



Six new species of *Melocalamus* (Gramineae: Bambusoideae) from Vietnam

H.N. Nguyen¹, V.T. Tran²

Key words

Gramineae
Melocalamus
Vietnam

Abstract Six new scrambling bamboo species of *Melocalamus* (Gramineae) are described: *M. blaoensis*, *M. cucphuongensis*, *M. kbangensis*, *M. pacoensis*, *M. truongsongensis* and *M. yenbaiensis*. The genus is new for Vietnam. Its diagnostic characters are scrambling stems and fleshy fruits.

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INTRODUCTION

Bamboos have long been closely related to the life of Vietnam's people for thousands of years and bamboo clumps are considered as symbols of culture in rural areas. They are used for numerous purposes: house and bridge construction, piping, household implements and tools, food (fresh and dried bamboo shoots), fuel, etc.

Out of the c. 1 200 bamboo species, Vietnam may have up to more than 200, as many as or more than the number found in the nearby Yunnan province of China, because additional new species may be expected from the west and south (Nguyen 2006).

Many species have cariopses but some have fleshy fruits with different shapes and sizes such as *Cyrtochloa* S.Drantsf., *Dinorchloa* Buse, *Melocalamus* Benth., *Melocanna* Trin. and *Sphaerobambos* S.Drantsf.

Melocalamus was casually and invalidly mentioned by Benth in 1881 with the only species *Pseudostachyum compactiflorum* Kurz for specimens collected by Kurz in Martaban, Burma (Myanmar). He validated it in 1883 with *M. compactiflorus* (Kurz) Benth. as the only species. Later, 9 other species were added: *M. arrectus* T.P.Yi, *M. elevatissimus* Hsueh & T.P.Yi, *M. fimbriatus* Hsueh & C.M.Hui, *M. gracilis* R.B.Majumdar, *M. indicus* R.B.Majumdar, *M. mastersii* (Munro) R.B.Majumdar, *M. mclelandii* (Munro) H.B.Naithani, *M. ningmingensis* Ohnrb., *M. scandens* Hsueh & C.M.Hui (Ohnrb. 1999). Li & Stapleton (2006) reviewed and rearranged the four species in China namely *M. arrectus*, *M. compactiflorus* (with two varieties: *M. compactiflorus* var. *compactiflorus* and var. *fimbriatus* (Hsueh & C.M.Hui) D.Z.Li & Z.H.Guo), *M. elevatissimus* and *M. scandens*. However, there was no information on *M. ningmingensis* Ohnrb. (cited from Ohnrb. 1999).

Melocalamus gracilis and *M. indicus* have been transferred to *Dinorchloa* as *D. gracilis* (R.B.Majumdar) Bennet & S.S.Jain ex D.N.Tewari and *D. indica* (R.B.Majumdar) Bennet, while *M. mastersii* has been returned to *Bambusa*: *B. mastersii* Munro (see Seethalakshmi & Kumar (1998).

MATERIAL AND METHODS

With support from the research projects 'Conservation of Forest Plant Genetic Resources, period 2001–2005' and 'Species Diversity and ex situ Conservation of Some Bamboos in Vietnam' (2003–2005) by IPGRI, field surveys have been conducted all over Vietnam including provinces of northern, central and southern Vietnam.

Based on the morphology of clumps, stems, leaves, sheaths, flowers and fruits and the publications by Gamble (1896), McClure (1936, who reduced *Melocalamus* to *Dinorchloa*), Dransfield (1981), Hui & Hsueh (1992), Seethalakshmi & Kumar (1998), Pham (1999), Li (2000), Guo & Li (2001), Li & Stapleton (2006), six new species of *Melocalamus* were recognized by Nguyen & Tran (2006, in Vietnamese), which are here formally named and described.

RESULTS

Melocalamus

Melocalamus Benth. (1881: 134), nom. inval.; in Benth & Hooker (1883: 1212). — Type: *Melocalamus compactiflorus* (Kurz) Benth.

Diagnostic characters (after Clayton et al. 2008): Perennial. Rhizomes short, pachymorph. Culms sympodial, scandent, 1.2–2.5 cm diam, bud complement 1, branch complement several in a horizontal line, 1 branch dominant, lateral branches dendroid, internodes and branches usually long. *Culm sheaths* persistent, stiff, base usually swollen, internodes hollow, auricles absent or falcate, then with setose oral hairs, blades wedge-shaped, reflexed. *Ligules* membranous. Leaf blades with a short pseudo-petiole, with obscure cross-venation. Inflorescences indeterminate, paniculate, a complex of partial inflorescences and intervening foliar organs, spikelet-bearing axes capitate, bractiferous with axillary buds, prophyllate below the lateral spikelets. Pseudospikelets small, laterally compressed, breaking up at maturity above the glumes. Glumes persistent, 2–4, subequal, shorter than the spikelet, awnless. Florets 2 or 3, the lower one or two bisexual, the upper one sterile, without proximal incomplete florets. Fertile lemma 3- or 5-nerved. Rachilla internodes suppressed. Lodicules 3, ciliate. Stamens 6. Ovary with a conspicuous, broadly conical, fleshy apical appendage. Styles 2 or 3. Fruits fleshy, spherical, pericarp thick, free, endosperm evanescent.

¹ Forest Science Institute of Vietnam, Dong Ngac, Tu Liem, Hanoi, Vietnam; corresponding author e-mail: nhnghia@netnam.vn.

² Forest Science Institute of Vietnam, Dong Ngac, Tu Liem, Hanoi, Vietnam.



Fig. 1 *Melocalamus blaoensis* H.N.Nguyen & V.T.Tran. a. Culm sheath; b. branchlet with leaves; c. section of flowering branch; d. branchlet with fruits; e. spikelet; f. dorsal view of lemma; g. dorsal view of palea; h. stigma; i. stamen; j. lodicules (from HN-LN 0423 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi).

Distribution — Ten species in Bangladesh, India (Assam, W Bengal, Meghalaya), and Burma (Myanmar: Kanchin, Mandalay, Mon, Tinanthayi) to S China (Guangxi, S Yunnan, SE Xizang), up to 1 800 m altitude.

