14

13a. Rhizomes up to 2m long ____ 10. **Yushania**

13b. Rhizomes up to 30cm long ____ 9. **Borinda**

14a. Spikelets with 2 or more flowers ____ 11. **Drepanostachyum**

14b. Spikelets usually 1-flowered ____ 12. **Himalayacalamus**

SYSTEMATIC TREATMENT

Subtribe **Bambusinae** Agardh, Aphor., g. 153 (1823).
Inflorescence iterauctant, fully bracteate, stamens 6 or more, style solid.

1. Bambusa Schreber, Gen. Pl. 1: 236 (1789), **nom. cons.**
Type species: *Bambos arundinacea* Retz.

Tropical and subtropical bamboos from 2m to 25m in height. Inflorescence iterauctant, enclosed by a 2-keeled prophyll, the florets usually separated by clearly distinguishable disarticulating rhachilla internodes. Stamens 6, filaments free, spikelets terminating in an incomplete or rudimentary floret, paleas keeled and acute. Rhizomes pachymorph, without extended necks.

GENERIC STATUS AND SEPARATION

This genus has around 120 species (Clayton & Renvoize, 1986), but has not been revised comprehensively since the monograph of Camus (1913), in which 73 species were described. As well as being the most common bamboo genus in the Indian subcontinent, it is also indigenous to most of Southeast Asia, and is cultivated in most tropical regions of the world. *Gigantochloa, Thyrsostachys,* and *Dendrocalamus* are very similar to *Bambusa,* and it is difficult to separate the four genera without flowers.

Gigantochloa species occur mainly in Malaysia, although the species *G. macrostachya* Kurz has also been collected in Assam. They can be distinguished when flowering by the termination of their spikelets in a long, empty lemma. In addition, their stamens have filaments fused into a tube, but the spikelet termination is considered a better distinguishing characteristic (Holttum, 1946).

Thyrsostachys species differ from *Bambusa* species in having deeply cleft paleas. The only two species known also have much narrower leaves than those of most *Bambusa* species. They are common in Thailand and Burma, and probably extend into Assam.

Dendrocalamus was described by Nees (1834) when only one species was known. His description was incorrect in stamen number, and his concept of the genus was subsequently expanded to accommodate a wider range of species. Munro (1868), Bentham (1883), and Gamble (1896) separated *Dendrocalamus* species from those of *Bambusa* on seed characters, but the inadequacy of these characters for separating the two genera was demonstrated by Holttum (1956a). The extension and disarticulation of rhachilla internodes was informally adopted as a better character, but this remains unsatisfactory in many intermediate species. Soderstrom & Ellis (1987), in a provisional revision of bamboo genera, remarked upon the need for better characters to separate *Bambusa* and *Dendrocalamus*.

Investigations into the inflorescences of *Bambusa* and *Dendrocalamus* species from the Himalayas (Stapleton, 1991) have shown that the number of keels on the inflorescence prophyll can distinguish between the two genera with much less ambiguity than rhachilla disarticulation. Prophylls of *Bambusa* species were shown to have two keels, while those of *Dendrocalamus* species had only one (see Fig. 1). Prophylls basal to their pseudospikelets

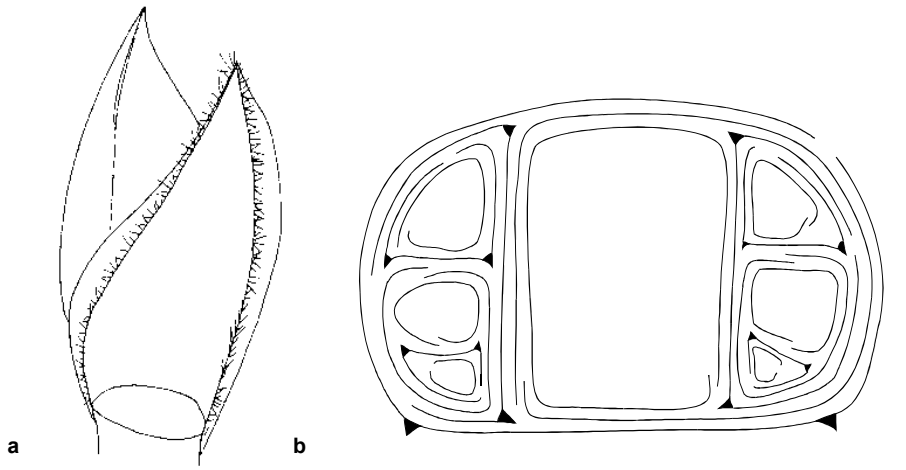

FIG. 1. Inflorescence sheathing in *Bambusa nutans.* a, 2-keeled prophyll and the subsequent sheath, ×4; b, diagrammatic cross-section of major sheaths within the inflorescence, ×8.

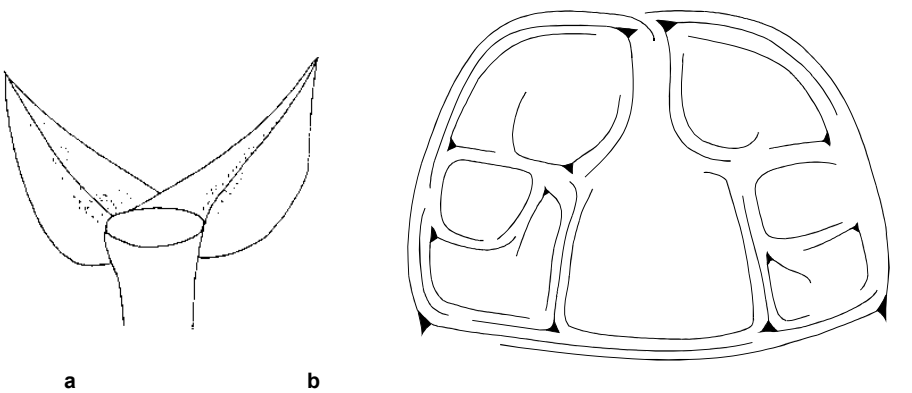

FIG. 2. Inflorescence sheathing in *Dendrocalamus hamiltonii.* a, single-keeled prophyll and subsequent sheath, ×4; b, diagrammatic cross-section of major sheaths within the inflorescence, ×8.

show the same distinction. This finite difference in keel number results from the greater width of sheaths throughout the inflorescence in *Bambusa* species (Fig. 2).

Separation of *Dendrocalamus* and *Bambusa* without flowers can be difficult. Typical *Bambusa* species have large culm sheath auricles, glossy culms, uniform branches, and small leaves. However, *Bambusa* species with narrower prophylls and shorter rhachilla sections tend to possess some of the vegetative characteristics more typical of *Dendrocalamus* species. These include small or absent culm sheath auricles, dense furry wax on the culms, dense pubescence on the culm sheaths, large root-bearing central branches, and large leaves.

A further related genus with narrow, rough, scrambling or climbing culms with thickened nodes and tiny capitate iterauctant inflorescences, *Melocalamus*, is known from Assam, and may also occur in Nepal and Bhutan.

SPECIES ENCOUNTERED IN NEPAL AND BHUTAN

The well-known species of the Gangetic plains, *Bambusa vulgaris*, *B. arundinacea*, and *B. tulda,* are all rare in the Himalayas. The common Himalayan species are less well known, and a little harder to distinguish. They can be divided into three groups for identification purposes: large-stature species with prominent culm sheath auricles, large-stature species with small auricles or no auricles at all, and species of smaller stature reaching a diameter at breast height (d.b.h.) of only 5cm or less.

The commonest large-stature bamboos with prominent culm sheath auricles in Nepal and Bhutan are treated here as subspecies of *B. nutans* Wall. ex Munro. Wallich applied the name to collections made in Nepal in 1821 (at Nagarjun, Balaju, Kathmandu Valley, where this bamboo is known in Nepali as *tharu bans*). Since then the name *B. nutans* has usually been applied to a different taxon in Nepal, known as *mal* or *makla bans* in the eastern Himalayas. These two taxa are very close and can be considered subspecies of *B. nutans*. Buchanan-Hamilton used the name *B. macala* for the eastern subspecies in his unpublished catalogue and on herbarium labels, but this name has since been widely applied as a synonym of a different species, *B. tulda,* which also has the local name *makla bans*. The eastern subspecies is described as subsp. *cupulata* below, because of its strongly cupped culm sheath blades, rather than adopting Buchanan-Hamilton's unpublished epithet which might cause confusion.

B. tulda occurs sporadically along the outer foothills of Nepal and Bhutan, being common around the Chitwan area of the Nepalese plains (terai) and in Chirang district of southern Bhutan. Although previous authors have found it difficult to define the distinction between *B. nutans* and *B. tulda* accurately, living plants of the two species are readily distinguishable in Nepal and Bhutan. *B. tulda* has shorter, slightly crooked culms with much thicker walls and faint to obscure yellow stripes towards the base. In the field and in better herbarium collections, the leaves of *B. tulda* are distinguishable by the much larger leaf sheath auricles with widely spreading setae. In addition the smaller of the two culm sheath auricles is generally narrower and taller than that of *B. nutans*, and there are fewer hairs inside the culm sheath blade. The spikelets of *B. tulda* have longer rhachilla internodes than those of *B. nutans*, and the spikelets remain intact for longer. Towards the western end of its range in the terai of Lumbini District in West Nepal (where it is known locally as *chab bans*), *B. tulda* becomes progressively shorter with heavier branching, smaller leaves, and more crooked culms.

Species without large prominent culm sheath auricles are more difficult to distinguish from *Dendrocalamus* species when flowers are not available. Such intermediate species include two new species apparently endemic to the Himalayas, *Bambusa nepalensis* and *Bambusa clavata,* both of which have very small auricles with spreading setae, and *B. balcooa*, which has no auricles at all. These three species have certain characteristics in common with *Gigantochloa* species from Southeast Asia. Vegetative appearances are similar, and their flowers also have superficial similarities.

Sinocalamus McClure (1940), *Neosinocalamus* Keng f. (1983), *Dendrocalamopsis* (Chia et Fung) Keng f. (1983), and *Sellulocalamus* W.T. Lin (1989) have been described for species which are intermediate between *Bambusa* and *Dendrocalamus*, but it seems very difficult to distinguish between all these genera consistently. Even the genera *Dendrocalamus* and *Gigantochloa* are very difficult to separate from *Bambusa*, and might not be upheld as separate genera by some western taxonomists were they not so well established. McClure (1966) eventually decided not to recognize his genus *Sinocalamus*, although it is still recognized by many Chinese taxonomists.