KEY TO THE SPECIES OF *MELOCALAMUS*

1. Culm sheaths auriculate 2
1. Culm sheaths without auricles. — Vietnam 8
2. Auricles glabrous or with soft hairs, adnate to the apex of the sheath 3
2. Auricles setose. — Vietnam. 7
3. Auricles symmetrical 4
3. Auricles asymmetrical. — China *M. scandens*
4. Auricles not curved outwards, with soft hairs
- *M. compactiflorus* 5
4. Auricles curved outwards, glabrous. — Vietnam. 6
5. Ligules glabrous. — India to China
- *M. compactiflorus* var. *compactiflorus*
5. Ligules tomentose. — China
- *M. compactiflorus* var. *fimbriatus*
6. Auricles curved outwards, amplexicaul **1. *M. blaoensis***
6. Auricles erect, not amplexicaul **3. *M. kbangensis***
7. Branches solid. Auricles erect *M. pacoensis*
7. Branches hollow. Auricles curved outwards
- *M. truongsonensis*
8. Branches solid 9
8. Branches hollow. Apex of sheath not deeply concave.
- **6. *M. yenbaiensis***
9. Culm sheath apically with 1 or 2 thin projections on each side. — China *M. elevatissimus*
9. Culm sheath apically without projection 10
10. Apex of sheath slightly concave. — China *M. arrectus*
10. Apex of sheath deeply concave **2. *M. cucphuongensis***

KEY TO THE SPECIES OF *MELOCALAMUS* IN VIETNAM

1. Stigmas 3 2
1. Stigmas 2 5
2. Culm sheaths without auricles. 3
2. Culm sheaths with auricles 4
3. Branches solid, stigmas have filament form, not originated from style, oblique **2. *M. cucphuongensis***
3. Branches hollow. Stigmas flat, originated from style, not oblique. **6. *M. yenbaiensis***
4. Sheath purple, auricles 2.5–3 cm wide, 1.1–1.3 cm high. Stigmas round, large and short **1. *M. blaoensis***
4. Sheath not purple, auricles 2–2.5 cm wide, 0.3–0.5 cm high. Stigmas filamentous, long. **3. *M. kbangensis***
5. Sheath blades triangular, auricles erect. Stigmas sessile on the ovary. **4. *M. pacoensis***
5. Sheath blades linear, auricles curved outwards. Stigmas at the end of well-developed styles **5. *M. truongsonensis***

1. *Melocalamus blaoensis* H.N.Nguyen & V.T.Tran, *sp. nov.* — Fig. 1

Rhizomata sympodiala, culmi scandentes, 1–1.5 cm diam, internodiis 35–40 cm longis. Vaginae culmorum coriaceae duraeque; auriculis conspicuis, revolutis, 0.4–0.5 cm altis, 1.5–2 cm latis. Ligulis foliarum ad 0.5 cm altis. Inflorescentiis iteraurantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae dissite glomeratae; lodiculae aequales; stigmatibus 3, brevis, epistylis, plumosis. — Typus: *HN-LN 0423* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Lam Dong Province, Bao Lam District, Loc Bac Commune, 8 April 2003.

Culms up to 20 m long; 1–1.5 cm diam, flexuose, internodes 35–40 cm long, hollow stems and branches. Young stems covered with sparse, appressed, stiff hairs; nodes with 1 cm high, 2 cm wide buds and a white, powdery 1.5 cm high circle under the node. There is a large branch as the main stem and some small branches. *Culm sheaths* purple, swollen at base, lower base 9–9.5 cm wide, 13–15 cm high; upper base 3.5–4 cm wide. Outer surface covered with a thick, white, powdery layer and smooth veins. Blade triangular, 11–13 by 2.5–3 cm, green as normal leaves and deflexed or reflexed; base concave, apex with long, acute tip. *Auricles* 1.5–2 by 0.4–0.5 cm, curved outwards; two auricles almost embraced the shoot. Leaf wedge-shaped, 16–17 by 1.5–8 cm, base obtuse or rounded, veins 5 or 6 pairs. *Auricles* short, with short hairs. Leaf sheaths with hairs at margins. Pseudopetiole 0.2 cm long, covered with sparse, smooth pubescence. Flowering branches flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikelets small, with a very short pedicel, 2.5–3 by 2.5–3 mm, each with 2 opposite complete florets and one sterile in the middle; glumes 2 or 3, the largest 1.8–2 by 1.8–2 mm, covered with long hairs; lateral veins 5, midrib conspicuous, apically swollen at tip. Lemma 2–2.5 by 2–2.5 mm, outer surface with dense pubescence; veins 5, midrib conspicuous, apically swollen at tip. Palea keeled, clasping the styles and stamens, 2–2.2 by 2–2.5 mm; outer surface covered with dense pubescence, margin with long hairs. Lodicules ovoid, 1.5–1.8 by 0.8–1 mm, margins with long hairs. Stamens c. 2 by 0.2–0.4 mm. Styles filiform. *Stigmas* 3, large, short, two on the top of the styles and one originated from one of those two. Ovary ovoid, velutinous. Fruits fleshy, globose, up to 2 cm diam, with furrows and many hairs when young.

Distribution — Loc Bac Commune, Bao Lam District, Lam Dong Province.

Habitat — The species grows along streams in Loc Bac Commune (Bao Lam District, Lam Dong Province) at 890–900 m a.s.l. altitude, in natural forest after timber exploitation. Flowers were observed in April 2003 and May 2004 with many seedlings. Shoots occur in July and August.

Vernacular name — Tre qua thit Loc Bac.

2. *Melocalamus cucphuongensis* H.N.Nguyen & V.T.Tran, *sp. nov.* — Fig. 2

Rhizomata sympodiala, culmi scandentes, 3.5–4 cm diam, internodiis 45–55 cm longis. Vaginae culmorum coriaceae duraeque; auriculis nullis. Ligulis foliarum ad 0.15 cm altis. Inflorescentiis iteraurantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculis dissite glomeratis; lodiculae inaequales; stigmatibus 3, 2 epistylis, 1 epistigmatibus, plumosis — Typus: *HN-LN 0421* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Ninh Binh Province, Nho Quan District, Cuc Phuong National Park, 1 September 2005.