Small-stature bamboos in this genus with culm diameters of less than 5cm are presently quite rare, but they are becoming more widely cultivated in the Nepalese plains (terai) where they can provide small-diameter culms for tying and weaving. The small temperate genera which provide such material in the hills will not grow in the heat of the terai. Chinese hedge bamboo, *B. multiplex,* is one such species, and small varieties are now increasingly cultivated in Nepal for weaving material. A miniature cultivar with culms of less than 5mm diameter and tiny lanceolate leaves, known as the Chinese Goddess bamboo, is grown as a pot-plant or low hedge. *B. multiplex* is a species of wide ecological tolerance, growing from sea-level in Calcutta to over 2300m in Thimphu. A separate species similar to *B. multiplex*, but with large culm sheath auricles, is quite common at the eastern end of the Nepalese terai. It has also been encountered near the Assamese border in central Bhutan. This species has been reported from Bangladesh (Alam, 1982), and is named here as *B. alamii*. As one of only two small-stature bamboos grown in the terai, it is likely to be cultivated more widely in the future.

It is sometimes assumed that most cultivated plants have been introduced from other areas. The natural habitats of any wild *Bambusa* species of the middle hills have been transformed by agricultural activities, but woody cultivated plants are often adopted remnants of the natural vegetation. As the cultivated species and subspecies differ so markedly from those of the Indian plains, it seems likely that nearly all the cultivated *Bambusa* species in the Himalayas are indigenous, and some appear to be endemic.

KEY TO *BAMBUSA* SPECIES AND SUBSPECIES OF NEPAL AND BHUTAN

1a. Culm diameter at breast height more than 5cm ____ 2
1b. Culm diameter at breast height less than 5cm ____ 7

2a. Culm sheath auricle absent ____ 2. **B. balcooa**
2b. Culm sheath auricle present ____ 3

3a. Breadth of culm sheath auricles > 10mm ____ 4
3b. Breadth of culm sheath auricles 2–10mm ____ 6

4a. Leaf sheath auricles large, oral setae spreading ____ 7. **B. tulda**
4b. Leaf sheath auricles small, oral setae erect ____ 5

5a. Culm sheath blade weakly cupped ____ 6a. **B. nutans** subsp. **nutans**
5b. Culm sheath blade strongly cupped ____ 6b. **B. nutans** subsp. **cupulata**

6a. Culm sheath ligule uniformly serrate ____ 5. **B. nepalensis**
6b. Culm sheath ligule fimbriate with large cleavage ____ 3. **B. clavata**

7a. Breadth of culm sheath auricles <1cm ____ 4. **B. multiplex**
7b. Breadth of culm sheath auricles >1cm ____ 1. **B. alamii**

ENUMERATION OF SPECIES IN NEPAL AND BHUTAN

1. **Bambusa alamii** Stapleton, **sp. nov. Fig. 3.**

Vaginis culmorum asymmetricis *Bambusae eutuldoidi* McClure similis, sed culmis gracilibus, laminis vaginorum culmorum aliquantum cordatis et intus glabris, auriculis e laminis magis separatis, laminis foliorum glabris distinguenda.

Type: Nepal, Jhapa, Damak, c.100m, c.26°40′N 87°40′E, 9 i 1991, *Stapleton* 907 (holo. E).

Syn.: *Bambusa* sp. (not identified) [Alam, Plant Tax. Series, For. Res. Inst. Chittagong, Bull. 2: 15, Fig. 8 (1982).]

Representative specimen:

BHUTAN: Gaylegphug, 26°56′N 90°31′E, *Stapleton* 813 (THIMPHU).

Local names: none in Nepal, *mugi bans* (Nepali) in Gaylegphug.

Similar to *Bambusa eutuldoides* in its asymmetrical culm sheaths, but can be distinguished by its narrower culms, the somewhat cordate culm sheath blades which are glabrous inside, the auricles which are more separated from the blades, and its glabrous leaves.

Clumps caespitose, dense. *Rhizomes* pachymorph. *Culm* habit erect to drooping, maximum length 12m; at breast height maximum diameter 3.5cm, walls 0.5cm thick, nodes scarcely raised, no roots; maximum internode length 40cm; surface lightly covered with white wax at first, becoming glossy. New *culm sheath* at breast height 16cm wide at base, asymmetrically triangular, attenuating evenly to 6cm width at ligule, height to ligule 14cm; blade 12cm long, cordate, quite persistent. Sheath persistent, firmly attached above bud, completely glabrous; auricles dissimilar, one 1–2cm wide, rounded, one 2–5cm wide, elongated and tapering, both lightly corrugated, glabrous, and prominently veined; oral setae dense, 10–30 one side, 30–50 other side, 3–10mm long, curving or bent, brown; ligule 0.5–2mm wide, entire, asymmetrical. New *leaf sheath* glabrous, margins glabrous, callus pronounced, glabrous; auricles 1–3mm long, oval, erect or reflexed, larger on lower sheaths; oral setae 1–5 each side, 3–10mm long, deciduous, glabrous, straight, usually erect; ligule c.1mm long, truncate; blade maximum length and breadth 250 × 23mm, glabrous. *Branches* or buds present to ground level;

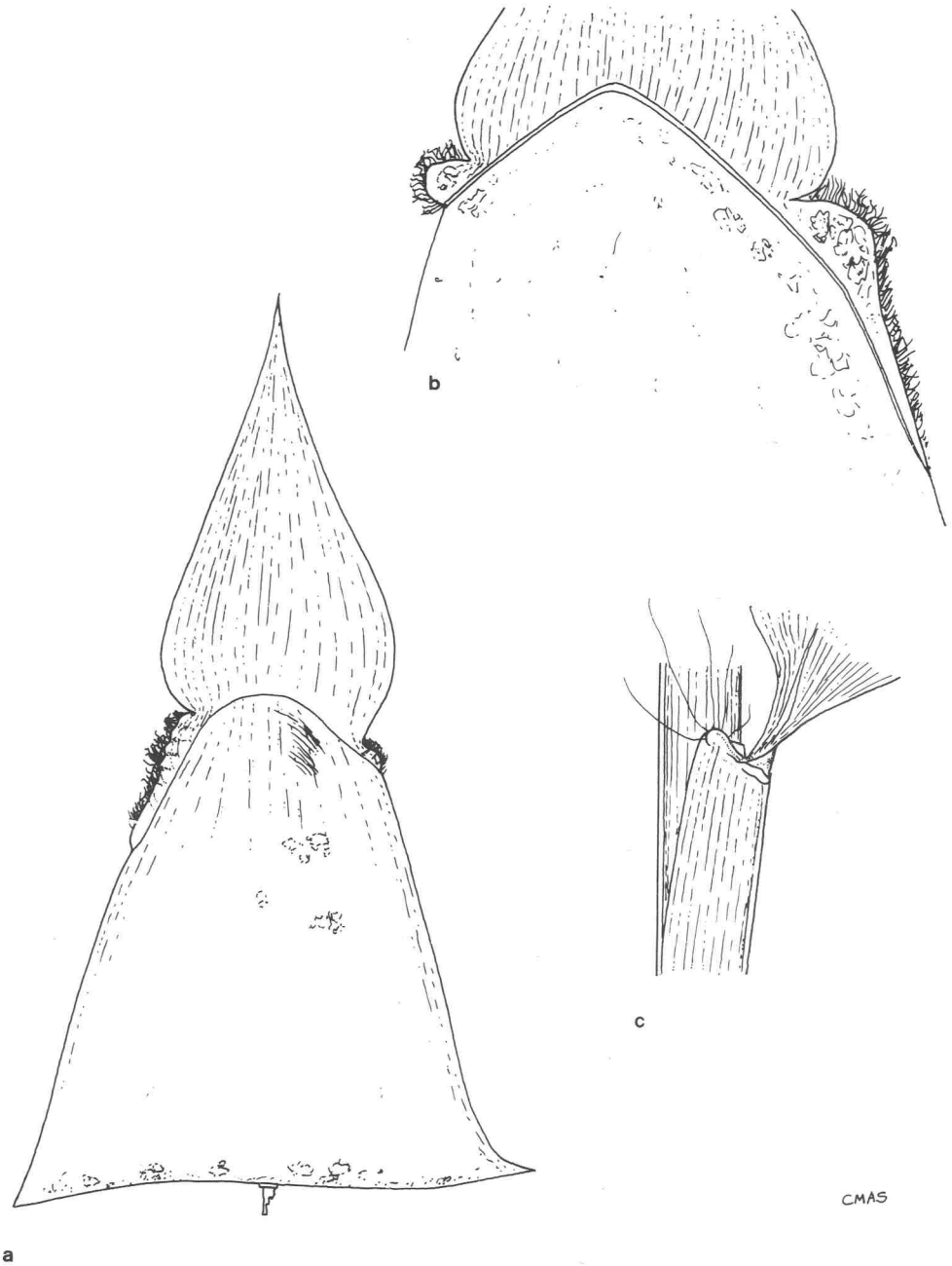

FIG. 3. *Bambusa alamii.* a, culm sheath exterior, ×0.5; b, culm sheath interior, ×0.8; c, leaf sheath, ×3.3.

maximum diameter of mid-culm central branch c.7mm, no roots; maximum diameter of mid-culm laterals 3mm; no thorns. *Inflorescence* not known.
Distribution: Bangladesh, eastern Nepali terai, Assam, southern border of Bhutan.

2. **Bambusa balcooa** Roxb. [Hort. Beng.: 25 (1814) **nom. nud.** ex], Fl. Indica ed. 2, 2: 196 (1832).
Type: Roxb. Icones 1402 (lecto. selected here, K).

Syn.: *Dendrocalamus balcooa* (Roxb.) Voigt, Hort. Sub. Calc.: 718 (1845).
Bambusa vasaria [*sensu* Buch.-Ham., Cat.: 117 *nom. nud.* (1822)] *et* Wall., Cat. 5025 *nom. nud.* (1831–2)], *non sensu* Rumphius, Herb. Amb. (1750).

Representative specimens:

NEPAL: Rupandehi dist., Bhairahawa, *Stapleton* 372; Palpa dist., Dharampani, *Stapleton* 349; Kathmandu, *Stapleton* 154, ibid. *Stapleton,* 335.
BANGLADESH: Dinajpur, Birgunj, *Buch.-Ham.* 883 (E).

Local names: *dhanu bans, bhalu bans*, *bhalkhu bans* (Nepali), *harod bans* (Maithili), *than bans* (Nepali?, Rupandehi dist.).
Distribution: Bangladesh, West Bengal plains, Assam, Bihar, all Nepali terai, and hills of Central and West Nepal.

3. **Bambusa clavata** Stapleton, **sp. nov. Fig. 4.**
Bambusae nepalensi mihi affinis, sed spiculis majoribus purpurei, cera alba culmorum non nisi proxime sub et super nodos biannulata insidentibus, et praeterea a speciebus cognoscentibus omnibus ligulis vaginarum culmorum suis plerumque fissura singula erosa (fissura in lateris oppositis ad nodos alternantes alternans) differt.
Type: Bhutan, Gaylegphug, 26º56′N 90º31′E, 17 ii 1989, *Stapleton* 814 (holo. THIMPHU).
Local names: *pag shi* (Dzongkha), *chile bans* (Nepali).

Related to *B. nepalensis* Stapleton but differing in its larger, more purple spikelets, the white culm wax only found immediately above and below the nodes (in a double ring), and differing especially from all known species by the frequent occurrence of a single bite-like cleavage in the culm sheath ligule, which alternates between opposite sides of the ligule at alternate nodes.

Clumps caespitose, dense. *Rhizomes* pachymorph. *Culm* habit drooping, maximum length 20m, at breast height maximum diameter 9cm, walls c.2cm thick, nodes slightly raised with no roots, maximum internode length 40cm, surface with thin slippery wax covering at first, glossy later, persistent white wax rings above and below the nodes, wax darker immediately below the node. New *culm sheath* from breast height c.35cm wide at base, height to ligule c.20cm; blade large, c.10cm tall and 20cm wide, cordate, with light hairs towards edges at first, deciduous. Sheath deciduous, uniformly covered with mid to very dark brown appressed deciduous hairs at first with more persistent basal ring of hairs; auricles small, rounded, 5–10mm wide; oral setae up to 30 each side, 3–5mm long, curved; ligule 2–15mm tall, fimbriate, asymmetrical with single cleavage when growing strongly, cleavage on alternate sides at alternate nodes. New *leaf sheath* glabrous, margins of upper sheaths glabrous, overlapping edge of lower sheaths ciliate, callus pronounced, glabrous; auricles very small; oral setae 1–5 each side, 2–5mm long, erect or curving; ligule short, < 1mm tall, obliquely truncate, very shortly pubescent, often long ciliate at edges; petiole glabrous. *Branches* or buds absent at basal 5–10 nodes, buds shortly acuminate, maximum diameter of mid-culm central

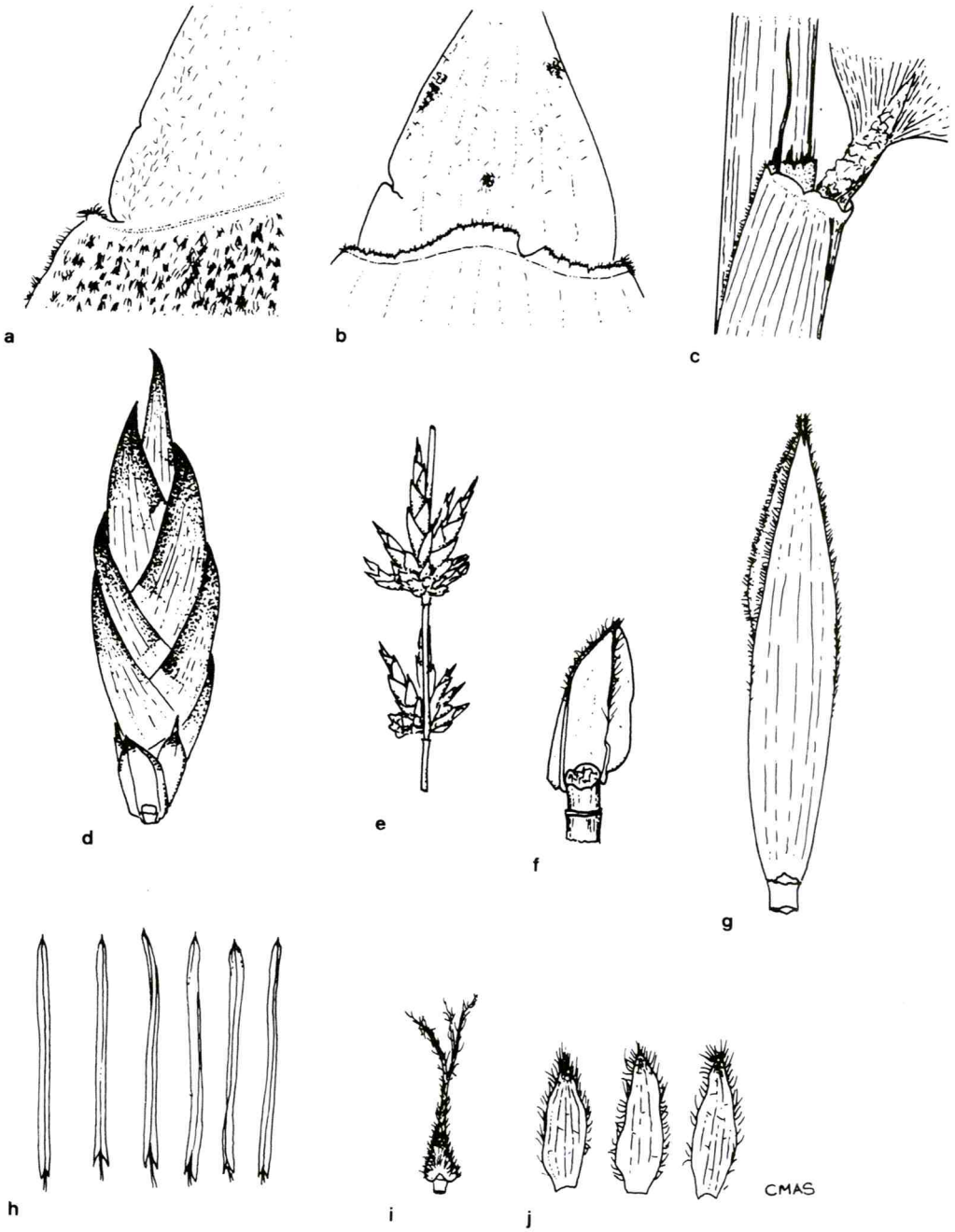

FIG. 4. *Bambusa clavata*. a, culm sheath exterior, ×0.8; b, culm sheath ligule, ×0.4; c, leaf sheath, ×6; d, pseudospikelet, ×2; e, mature inflorescences, ×0.8; f, 2-keeled inflorescence prophyll, ×3; g, palea, ×4; h, anthers ×4; i, gynoecium, ×6; j, lodicules, ×4.

branch 3cm, bearing roots, maximum diameter of mid-culm lateral branches 1cm. Thorns absent. *Inflorescence* branching extremely limited at first, initially only 1–3 large spikelets in a clavate inflorescence, later with up to 30 smaller spikelets in more capitate form. Prophylls all 2-keeled. *Pseudospikelet* with 3 gemmiparous bracts, 0–1 empty glume, 5–8 fertile lemmas, terminating in a rudiment or complete floret; rhachilla sections 1–2mm long, sheath insertion marked by a red band, disarticulation reluctant. *Fertile lemma* 5–19mm long, green where protected, exposed parts dark purple, fading to straw colour, exterior glabrous, very shortly pubescent inside apex, margins glabrous. *Palea* dorsally glabrous, wings lightly scabrous, shorter than fertile lemma, 4–15mm long, narrow; apex acute, single or shortly bifid; margins very shortly to 0.7mm ciliate for distal ⅓ matching keel ciliation; keels in lower florets pronounced and ciliate from base to apex, cilia up to 1mm, upper florets ciliate for distal ½ only, cilia up to 0.5mm long. *Lodicules* 3, lateral pair ovate-acute, 3–6mm tall, shortly fimbriate, rear ovate, 5–7mm tall, 1mm fimbriate. *Stamens* free. *Anthers* 8–10mm long, yellow with purple apiculate or penicillate tips, on separate filaments. *Ovary* triangularly ovate, pubescent, tapering slowly into a 2mm style and branching promptly into 2–3 plumose purple stigmas.

Distribution: Apparently endemic to the hills of central Southern Bhutan, where it is commonly cultivated.

4. **Bambusa multiplex** (Lour.) Raeusch. ex J.A. & J.H. Schult. in Roemer & Schultes, Syst. veg.: 1350–1351 (1830).

Syn.: *Arundo multiplex* Lour., Fl. Cochinch.1: 58 (1790).

Ludolfia glaucescens Willd., Ges. Naturf. Freunde Berlin. Mag. 2: 320 (1808); *Arundinaria glaucescens* (Willd.) P. Beauv., Essai Agrost.: 144, 152 (1812); *Bambusa glaucescens* (Willd.) Holttum, Kew Bull. 11(2): 207, 211 (1956).

Bambusa nana Roxb., Fl. Ind. ed. 2, 2: 199 (1832).

Representative specimens:

INDIA: West Bengal, Kalimpong, *Pradhan* s.n. (THIMPHU).

NEPAL: Kathmandu, cultivated in the Royal Botanic Gardens, Godawari.

BHUTAN: Phuntsholing, 26º52′N 89º23′E, *Grierson & Long* 3003 (THIMPHU, E).

No type specimens remain for either *Arundo multiplex,* a hedge bamboo cultivated in Vietnam*, Ludolfia glaucescens,* a conservatory plant cultivated in Europe*,* or *Bambusa nana*, a hedge bamboo cultivated in India. Their identities were discussed by Holttum (1956b), who concluded that *Ludolfia glaucescens* and *Bambusa nana* were synonymous, while *Arundo multiplex* was a separate species which he distinguished on leaf characteristics. This is surprising, as Young (1946) had written an account of variation within this species, detailing the great variability in leaf size and colour. Holttum (1956b) suggested that *Arundo multiplex* might be synonymous with *B. tuldoides,* but that possibility was later discounted by Soderstrom (1985), who considered that *Arundo multiplex* and *Ludolfia glaucescens* were synonymous, although he had reservations about the identity of *Bambusa nana*. From the descriptions it would appear that all three names are synonymous, but that they all refer to particular cultivars, rather than the natural variety of the species, which is indigenous to China.

It would appear that *Arundo multiplex*, with dark green leaves of up to 15cm, is closest to the normal uncultivated form, while *Ludolfia glaucescens* and *Bambusa nana* represent variously

dwarfed forms with smaller, paler leaves on curving branchlets. Young (1946) described the smaller forms as variety Fernleaf, but as he asserted that most of these forms were not stable, slowly reverting to the larger form, they do not seem to justify full varietal status. Several ornamental cultivars of this species with variegated leaves and culms have been described, including an extremely small plant with solid culms and tiny lanceolate leaves, known as the 'Chinese Goddess' bamboo. A neotype from Vietnam should be selected for *Bambusa multiplex*.