Culms 15–20 m long, 3.5–4 cm diam, with zigzag, solid stems and branches. Young stems covered with appressed, white hairs; one white powdery, 2 cm high circle under the node. Internodes 20–30 cm long at the stem base and 45–55 cm long on the upper part. There is generally one large branch reiterating the main stem and some small branches on remaining culm nodes. *Culm sheaths* oblong, stiff, swollen at base, covered with white powder when young; lower base 8.5–9 cm wide, 17–18 cm high; upper base 4–5 cm wide, curved at two margins, with smooth veins. Blade triangular, with acute tip and concave base, originally vertical, then deflexed. *Ligules* 0.2 cm high. Leaf blade large, wedge-shaped, 17–20 by 3.2–3.4 cm, apex with up to 2 cm long tip. Base obtuse, oblique. Veins many, smooth, not conspicuous. *Ligules* 0.15 cm high. Leaf sheaths rough, with white powder and conspicuous veins from the base. Pseudopetiole 0.3 by 0.2 cm. Flowering branches

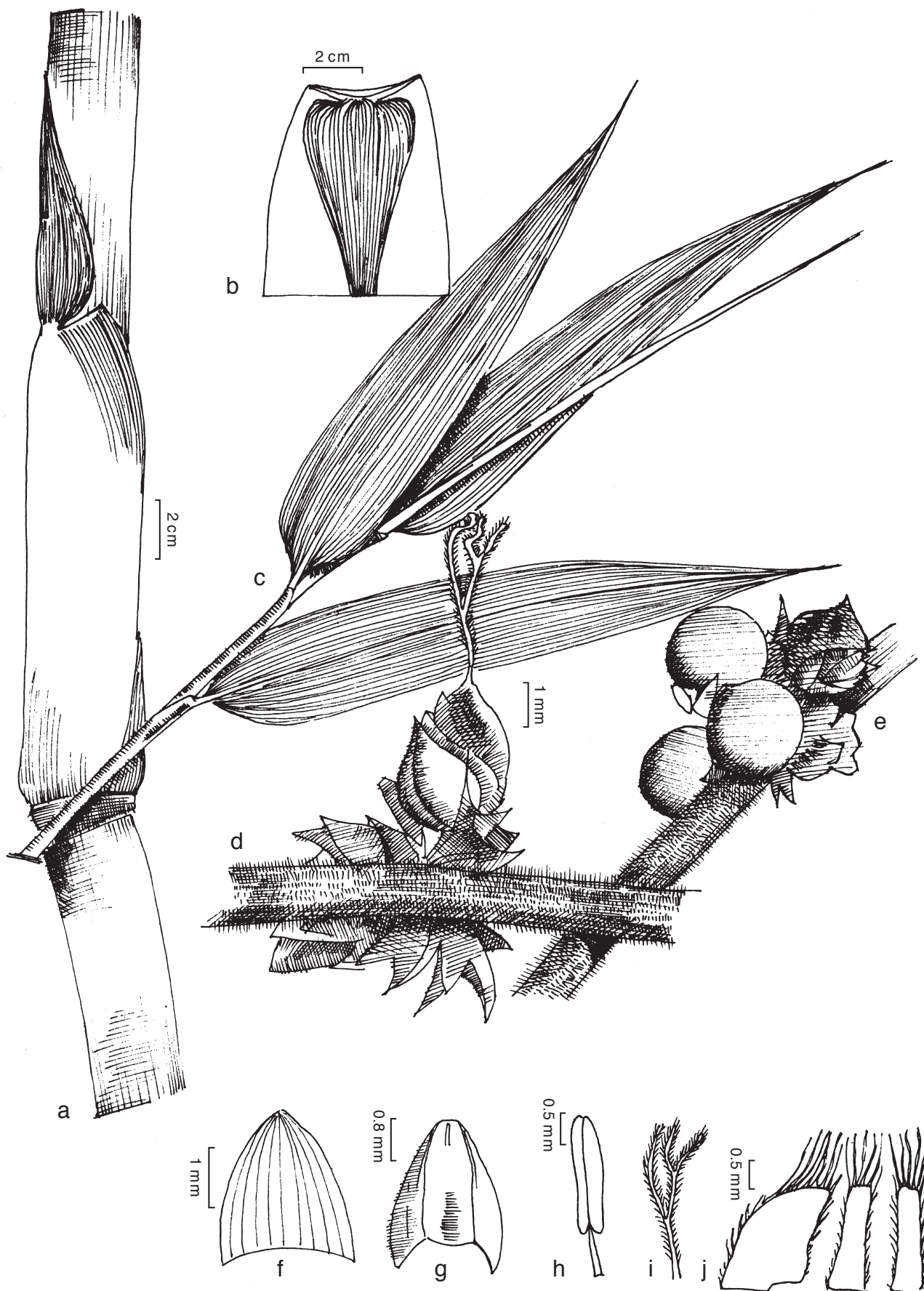


Fig. 2 *Melocalamus cucphuongensis* H.N.Nguyen & V.T.Tran. a. Culm sheath; b. outside of sheath; c. branchlet with leaves; d. section of flowering branch; e. section of fruit branch; f. dorsal view of lemma; g. dorsal view of palea; h. stamen; i. stigma; j. lodicules (from HN-LN 0421 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi)..