5. **Bambusa nepalensis** Stapleton, **sp. nov. Fig. 5.**

Bambusae kingianae Gamble affinis, sed spiculis minoribus, lemmatis fertilibus paucioribus (2–3), ciliis carinarum palearum paucioribus, stylis longioribus differt.

Type: Nepal, Kathmandu Valley, Bansbari, 27°44′N 85°21′E, 20 xii 1987, *Stapleton* 719 (holo. E).

Syn.: *Dendrocalamus* sp. Type D13 [Stapleton in Jackson (ed.) Manual of Afforestation in Nepal: 209 (1987)].

Representative specimens:

NEPAL: Kathmandu, 27°44′N 85°21′E, *Stapleton* 920 (E); ibid. *Stapleton* 317; Dolakha, Thulopakhar, 27°43′N 85°53′E, *Stapleton* 319; Dhankuta, Hile, 27°02′N 87°19′E, *Stapleton* 109.

Local names: *tama bans* (Kathmandu), *phusre bans*; *khosre bans* (East Nepal).

Related to *B. kingiana*, but with smaller spikelets with fewer fertile lemmas (2–3), fewer cilia on the palea keels, and longer styles.

Clumps caespitose, dense. *Rhizomes* pachymorph. *Culm* habit erect to drooping, maximum length 20m; at breast height maximum diameter 10cm, walls 1–1.5cm thick, nodes scarcely raised at all, no roots; maximum internode length 40cm; surface with fairly dense, very persistent white and brown furry wax below nodes. New *culm sheath* from breast height 50cm wide at base, height to ligule 25cm; blade to 9cm long, 12cm wide, cordate, appressed to culm, very persistent, with dense scattered hairs inside in triangle above ligule. Sheath persistent, sheath and blade uniformly covered in mid-brown fawn or honey-coloured fine appressed hairs, shoulders broad; auricles small, 2–7mm wide; oral setae 5–10 each side, 3–5mm long, curved; ligule 3–5mm tall, uniformly serrate. New *leaf sheath* with bright or dull white appressed or erect quite persistent hairs, overlapping margin shortly ciliate for distal ¼; callus well developed, very shortly ciliate or glabrous; auricles none; oral setae none or 1–2 at first, c.2mm long, erect, deciduous; ligule 2–3mm tall, truncate, serrate or ragged, waxy; petiole adaxial shortly pubescent, abaxial glabrous or waxy; blade up to 30cm long, breadth c.6cm. *Branches* and buds absent at basal 6–10 nodes; maximum diameter of mid-culm central branch 3cm, bearing roots; maximum diameter of lateral branches 1cm; no thorns. *Inflorescence* slightly cuboid, with moderate branching, young inflorescences with 7–25 spikelets, older ones capitate with 100 spikelets or more. Prophylls around inflorescence usually 2-keeled, but the second keel lacking in collections from East Nepal. Prophylls basal to the pseudospikelet always 2-keeled. *Pseudospikelet* with 1–3 gemmiparous bracts, 1 empty glume, 2–3 fertile lemmas, terminating in a tiny rudiment; rhachilla sections glabrous, not readily disarticulating, 0.5–1mm long, glume insertion marked by a red line. *Fertile lemma* 6–7mm long, distal ¼ with cilia of 0.2mm, green with purple tips, very shortly pubescent internally and externally at tip. *Palea* 5–7mm, margins distal ⅓ to ½ with cilia of up to 0.5mm, green with purple tips;

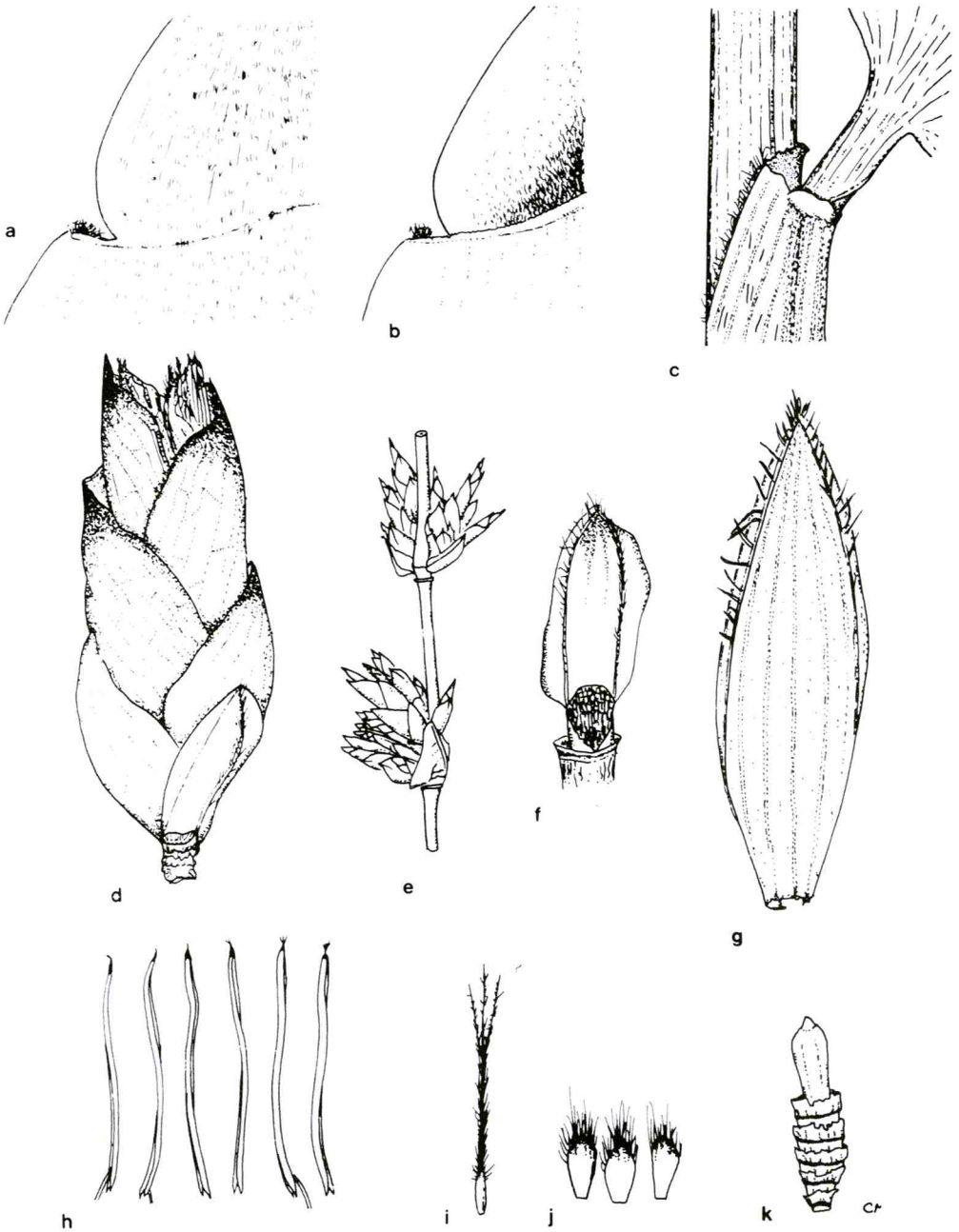

FIG. 5. *Bambusa nepalensis*. a, culm sheath exterior, ×0.6; b, culm sheath interior, ×0.4; c, leaf sheath, ×3; d, pseudospikelet, ×8; e, young inflorescences, ×1.5; f, 2-keeled inflorescence prophyll, ×3; g, palea, ×12; h, anthers, ×2.5; i, gynoecium, ×6; j, lodicules, ×8; k, rhachilla, ×10.

keels basal ½ indistinct, distal ½ to ⅕ with cilia of up to 0.5mm, apex blunt, with cilia of 0.5mm. *Lodicules* 3, well developed, 0.7 to 3mm long, variously ovate, long fimbriate, apices tinged purple. *Stamens* free. *Anthers* 5–6mm long, 0.5mm wide, body yellow often with purple tinges; tips purple, long apiculate, often shortly penicillate. *Ovary* narrowly linear-lanceolate, glabrous; style long, up to 5mm with 3 purple, pubescent to shortly plumose stigmas.
Distribution: Endemic to the hills of central and eastern Nepal.

The second most common bamboo in the Kathmandu Valley after *B. nutans* subsp. *nutans*, widely planted throughout western, central, and eastern Nepal. Usually confused with *D. hamiltonii* in the past.

6. **Bambusa nutans** [Wall., Cat. 5031 (1831–2) **nom. nud**. ex] Munro, Trans. Linn. Soc. London 26: 92 (1868).
Type: Nepal, Kathmandu, Naga-Arjun [Nagarjun, 27°44′N 85°17′E], v 1821, *Wallich*, Cat. 5031 (lecto. K–W selected here, isolecto. E).

6a. subsp. **nutans**

Representative specimens:

NEPAL: Kathmandu, Naghajuhn, iv 1821, *Wallich* Cat. 5031 (K–W); Kathmandu, Bansbari, 27°44′N 85°21′E, *Stapleton* 916 (E); Pokhara, Phewa Tal, *Stainton, Sykes, & Williams* 5265 (BM, E); Pokhara, 3000ft, *Stainton, Sykes, & Williams* 2484 (BM).

This is the most common bamboo in the Kathmandu Valley, and widely planted from Dolakha district in central Nepal at least as far as Palpa district in western Nepal, but apparently not known in the terai. Spikelets of this species normally fall apart very quickly, but in this subspecies there is often an orange or black crustaceous fungal growth, which can cement the spikelets together.
Local names (Nepali): *tharu bans* (Kathmandu), *sate bans* (Pokhara).
Distribution: Middle hills of central and western Nepal, possibly extending through to the western Himalayas in Himachal Pradesh and Uttar Pradesh.

6b. **Bambusa nutans** Munro subsp. **cupulata** Stapleton, **subsp. nov. Fig. 6.**
Bambusae nutanti Wall. ex Munro subsp. *nutanti* similis, cujus flores habet, sed laminis vaginarum culmorum caducis cupulatioribus, culmis minoribus nunquam sulcatis, laminis foliorum glabris, pilis vaginarum culmorum nigerrimis (non atro-brunneis) differt.
Type: Nepal, Sankhuwasabha district, Khandbari, 27°23′N 87°13′E, 3 v 1982, *Stapleton* 141 (holo. E).