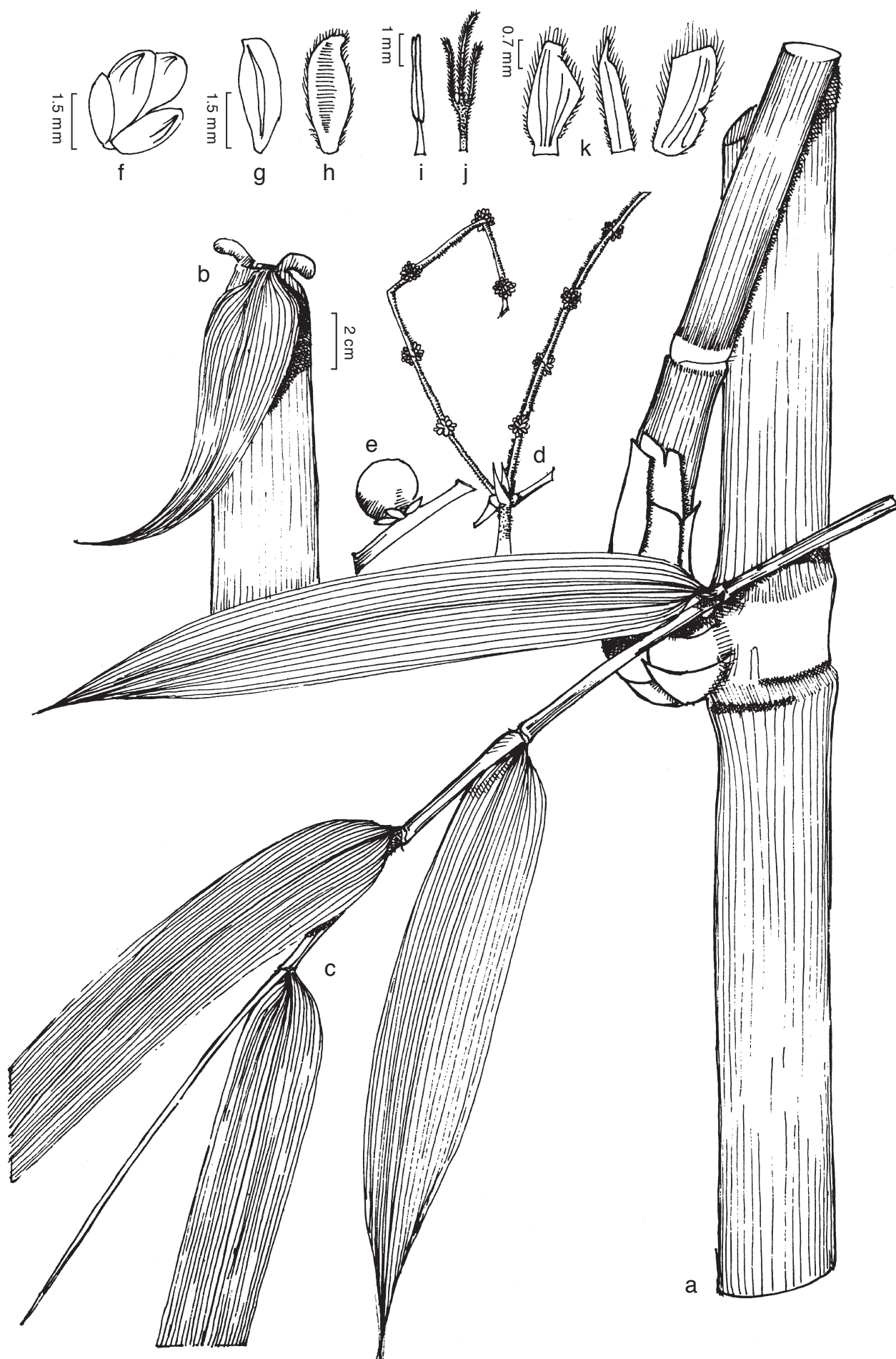


Fig. 3 *Melocalamus kbangensis* H.N. Nguyen & V.T. Tran. a. Longitudinal culm with branch; b. outside of sheath; c. branchlet with leaves; d. flowering branch; e. fruit; f. spikelet; g. ventral view of palea; h. dorsal view of palea; i. stamen; j. stigma; k. lodicules (from HN-LN 0426 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi).

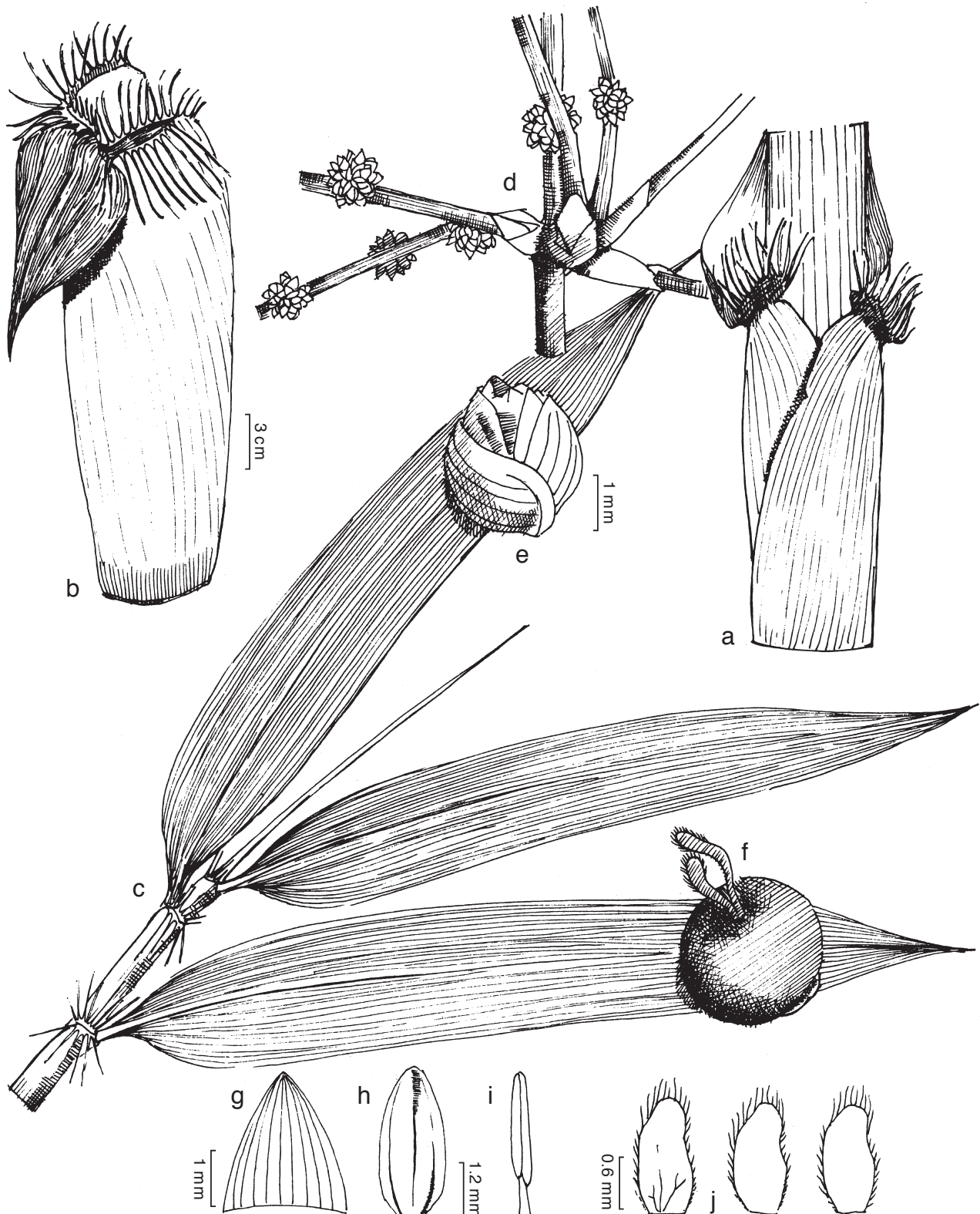


Fig. 4 *Melocalamus pacoensis* H.N.Nguyen & V.T.Tran. a. Culm sheath; b. outside of sheath; c. branchlet with leaves; d. flowering branch; e. spikelet; f. fruit with stigma; g. dorsal view of lemma; h. dorsal view of palea; i. stamen; j. lodicules (from HN-LN 0424 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi).

flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikelets very small, with a very short pedicel, 3 by 3 mm, each with 2 opposite complete florets and one sterile in the middle; glumes 2 or 3, the largest 2–2.5 by 2–2.5 mm, covered with long hairs; lateral veins 5, midrib conspicuous and apically swollen at the tip. Lemma 3 by 2.5–3 mm, outer surface with sparse and standing hairs; veins 5, midrib conspicuous, apically swollen at the tip. Palea keeled, clasping styles and stamens,

2–2.5 by 2–2.5 mm; base deeply concave; top rounded; outer surface covered with dense pubescence, margin with long hairs. Lodicules 3, two of them oblong, c. 1 by 0.5 mm, margins with long hairs; the remaining one oblique ovoid, up to 1.5 mm long, top with very long hairs. Stamens 6, 1.8–2 by 0.3–0.5 mm. Styles filiform. Stigma 3, filiform, two originated from the top of the styles and one originated from one of those two. Ovary ovoid, velutinous. Fruits fleshy, flattened globose, with furrows and many hairs when young.

Distribution — Cuc Phuong National Park, Nho Quan District, Ninh Binh Province, Vietnam.

Habitat — The species can be found at c. 240 m a.s.l. altitude in natural evergreen broadleaved forest. Flowers were observed in Cuc Phuong National Park in 2004 and fruits and seedlings were observed in September 2005.

Vernacular name — Giang dac.

3. *Melocalamus kbangensis* H.N.Nguyen & V.T.Tran, *sp. nov.* — Fig. 3

Rhizomata sympodiala, culmi scandentes, 2–2.5 cm diam, internodiis 55–58 cm longis. Ramis principalibus cavis. Vaginae culmorum coriaceae duraeque; auriculis conspicuis, revolutis, 0.3–0.5 cm altis, 2–2.5 cm latis. Auricula foliarum, apice strigis 0.4–0.6 mm altis; oribus vaginarum tomentosis; ligulis 0.1 cm altis. Inflorescentiis iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae dissite glomeratae; lodiculae inaequales; stigmatibus 3 longis, parvis, epistylis, plumosis. — Typus: *HN-LN 0426* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Gia Lai Province, Kbang District, Kon Ha Nung Forest Station, 18 October 2006.

Culms more than 15 m long, 2–2.5 cm diam, internodes 55–58 cm long, with not so flexuose, grey green stems. Young stems covered with dense, appressed, white hairs. Internode swollen above node; one big sheath scar and a white, 1.5 cm high circle under the node. Base and stems solid, but branches gradually hollow. Branches slender as in *Schizostachyum* and many to the node. Culm sheaths cylindrical, stiff, slightly swollen at base, with dense, soft, appressed, silvery white hairs. Lower base truncate, 5–7 cm wide, 14–16 cm high; upper base 3.5–4.5 cm wide; two shoulders not equal, one horizontal and one spreading downwards. Blade elongated triangular, 12–16 by 2–2.5 cm, apex acute, base concave, curved like sickle when dried, inner surface covered with dense hairs at base. Two auricles 2–2.5 by 0.3–0.5 cm, connated to base of the blades, elongated and spreading outwards, one auricle standing and curved as buffalo's horn, the other auricle usually horizontal and margin curved downwards. Ligules short. Leaf lanceolate, 28–30 by 3.8–4.5 cm, base lightly acute, oblique; margins serrate, veins 9 or 10 pairs. Pseudopetiole 0.4–0.6 by 0.2–0.25 cm, tomentose on both surfaces and caducous. Leaf sheaths covered with dense, standing, silvery white hairs when young; margins of the leaf sheaths tomentose, dense, white. Auricles short, with white, 0.4–0.6 cm long hairs. Ligules up to 0.1 cm high. Distance between leaves 3–4 cm. Flowering branches flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikes very small, with a very short pedicel, each with 2 complete florets and one sterile mushroom-shaped floret at the top. Glumes 2 or 3, the largest c. 2 by 2.5 mm, covered with sparse hairs, margins with long hairs. Lemma 2.5–3 by 2.5–3 mm; midrib conspicuous but lateral veins not so, margins and tops with white hairs. Palea keeled, 2–3.5 by 2.5–3 mm; margins with long white hairs. Lodicules 3, margin with white long hairs; two of them triangular, 2–3 by 1–1.5 mm, top rounded or acute; the remaining one oblong, 2–2.5 by 0.5 mm. Stamens 6, c. 2 by 0.5 mm. Styles filiform, with dense, stiff, standing and short hairs. Stigmas 3, filiform, on the top of the styles, with dense, long pubescence. Fruits fleshy, globose.