Syn.: *Bambusa macala* [Buch.-Ham., Cat.: 117 (1822) *nom. nud.*; Wall., Cat. 5026a *nom. nud.* (1831–2)].
Bambusa nutans subsp. *malbans* [Stapleton, unpublished PhD thesis: 109, University of Aberdeen (1991)].

Representative specimens:

BHUTAN: Gaylegphug, 26°56′N 90°31′E, *Stapleton* 811 (THIMPHU).
BANGLADESH: Dinajpur, Birgunj, *Buch.-Ham.* 880 (E).
NEPAL: Sankuwasabha, Chhokrang , 27°38′N 87°22′E, *Long et al.* EMAK 819 (E).

Local names: *mal bans* (Nepali), *makla bans* (Bengali), *jhu shi* (Dzongkha).

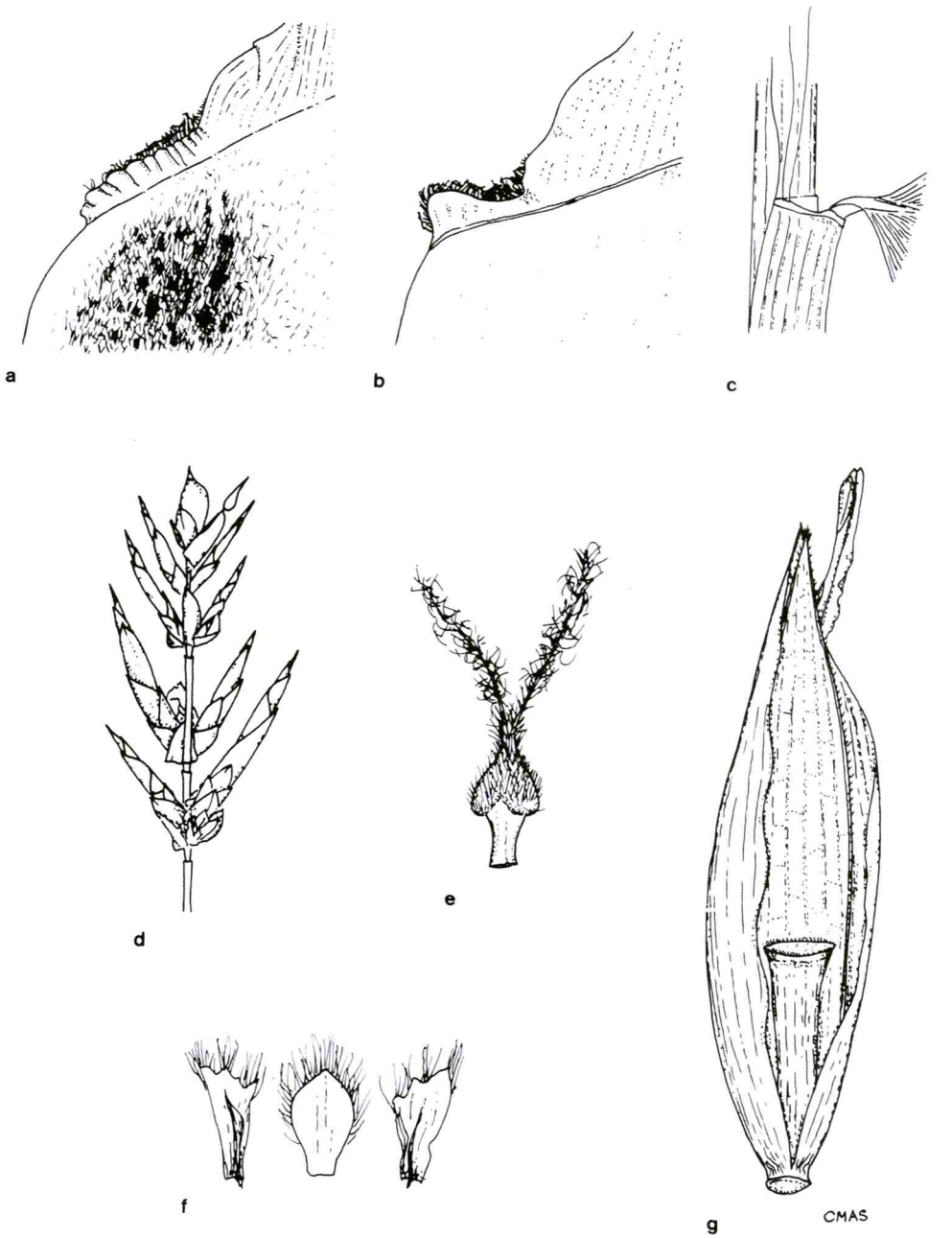

FIG. 6. *Bambusa nutans* subsp. *cupulata*. a, culm sheath exterior, ×0.5; b, culm sheath interior, ×0.5; c, leaf sheath, ×4; d, young inflorescences, ×1; e, gynoecium, ×8; f, lodicules, ×2.5; g, floret, ×7.

Similar to *Bambusa nutans* subsp. *nutans*, and having the same flowers, but differing in its more cupped and quickly deciduous culm sheath blades, the absence of any sulcation on smaller culms, the glabrous leaf blades, and by the jet black culm sheath hairs, which are dark brown in typical *B. nutans*.

Clumps caespitose, dense to open. *Rhizomes* pachymorph. *Culm* habit erect to drooping, maximum length 25m; at breast height maximum diameter 9cm, walls 1.5–2cm, nodes scarcely raised at all, no roots; maximum internode length 59cm; no sulcation on smaller culms; surface with light white wax at first, becoming glossy, thin deciduous white ring above nodes at first. New *culm sheath* from breast height c.30cm wide at base, height to ligule c.25cm; blade 12cm long × 20cm wide, strongly cupped and cordate, deciduous, most falling off before sheath. Sheath with jet black appressed or erect deciduous hairs all over, very short light-coloured appressed hairs in lines inside blade; auricles varied, up to 3cm wide, 2cm tall, separate or merging into blade; oral setae light-coloured, bent, up to 1cm long; ligule narrow, 1–2mm tall, margin finely serrate. New *leaf sheath* glabrous, margins glabrous, callus prominent, glabrous; auricles indistinct, narrow; oral setae deciduous, 1–4 on young leaves, erect, c.1cm long; ligule short, <2mm; blade maximum length 31cm, maximum width 5cm. *Branches* or buds present to base of culm; maximum diameter of mid-culm central branch 2cm, never rooting; maximum diameter of mid-culm laterals 1cm; no thorns. *Inflorescence* branching limited, young inflorescences with few spikelets; prophylls all 2-keeled. *Pseudo-spikelet* with 2 gemmiparous bracts, no empty glumes, c.5 fertile lemmas, terminating in an incomplete floret, rhachilla sections glabrous with short-ciliate apices, disarticulating very readily. *Fertile lemma* 12–20mm long, glabrous, margins wide and rolled. *Palea* up to 15mm long, keels with variable ciliation, cilia 0.3mm to more than 1mm long, veins and tessellation evident between keels, single apex usually minutely penicillate. *Lodicules* 1.5–2.5mm long, 1 obovate, 2 oblique and laterally thickened. *Anthers* yellow, tip shortly bifid, acute or shortly penicillate. *Ovary* orbicular to oblong, style short to medium length, stigmas 2.

Distribution: Hills of Eastern Himalaya and plains of West Bengal, Assam, and Bangladesh.

The most common bamboo in the hills and terai of eastern Nepal, widely cultivated.

7. **Bambusa tulda** Roxb. [Hort. Bengal: 25 (1814) **nom. nud.** ex], Fl. Indica ed. 2, 2: 193 (1832).

Type: Roxb. Icones 1403 (lecto. selected here, K, isolecto. E).

Syn.: *Dendrocalamus tulda* (Roxb.) Voigt in Hort. Sub. Calc.: 718 (1845).

Representative specimens:

NEPAL: Kathmandu, Lazimpat, *Stapleton* 919; Rupandehi, Bhairawa, *Stapleton* 370.

BHUTAN: Chirang dist., Damphu, 27º02′N 90º07′E, *Stapleton* 816 (THIMPHU).

Local names: *kada bans* (Nepali, Kathmandu), *koraincho bans* (Nepali, Chitwan dist.), *chab bans* (Rupandehi dist.), *singhane bans* (Nepali, Chirang dist.), *tulda bans* (Bengali).

Distribution: Burma, Bangladesh, India (West Bengal, Assam, Bihar), southern Bhutan, Nepal (Siwalik Hills and terai).

2. Dendrocalamus Nees, Linnaea 9(1): 476 (1834).
Type species: *Dendrocalamus strictus* (Roxb.) Nees.

Tropical and subtropical bamboos from 10m to 32m in height. Inflorescence iterauctant, enclosed by two narrow single-keeled bracts, rhachilla internodes not clearly separated and not disarticulating. Stamens 6, filaments free, spikelets terminating in an incomplete or rudimentary floret, paleas keeled and acute. Rhizomes pachymorph, without extended necks.

GENERIC STATUS AND SEPARATION

As remarked under *Bambusa*, the original description of this genus was inadequate as it was based upon a single species, and the subsequently adopted use of pericarp characters to distinguish between *Dendrocalamus* and *Bambusa* (Munro, 1868; Bentham, 1883; Gamble, 1896) has since been discredited (Holttum, 1956a). Nevertheless the genus is still universally recognized, and *Dendrocalamus* species can be distinguished from those of *Bambusa* by the presence of single-keeled prophylls throughout the inflorescence (Stapleton, 1991). They are distributed throughout the Himalayas, much of India and Southeast Asia, as well as southern China. Although *D. strictus* is found in many low-altitude regions of India, most other species are restricted to higher rainfall or montane areas. In *Dendrocalamus* the inflorescence is heavily branched and forms a tight capitulum. The spikelets are shorter, and, as Nees himself pointed out, the styles are longer and lodicules are absent (or, to be more accurate, scarce).

Many of the distinctive characteristics of Himalayan *Dendrocalamus* species may be interpreted as adaptations to the damp and windless subtropical understorey or gully sites in which they are often found. *Dendrocalamus* species can be contrasted with species of *Bambusa* and the temperate genera by several floral characteristics which seem to allow greater pollen production. Species of *Bambusa* have less congested inflorescences and tend to occur in drier and more open sites where there is more wind to facilitate cross-pollination. Temperate genera occur higher up the mountains on steeper slopes where there is also regular movement of air. They have semelauctant inflorescences with less branching, and 3 stamens instead of 6. The vigorous periodic gregarious flowering witnessed in several *Dendrocalamus* species may be a further adaptation to increase cross-pollination. Temperate bamboo species tend to have shorter flowering cycles, while the non-bambusoid grasses, most of which have successfully evolved out of the forest altogether into environments with much more wind, have annual flowering cycles.