Distribution — Kon Ha Nung Forest Station, Kbang District, Gia Lai Province.

Habitat — Occurs in evergreen broad-leaved forests, along hillsides or on flat land with thick humus layer. Flowers and fruits were collected in October 2006 and December 2007.

Vernacular name — Tre qua thit Kon Ha Nung.

4. *Melocalamus pacoensis* H.N.Nguyen & V.T.Tran, *sp. nov.* — Fig. 4

Rhizomata sympodiala, culmi scandentes, 1.8–2.3 cm diam, internodiis 80–85 cm longis, muris 0.8 cm crassis. Vaginae culmorum coriaceae duraeque; auriculis conspicuis, erectis, 0.5–0.6 mm altis, 4–4.5 mm latis, apice strigis ad 2 cm altis. Auriculis foliarum exterioribus 0.2 cm altis, 0.8 cm latis, apice strigis ad 2.5 cm longis; ligulis 0.2 cm altis, apice strigis ad 2.5 cm longis. Inflorescentiis iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae dissite glomeratae; lodiculae inaequales; stigmatibus 2, epiovariis, plumosis. — Typus: *HN-LN 0424* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Hoa Binh Province, Mai Chau District, Hang Kia-Pa Co Nature Reserve, 4 April 2005.

Culms more than 10 m long, 1.8–2.3 cm diam, culm wall 0.8 cm, internodes 80–85 cm long. Young stems green, old stems grey green, nodes covered with appressed, white hairs. One large branch reiterating the main stem and some small branches on remaining culm nodes. Stems hollow as *Schizostachyum*. This feature can be used for distinguishing this species from other *Melocalamus* species. Culm sheaths stiff, embraced the culm; outer surface covered with smooth, fugacious, black hairs. Lower base 22–30 by 15–18 cm; upper base 9–12 cm wide. Blade triangular, 13–19 by 4.5–6.5 cm. Auricles rounded, 4–4.5 by 0.5–0.6 cm, serrate, with 2 cm long stiff hairs. Ligules rounded according to sheath base, with sparse, 1.2 cm long hairs. Leaf blades 30–36 by 6–7 cm, base obtuse, oblique. Veins 10–12 pairs. Ligules 0.2 cm high, with sparse stiff hairs. Auricles c. 0.2 by 0.8 cm, undulated, with sparse stiff 2.5 cm long hairs. Pseudopetiole 0.3 cm long. Flowering branches flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikes small, with a very short pedicel, 2.5–3 by 2.5–3 mm, each with 2 complete florets and one sterile in the middle. Glumes 2 or 3, outer surface covered with smooth hairs, margins with short standing hairs; the largest c. 2 by 2 mm, base concave, top slightly truncate; lateral veins 5, midrib conspicuous, apically swollen at tip. Lemma 2–2.5 by 2–2.5 mm, outer surface with dense pubescence; margin thin, tomentose; veins 5, midrib conspicuous, apically swollen at tip. Palea keeled, not clasping whole styles and stamens, 2–2.5 by 1.8–2 mm; outer surface covered with sparse pubescence, margins with long hairs. Lodicules 3, two of them ovoid, 1–1.2 by 1 mm, margins with long hairs; the last one oblong. Stamens 6, c. 1.5 by 0.5 mm, tip acuminate. Stigmas 2, flat, on the top of ovary, tomentose. Ovary ovoid, velutinous. Fruits fleshy, globose.

Distribution — This bamboo occurs with other bamboos in degraded natural forest in Hang Kia-Pa Co Nature Reserve (Mai Chau District, Hoa Binh province) at 648–980 m a.s.l. altitude, Quan Son District (Thanh Hoa), Bac Quang and Vi Xuyen Districts (Ha Giang). Flowers and fruits were observed in April 2005 with some seedlings.

Habitat — Hang Kia-Pa Co Nature Reserve, Mai Chau District, Hoa Binh Province; Quan Son District, Thanh Hoa Province, and Bac Quang and Vi Xuyen Districts, Ha Giang Province.

Vernacular name — Tre qua thit Pa Co.

5. *Melocalamus truongsonensis* H.N.Nguyen & V.T.Tran, *sp. nov.* — Fig. 5

Rhizomata sympodiala, culmi scandentes, 2–3 cm diam, internodiis 58–60 cm longis. Ramis principalibus cavis. Vaginae culmorum coriaceae duraeque; auriculis conspicuis, revolutis, 0.6–0.8 cm altis, 0.5–0.8 mm latis, ligulis ad 0.2 cm altis, strigis caducis, apice demum serrulato. Auriculis foliarum revolutis ad 0.1 cm altis, 0.3 cm latis, apice strigis ad 1.5 cm longis. Inflorescentiis iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae dissite glomeratae; lodiculae inaequales; stigmatibus 2, magnis, epistylis, plumosis. — Typus: *HN-LN 0425* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Quang Nam Province, Song Thanh Nature Reserve, 28 August 2005.