The highly congested inflorescences of most *Dendrocalamus* species do not allow for much opening of the florets, and the scarcity of lodicules in this genus may be related to this. Stigmas have to be exserted apically in the congested inflorescence, and the long styles found in this genus make this possible. In the Himalayas *Dendrocalamus hamiltonii* rarely produces more than one seed per spikelet, possibly because of low cross-pollination rates, and this may explain the lack of rhachilla disarticulation. Reduction of prophylls from 2-keeled to narrow single-keeled structures could be another consequence of the extensive branching within the inflorescence. It would allow more space for further orders of branching, and would concentrate more resources upon floret components. The close packing of spikelets within the inflorescence would make up for any reduction in the protection offered by the prophylls. This,

however, assumes that single-keeled prophylls are derived rather than ancestral, although this may not be true in the bamboos.

Profuse production of aerial roots on the culm nodes and on the large rhizomatous branch bases is also characteristic of Himalayan *Dendrocalamus* species. This may be an adaptation to damp gully environments, where rooting of distal portions of fallen culms is an effective means of plant dispersal. This characteristic, along with dense, dark-coloured, fur-like culm wax, usually distinguishes *Dendrocalamus* species from those of *Bambusa*, although intermediate species such as *B. balcooa, B. nepalensis,* and *B. clavata* also have aerial roots and substantial wax on the culms.

SPECIES AND VARIETIES ENCOUNTERED IN NEPAL AND BHUTAN

By far the commonest Himalayan *Dendrocalamus* species is *D. hamiltonii*. This species is apparently found along the entire Himalayan range, where it grows in gullies in subtropical forest types, especially along the outer ranges of hills, such as the Siwaliks and Mahabharat Lekh. It is also found further into the foothills where it is quite widely planted. There is substantial variation within this species and it has several distinct varieties. Two of these are very common, namely the variety *undulatus* described below, and var. *edulis* Munro.

D. hamiltonii var. *undulatus* Stapleton is found from Kathmandu to East Nepal, although it is particularly common in Dolakha district of Central Nepal. It is distinguished principally by its irregularly shaped internodes. The culms are used for making pillars and containers, and not for weaving. The culms are often not harvested at all, their branches being lopped for fodder on an annual basis. This variety is quite distinct from the type variety of *D. hamiltonii* in its vegetative characteristics. It has shorter, broader, more irregularly shaped culm internodes, which are slightly swollen towards the base, and more crinkled culm sheath blades. However, the flowers are quite similar to those of var. *hamiltonii*, although there is less purple coloration on the anthers and the fertile lemmas.

Var. *edulis* Munro is the commonest variety of *D. hamiltonii* in Central Bhutan, where it is sub-dominant in small areas of various types of subtropical forest. It would seem to be the best variety of this species for production of edible shoots. In contrast to var. *undulatus*, var. *edulis* is very difficult to separate from the type variety in the vegetative state, although the flowers are readily distinguishable. Munro described the variety as having more flowers in the spikelets, occasional lodicules, larger inflorescences, and broader but thinner leaves. The width of the leaves, however, does not seem to be a reliable character. The broad leaf in the type specimen came from the apex of a new shoot, which is always highly uncharacteristic of mature foliage. Examination of living material in the field has shown that this variety is more pendulous, and has fewer small recurved branchlets at lower nodes. In finer detail the leaf sheath hairs are a darker brown, the culm sheath ligule is more evenly dentate, and the leaf sheath ligule is often shorter, but these characters are quite variable within varieties and clumps, so they need to be used with caution.

The inflorescence of var. *edulis* is clearly distinguishable by its much longer bracts, spikelets, and fertile lemmas. The fertile lemmas are pale. The anthers are yellow with purple tips which are less acuminate but more penicillate. Collections of *D. hamiltonii* from Dehra Dun in Uttar Pradesh also have paler anthers than the type, but they still retain substantial red

coloration, and are not nearly as large as those of var. *edulis*. Var. *edulis* has similar flowers to those of *D. longispathus* Kurz from Burma, but its thick culm sheaths with erect glabrous blades and no depressed sinus appear to separate it from that species as described by Gamble (1896) and Alam (1982).

In comparison with *D. hamiltonii*, all other *Dendrocalamus* species are scarce, and usually fairly localized. In the Nepalese terai a small-stature form of *D. strictus* with solid culms and strong branching is quite common. The 3–5m tall culms have few uses but sections can be used as truncheons (*latthi*), usually for herding livestock. *D. strictus* is a polymorphic species with a wide distribution. Plants raised by the Nepalese Forestry Department from Indian seed will hopefully be larger than the indigenous form and should have thinner culm walls. The only other *Dendrocalamus* species known to occur in the plains of Nepal or West Bengal is *D. giganteus*, recognizable from afar by its stature alone. Reaching over 30m in height this species stands substantially taller than any other bamboo species in the region.

In the hills of Sikkim, Bhutan, and West Bengal, the rare *D. sikkimensis* Gamble ex Oliver occurs and is distinguished by the thick, erect, velvet-like culm sheath hairs, and the long bristles on the auricles of the culm sheaths and the leaf sheaths. From central Bhutan to central Nepal *D. hookeri* Munro also reaches large dimensions, but it is easily distinguished from *D. sikkimensis* by its less hairy culm sheaths with appressed hairs, much smaller ciliate auricles, and the absence of oral setae on its leaf sheaths. In the Himalayas this species has shorter leaf sheath ligules than those of collections made in the Khasia Hills.

Further as yet unidentified large-stature bamboos with characteristics of both *D. hookeri* and *D. hamiltonii* can be found in a few sites around Kathmandu, but they have not been seen elsewhere. They may represent a western variety of *D. hookeri,* or they may be exotic in origin. Further species have been encountered in West Bengal and eastern Bhutan, where they are known as *seto bans* and *so* respectively, but their flowers have not been found, so they cannot be placed in *Dendrocalamus* or *Bambusa* with any confidence.

KEY TO *DENDROCALAMUS* SPECIES OF NEPAL AND BHUTAN

1a. Culms solid or subsolid, diameter less than 5cm ____ 5. **D. strictus**
1b. Culms hollow, diameter more than 5cm ____ 2

2a. Culm sheath auricles always absent ____ see *Bambusa balcooa*
2b. Culm sheaths with auricles ____ 3

3a. Culm sheath auricles naked ____ 4
3b. Culm sheath auricle margins bearing setae ____ 5

4a. Culm sheath auricles small, triangular ____ 2. **D. hamiltonii**
4b. Culm sheath auricles broad and wavy ____ 1. **D. giganteus**

5a. Culm sheath auricle breadth 2–10mm _____ see *Bambusa nepalensis* and *B. clavata*
5b. Culm sheath auricle breadth 7–40mm _____ 6

6a. Culm sheath auricle breadth less than 2cm, leaf sheaths with a few deciduous oral setae less than 3mm in length _____ 3. **D. hookeri**
6b. Culm sheath auricle breadth >2cm, leaf sheaths with many persistent oral setae more than 5mm in length _____ 4. **D. sikkimensis**

ENUMERATION OF SPECIES IN NEPAL AND BHUTAN

1. **Dendrocalamus giganteus** Munro, Trans. Linn. Soc. London 26: 150 (1868).
Type: 'Cult. Calcutta' [Calcutta Botanic Garden], Hb. Munro (lecto. K, selected here).
Syn.: *Bambusa gigantea* [Wall. List of plants distributed from Bot. Garden Calcutta: 79 (1840) *nom. nud.*; Voigt, Hort. Sub. Calc.: 719 (1845) *nom. nud.*].
Representative specimen:
INDIA: West Bengal, Hasimara, c.27°30′N 89°00′E, *Stapleton* 452. West Bengal, Raniganj, 26°41′N 88°10′E, *Stapleton* 906.
Local names: *tokla bans* (Bengali), *rachhasi bans, burra bans* (Nepali).

2. **Dendrocalamus hamiltonii** [Nees & Arn. MS. ex] Munro, Trans. Linn. Soc. London 26: 151 (1868).
Type: Assam, Goalpara, 17 vii 1808, *Buch.-Ham.* 882 (lecto. selected here, E).
Syn.: *Bambusa maxima sensu* [Buch.-Ham., Cat.: 117 *nom. nud.* (1822) *et* Wall., Cat. 5039 *nom. nud.* (1831–2)], *non sensu* Rumphius, Herb. Amb. (1750).
Bambusa monogynia Griffith, Notulae 3: 63 (1851) *nom. illeg.*, non Blanco (1837).
Bambusa falconeri Munro, Trans. Linn. Soc. London 26: 95 (1868) *pro parte*.

KEY TO VARIETIES OF *D. HAMILTONII*

1a. Spikelets up to 15mm long; recurving branchlets few _____ var. **edulis**
1b. Spikelets up to 6mm long; recurving branchlets many _____ 2

2a. Anthers uniformly dark red or purple; culm internodes up to 9cm in diameter, not basally swollen; culm sheath blades slightly undulating _____ var. **hamiltonii**
2b. Anthers yellow to red with darker tips; culm internodes up to 15cm in diameter, often basally swollen; culm sheath blades strongly undulating _____ var. **undulatus**

2a. var. **hamiltonii**

Representative specimens:

BHUTAN: Gaylegphug, Norbuling 26°56′N 90°32′E, *Stapleton* 725 (THIMPHU); Chirang, Chhokarna, 27°02′N 90°05′E, *Stapleton* 815 (THIMPHU).
NEPAL: Makawanpur, Lamidanda 27°31′N 85°05′E, *Stapleton* 453; Kaski, Jhobang, 28°16′N 83°48′E, 5 xi 1975, *Wormald* 96 (BM); Sunsari, Tirhapur, 26°51′N 87°16′E, *Williams* 173 (BM); Kaski, Pokhara, 850m, 27 xii 1966, *Nicolson* 2895 (BM); Taplejung, Heydewa, Garhi Dande, 3 xi 63, *Hara et al.* 6307473 (BM); Nawal Parasi, Dauney Hills, 250m, iii 1971, *Makin* 127 (BM).
INDIA: West Bengal, Siliguri, Mong Pong 26°86′N 88°30′E, *Stapleton* (cult. Kew).

Local names: *tama bans*, *choya bans* (Nepali), *pag shi, patsa?* (Dzongkha).

2b. var. **edulis** Munro, Trans. Linn. Soc. London 26: 84 (1868).

Type: India, Sikkim, Rato valley, 4,000ft, ii 1850, *Hook. f. & Thomson* s.n. 'C' (lecto. K, selected here).