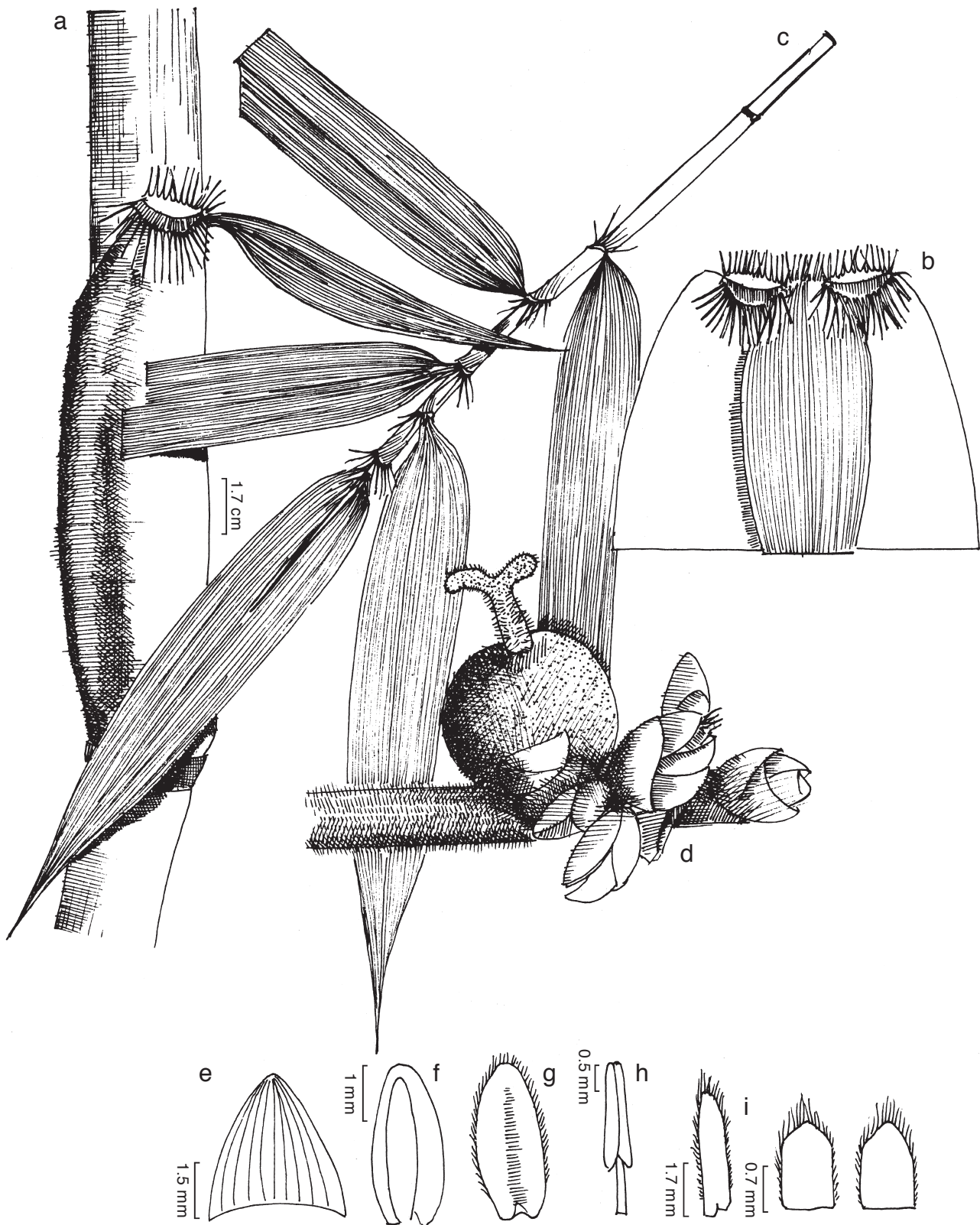


Fig. 5 *Melocalamus truongsonensis* H.N.Nguyen & V.T.Tran. a. Culm sheath; b. outside of sheath; c. branchlet with leaves; d. section of flowering branch and fruit with stigma; e. dorsal view of lemma; f. ventral view of palea; g. dorsal view of palea; h. stamen; i. lodicules (from HN-LN 0425 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi).

Culms 15–20 m long, 2–3 cm diam, internodes 58–60 cm long, with flexuose, solid stems and hollow branches. Tips long and drooping. Nodes swollen, 3.5–4 cm diam with 0.6–0.8 cm high sheath scars. One white powdery, 1–1.5 cm high circle above and under the node. One big branch with similar size as main stem and many small branches on top. *Culm sheaths* cylindrical, stiff, outer surface covered with dense, soft, appressed, black hairs and conspicuous veins on two margins of base. Lower base 16–17 by 12–14 cm; upper base 2.5–3 cm wide. Blades

4–7 by 0.5–0.8 cm. *Auricles* stiff, thick, 0.5–0.8 by 0.6–0.7 cm, deflexed, with two lines of 2.2 cm high hairs. *Ligules* 0.2 cm high, with fugacious hairs, become serrate after shedding. Old leaf wedge-shaped or ovate, young leaf oblong, apex with 2–3 cm long tip. Blade 20–23 by 3–3.5 cm. Base rounded or lightly acute, oblique. Veins 7 or 8 pairs. *Ligules* short. *Auricles* c. 0.1 by 0.3 cm wide, curved outwards, with dense, stiff, 1.5 cm long hairs. Leaf sheaths stiff, with smooth white hairs on 1/2 upper part. Pseudopetiole 0.2–0.3 cm long, with smooth hairs at base.