Representative specimens:

BHUTAN: Shemgang, Tingtibi, 27°06′N 90°39′E, *Stapleton* 709 (THIMPHU); Mongar, Shersingtang, 27°18′N 91°05′E, *Stapleton* 438; ibid. *Stapleton* 436; Shemgang, Dakpai, *Grierson & Long* 1344 (THIMPHU, E).

Local names: *pag shi* (Dzongkha), *guliyo tama bans* (Sikkim Nepali).

Distribution: Sikkim and West Bengal to Burma.

2c. **Dendrocalamus hamiltonii** Munro var. **undulatus** Stapleton, **var. nov. Fig. 7.**

A varietate typica internodiis culmorum latioribus leviter irregulariter ventricosis, vaginis culmorum latioribus, laminis vaginarum culmorum undulatis, lemmatibus et antheris minus purpurei differt.

Type: Kathmandu, Balaju, 27°46′N 85°18′E, 18 ii 1987, *Stapleton* 456 (holo. E).

Syn.: *Dendrocalamus* sp. Dhungre bans Type D6 [Stapleton in Jackson, Manual of Afforestation in Nepal: 210 (1987)].

Representative specimens:

NEPAL: Kathmandu, Balaju, 27°46′N 85°18′E, *Stapleton* 915; Dolakha, Charikot, 27°40′N 86°03′E, *Stapleton* 301; Dhankuta, Pakhribas, 27°03′N 87°17′E *Stapleton* 146.

Local name: *dhungre bans* (Nepali).

Differing from the type variety in its broader culm internodes which are irregularly mildly ventricose, its undulating culm sheath blades on broader culm sheaths, and its less purple fertile lemmas and anthers.

Clumps caespitose, dense. *Rhizomes* pachymorph. *Culm* habit erect to drooping, not pendulous, maximum height 23m; at breast height maximum diameter 15cm, walls 2–2.5cm thick, nodes slightly raised, internodes often swollen by 1–3cm diameter towards base, with aerial rooting at lowest 6–10 nodes, maximum internode length 35cm (short for diameter). Culm surface densely covered with white to light brown furry wax at first, remaining dull. New *culm sheath* from breast height c.60cm wide at base, height to ligule c.30cm; blade c.8cm long and c.12cm wide, triangular, deeply dimpled, bottom corners corrugated, persistent. Sheath deciduous, with dense appressed light to dark brown hairs from base to 2cm below blade; auricles small triangular/rounded, variable, naked; oral setae none; ligule narrow, 1–3mm tall, serrated in centre, dentate at edges. New *leaf sheath* with white appressed hairs at first, becoming glossy; margins glabrous; callus prominent; auricles none; oral setae none;

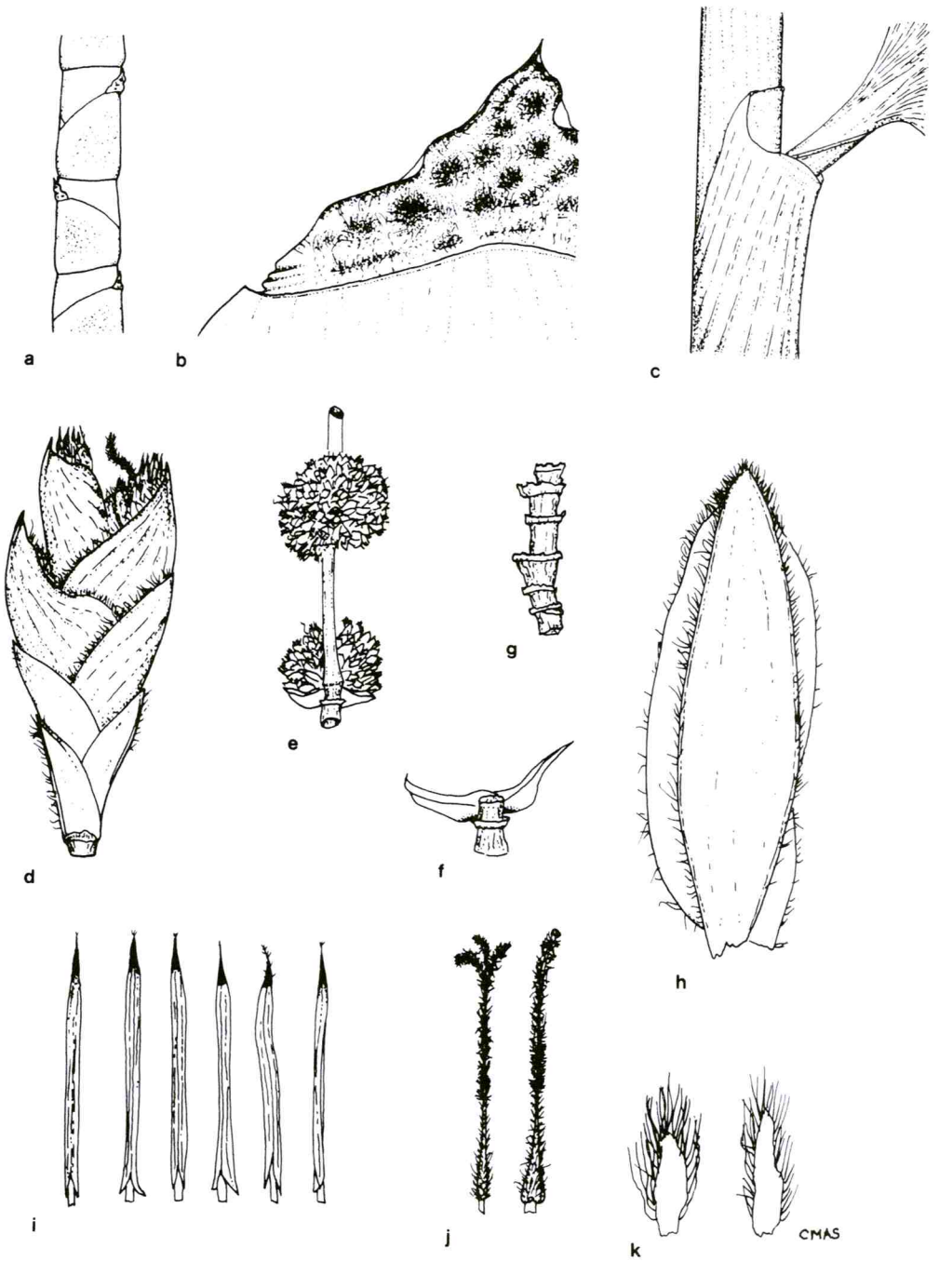

FIG. 7. *Dendrocalamus hamiltonii* var. *undulatus*. a, lower culm internodes, ×0.04; b, culm sheath interior, ×0.4; c, leaf sheath, ×4; d, pseudospikelet, ×6; e, mature inflorescences, ×0.8; f, single-keeled inflorescence prophyll, ×3; g, rhachilla, ×7; h, lower palea, ×12; i, anthers, ×7.5; j, gynoecia, ×5; k, lodicules, ×7.

ligule projecting, rounded/pointed, up to 10mm long × 8mm wide; blade maximum length and breadth 42 ×10cm. *Branches* or buds absent at up to 10 basal culm nodes; maximum diameter of mid-culm central branch 5cm, rooting prolifically; maximum diameter of mid-culm laterals 1cm. Thorns absent. *Inflorescence* branching highly congested, young inflorescences with more than 20 spikelets, older inflorescences with more than 100. Prophylls narrow, usually 1-keeled, those basal to pseudospikelet often with weak second keel. *Pseudospikelet* with 2 gemmiparous bracts, 2 empty bracts, 2–3 fertile lemmas, terminating in a complete floret, rhachilla sections <0.5mm long, no disarticulation. *Fertile lemmas* c.6mm long; margins ciliate to base, cilia 1mm near base, 0.5mm near apex; exterior glabrous, interior apically very shortly pubescent, mostly green but apical 1mm often purple. *Palea* 4–5mm long, margins 0.5mm ciliate to base, apex acute; keels 0.2–0.5mm ciliate to near base. Lodicules 0–3, narrow, 0.5–2mm long, fimbriate, unthickened. *Anthers* 3mm, honey-coloured with darker tips, tips aciculate/apiculate, often penicillate. *Ovary* triangular-ovate, pubescent. Style long, c.2mm, with 1–2 purple, plumose or clavate stigmas.
Distribution: Apparently endemic to Central and East Nepal.

3. **Dendrocalamus hookeri** Munro, Trans. Linn. Soc. London 26: 151 (1868).
Type: India, Bengal orient, Pundua, 11 vi 1850, *Hook. f. & Thomson* 411 (lecto. K, selected here).
Representative specimens:
BHUTAN: Wangdi Phodrang, Chhusutsa, 27°31′N 89°58′E, *Stapleton* 818 (THIMPHU).
NEPAL: Nepal, Sirkapur, 26°51′N 87°16′E, 5500ft, *Williams* 173 (K); Dhankuta, Pakhribas, 27°03′N 87°17′E, *Stapleton* 187; Mamamkhe 27°25′N 87°52′E, *Crawford et al.* KEKE 1127 (E,K).
Local names: *kalo bans, bhalu bans* (Nepali), *pag shi* (Dzongkha).
Distribution: East Nepal, Bhutan, and north-eastern states of India.

4. **Dendrocalamus sikkimensis** [Gamble MSS. ex] Oliver, Hooker's Icon. Pl. 18: t. 1770 (1888).
Type: India, Sikkim, 20 vii 1885, *Pantling* (lecto. K, selected here).
Representative specimen:
BHUTAN: Shemgang, Tingtibi, 27°08′N 90°40′E, *Stapleton* 810 (THIMPHU).
Local name: *dem chhering* ? (East Bhutan).
Distribution: Sikkim, West Bengal, Bhutan, and north-eastern states of India.

5. **Dendrocalamus strictus** (Roxb.) Nees, Linnaea 9 (1): 476 (1834).
Syn.: *Bambos stricta* Roxb., Cor. Pl. 1, 80: 58 (1798); *Bambusa stricta* (Roxb.) Roxb., Fl. Ind. ed. 2, 2: 193 (1832).
Bambusa tanaea [Buch.-Ham., Cat.: 118 (1822) *nom. nud.*; Wall., Cat. 5038A (1831–2) *nom. nud.*]
Representative specimens:
INDIA: "Small solid bamboo commonly called the male bamboo. Ex Roxburgh's college plants", [probably cult. Hort. Bot. Calc.], Hb. Roxburgh (E).
NEPAL: Rupandehi, Bhairahawa, *Stapleton* 371; Morang, Itahari, *Stapleton* 877.
Local names: *Sadanapa vedroo* (of the Telingas, Coromandel coast), *latthi bans* (Nepali), male bamboo (India).

As Roxburgh's collections from the Coromandel coast were destroyed in an inundation (King, 1895), a good comprehensive collection with the same local name from the same area should be made and designated as a neotype. Roxburgh's original illustration is rather stylised, and not adequate for typification.

Infra-specific variation within such an economically important species warrants detailed study. McClure (1966) cited two named varieties described on the basis of floral pubescence, and a further variety with striped culms. Deogun (1937) listed five unnamed forms with different culm characteristics.

Subtribe **Melocanninae** Reichenbach, Deutsch. Fl. 6: 6 (1846).
Inflorescence iterauctant, fully bracteate, stamens 6 or more, style long and hollow.

3. Melocanna Trinius in Sprengel, Neue Entd. 2: 43 (1821).
Type species: *Melocanna baccifera* (Roxb.) Kurz.

Tropical and subtropical bamboo, culms erect or nodding, 10–20m in height, branches sub-equal. Rhizomes pachymorph, with extended necks of up to 2m, clumps very open. Inflorescences iterauctant. Stamens 6, filaments free, style hollow. Fruit large, up to 12cm long, with fleshy pericarp.

This monotypic genus is clearly defined and easily recognized by its pear-sized fruit, extended rhizome necks giving open clumps, and distinctive culm sheaths with corrugations towards the apex and a very long blade. It occurs in extensive tracts in the Chittagong Hills, and is cultivated in many other districts of Bangladesh. It has been widely planted because of the straightness and strength of its culms, especially near tea estates in Assam, West Bengal, and the Nepalese terai (plains), and also in Palpa district of western Nepal.

1. **Melocanna baccifera** (Roxb.) Kurz, Prel. Rep. on For. & Veg. Pegu: 94 (1875).
Type: Roxb. Icones 1401 (lecto. selected here, K).

Syn.: [*Bambusa baccifera* Roxb. in Hort. Beng.: 25 (1814) *nom nud*. ex] Corom. Pl. iii 38 t. 243 (1819).
Melocanna bambusoides Trin. in Sprengel, Neue Entd. 2: 43 (1821).

Representative specimen:
NEPAL: Jhapa, Kakarvita, *Stapleton* 878 (THIMPHU).
Local names: *philim bans* (Jhapa), *lahure bans* (Palpa).

4. Cephalostachyum Munro, Trans. Linn. Soc. London 26: 138 (1868).

Syn.: *Schizostachyum* Griffith, Notulae Plantae Asiaticae 3: 64 (1851) *illeg. hom.* non *Schizostachyum* Nees.

Type species: *Cephalostachyum capitatum* Munro.

Subtropical bamboos, culms pendulous, 6–12m in height, branches subequal. Rhizomes pachymorph, without necks, clumps dense. Inflorescences iterauctant, each a dense capitulum of many spikelets when mature. Stamens 6, filaments free, style hollow.

GENERIC STATUS

Along with two other little-known Himalayan genera, *Pseudostachyum* Munro and *Teinostachyum* Munro, this genus has received little detailed attention since its description. These three genera are most common in the higher rainfall subtropical forests of Burma. According to Gamble (1896), Kurz had considered that *Teinostachyum* should be merged with *Cephalostachyum*, but Gamble maintained the separation between the genera in his treatment of the Indian bamboos. Holttum (1956a) suggested that *Cephalostachyum, Teinostachyum,* and *Pseudostachyum* should be merged with the Malaysian genus *Schizostachyum* Nees. Unfortunately he did not give a detailed justification for this opinion, and there have been no comparative studies to investigate generic delimitation in this subtribe. Nevertheless Clayton & Renvoize (1986) and Majumder (1989) have followed Holttum's suggestion and treated all four genera as conspecific. However, Dransfield (1980) considered that *Cephalostachyum*, *Teinostachyum,* and *Pseudostachyum* should be kept separate from *Schizostachyum* and she still holds this view (pers. comm.).

There are not sufficient species in the Himalayas to allow detailed comparisons of generic characters as undertaken in the Bambusinae and Arundinariinae, and until such detailed investigations have been completed it seems wisest to continue to recognize *Cephalostachyum, Teinostachyum,* and *Pseudostachyum* as separate genera.

SPECIES ENCOUNTERED IN NEPAL AND BHUTAN

One species is common in cooler sections of the wet subtropical forests across most of Bhutan, and it has also been found in Nepal. This bamboo is clearly identifiable as *Cephalostachyum fuchsianum* Gamble. However, that species is not clearly distinguished from species from the eastern Himalayas and the hills of Assam previously described by Munro (1868). Collections of *C. capitatum* Munro appear to have smoother fertile lemmas and leaf sheaths, as well as the shorter, less exserted spikelets described by Munro. It was described from material collected to the south of Assam, and may not be represented in the Himalayas. *C. latifolium* Munro was described from material apparently collected by Griffith in 'Bootan', although it does not appear to be recorded in his itinerary notes (Griffith, 1848). Gamble (1896) described a Himalayan species, *C. fuchsianum,* from much better collections than those available to Munro. He distinguished his species by its prominent oral setae on the leaf sheaths and its distinctive culm sheaths. However, the culm sheaths of *C. latifolium* Munro are very similar, also having a concave sinus. In addition the oral setae of the *Cephalostachyum* species common in Bhutan are quickly deciduous, leaving scarcely any trace. One of Gamble's own collections (*Gamble* 7588 K), which he identified as *C. latifolium* Munro, actually has distinct oral setae on one leaf sheath. Having compared the types of *C. latifolium* and *C. fuchsianum,* they appear to be conspecific. *C. fuchsianum* Gamble would therefore appear to be a synonym of *C. latifolium* Munro.

1. **Cephalostachyum latifolium** Munro, Trans. Linn. Soc. London 26: 140 (1868).
Type: Bhutan?, *Griffith* Hb. No. 2682, K.D. No. 6734 (lecto. selected here K, iso. BM).

Syn.: *Schizostachyum latifolium* (Munro) R. B. Majumdar in Karthikeyan, S. et al., Fl. In. Enumerat. – Monocot.: 281 (1989) *nom. illeg*., non sensu Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7(1): 117 (1896).

Cephalostachyum fuchsianum Gamble, Ann. Roy. Bot. Gard. (Calcutta) 7(1): 107 (1896), *syn. nov.*; *Schizostachyum fuchsianum* (Gamble) R.B. Majumdar in Karthikeyan, S. et al., Fl. In. Enumerat. – Monocot.: 281 (1989). Type: India, Sikkim, Songchonglu, 6,000' 1892 *Gammie* (lecto. selected here, K).

Representative specimens:

BHUTAN: Chhukha, Gedu, 26°55′N 89°32′E *Stapleton* 900 (THIMPHU); ibid. *Stapleton* 902 (THIMPHU); Chhukha, Jumdag to Chasilakha, 26°57′N 89°33′E *Grierson & Long* 3102 (THIMPHU, E); Shemgang, 27°13′N 90°40′E, 2000m *Grierson & Long* 1649 (THIMPHU); Gaylegphug, 26°58′N 90°31′E, 1500m *Stapleton* 421 (THIMPHU).
NEPAL: Sankuwasabha, Barun khola, 2000m, *Emery* 170 (BM); ibid. *Emery* 171 (BM); ibid. *Emery* 177 (BM).

Local names: *ghopi bans* (Nepali), *jhi* (Dzongkha).

5. Teinostachyum Munro, Trans. Linn. Soc. London 26: 142 (1868).
Type species: *Teinostachyum griffithii* Munro.

Subtropical bamboos, culms pendulous, 6–12m in height. Rhizomes pachymorph, without necks, clumps dense. Inflorescence iterauctant, with few small narrow spikelets, not becoming capitate. Stamens 6, filaments free, style hollow.

Camus (1922) described *Neohouzeoua* for species from several genera with connate filaments, and transferred *N. dullooa* from *Teinostachyum*. However, Holttum (1946) stated that the presence of a filament tube is not by itself a satisfactory character for the distinction of a genus, and this view has prevailed.

One species, *T. dullooa* Gamble, has been found in Bhutan. This distinctive species is clearly separated from *T. griffithii* Munro by the absence of falcate auricles spreading sideways from the leaf sheath shoulders and by its smaller florets.

1. **Teinostachyum dullooa** Gamble, Ann. Roy. Bot. Gard. (Calcutta): 101 (1896).
Type: Burma, Katha dist., Hawyaw Monastery garden, ii 1892, *Oliver* s.n. (holo. K).

Syn.: *Neohouzeaua dullooa* (Gamble) Camus, Bull. Mus. Hist. Nat. 28: 100 (1922); *Schizostachyum dullooa* (Gamble) R.B. Majumdar in Karthikeyan, S. et al., Fl. In. Enumerat. – Monocot.: 281 (1989).

Representative specimens:

BHUTAN: Tashigang, Deothang, Narphung La, 26°59′N 91°32′E, 1700m *Stapleton* 434 (THIMPHU); Punakha, Tashitang, 27°36′N 90°04′E, 1700m *Stapleton* 809 (THIMPHU).

Local names: *tokhre bans* (Nepali), *dalu* (Assam), *thaikwaba* (Burmese).
Distribution: Burma, Assam, Bangladesh, West Bengal, Sikkim, Bhutan.

6. Pseudostachyum Munro, Trans. Linn. Soc. London 26: 141 (1868).
Type species: *Pseudostachyum polymorphum* Munro.

Tropical and subtropical bamboo, culms pendulous or semi-scandent, 6–10m in height. Rhizomes pachymorph, with extended necks of up to 3m, culms pluricaespitose, with very thin walls. Inflorescence iterauctant, spikelets often curved and hispid. Stamens 6, filaments free, style hollow. Fruit small.

1. **Pseudostachyum polymorphum** Munro, Trans. Linn. Soc. London 26: 142 (1868).
Type: India, Assam, Nigrigam, 18 i 1836, *Griffith* K.D. 6735 (lecto. selected here, K).
Syn.: *Schizostachyum polymorphum* (Munro) R. B. Majumdar in Karthikeyan, S. et al., Fl. In. Enumerat. – Monocot.: 282 (1989).
Representative specimens:
BHUTAN: Shemgang, Tingtibi, 950m, *Stapleton* 708 (THIMPHU). Gaylegphug, Phibsoo, 26°46′N 90°07′E *Grierson & Long* 3832 (THIMPHU, E).
Local name: *dai* (Kengkha).

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