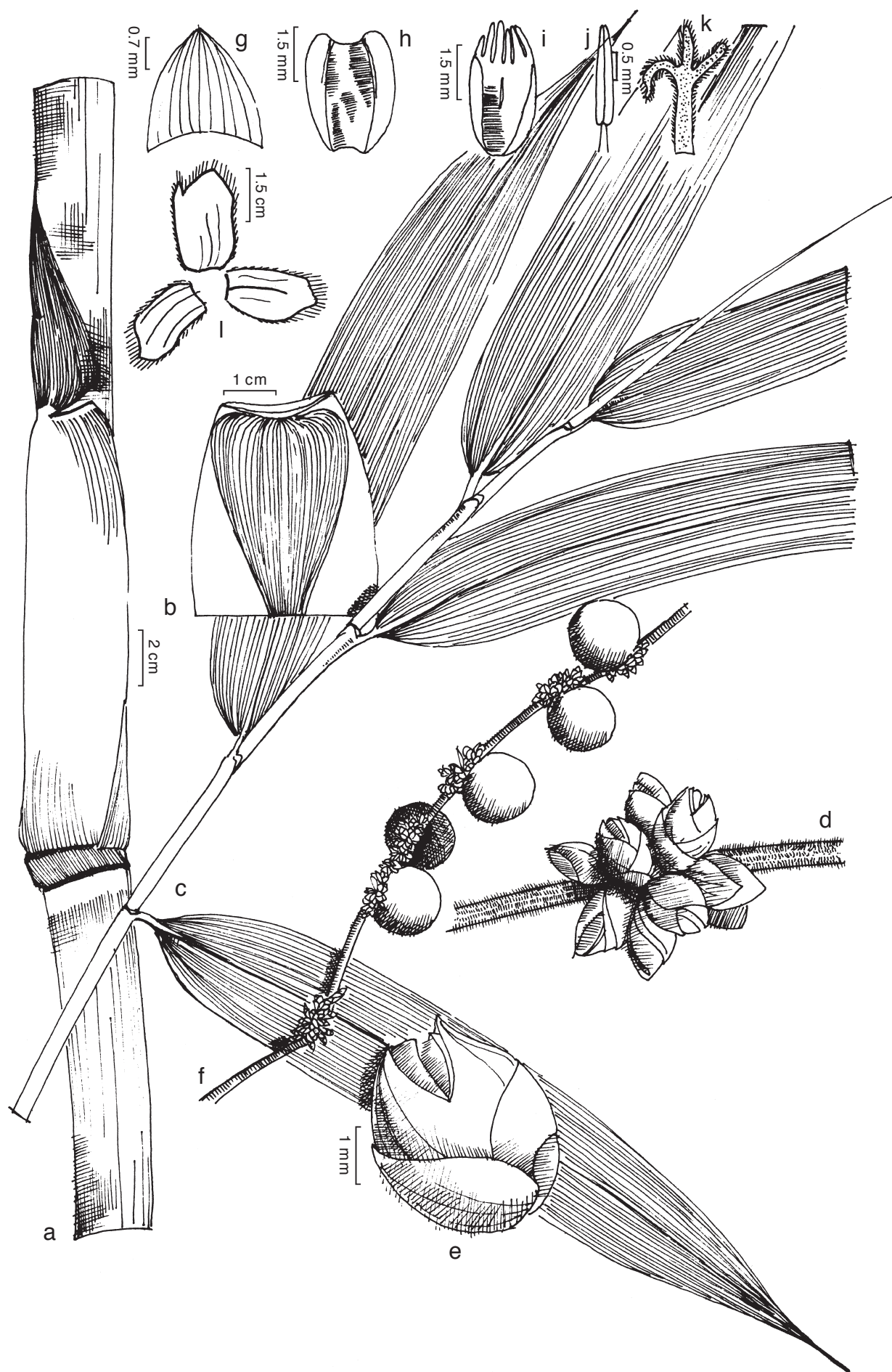


Fig. 6 *Melocalamus yenbaiensis* H.N.Nguyen & V.T.Tran. a. Culm sheath; b. outside of sheath; c. branchlet with leaves; d. section of flowering branch; e. spikelet; f. branchlet with fruits; g. dorsal view of lemma; h. dorsal view of palea; i. ventral view of palea; j. stamen; k. stigma; l. lodicules (from HN-LN 0420 (type), Herbarium of the Forest Science Institute of Vietnam, Hanoi).

Flowering branches flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikelets small, with a very short pedicel, c. 3 by 2–2.5 mm, each with 2 complete florets and one sterile in the middle. Glumes 2 or 3, outer surface covered with dense, smooth hairs; margins with long hairs; the biggest 2–2.2 by 2–2.2 mm; lateral veins 5, midrib conspicuous, apically swollen at tip. Lemma 3.5–4 by 3–3.5 mm, outer surface with dense pubescence; margins with long pubescence; veins 5, midrib conspicuous, apically swollen at tip. Palea keeled, clasping whole styles and stamens, c. 3 by 2.5–3 mm, top concave; outer surface covered with dense pubescence, margins with long hairs. Lodicules 3, two of them ovoid, c. 0.5 by 0.5 mm, margins with long hairs; the last one lanceolate, up to 1.5 mm long, margin with very long hairs. Stamens c. 1 by 0.5 mm. Styles large, flat, short, margins with smooth and long hairs. *Stigmas* 2, flat, on the top of styles, tomentose. Ovary ovoid, velutinous. Fruits fleshy, globose.

Distribution — The species occurs along the Truong Son road from Song Thanh Nature Reserve (Quang Nam Province), Ngoc Linh (Kon Tum), Ba Na (Da Nang), Bach Ma National Park (Thua Thien-Hue) to Phong Nha-Ke Bang National Park and Deo Gio Pass (Quang Binh).

Habitat — This species occurs at 180–1057 m a.s.l. altitude. Flowers, fruits and seedlings were collected in August 2005.

Vernacular name — Tre qua thit Truong Son.

6. *Melocalamus yenbaiensis* H.N.Nguyen & V.T.Tran, sp. nov. — Fig. 6

Rhizomata sympodiala, culmi 2.5–3 cm diam, internodiis 50–70 cm longis. Ramis principalibus cavis. Vaginae culmorum coriaceae duraeque; auriculis nullis, ligulis ad 0.2 cm altis. Ligulis foliarum ad 0.2 cm altis. Inflorescentiis iterauctantibus, spiculae parva, secus ramos elongatos, panícula dissite glomeratae; lodiculæ inaequales; stigmatibus 3, magnis, epistylis, plumosis. — Typus: *HN-LN 0420* (holo HN-LN: Herbarium of the Forest Science Institute of Vietnam, Hanoi), Vietnam, Yen Bai Province, Tran Yen District, Luong Thinh Commune, 14 September 2004.

Culms more than 15 m long, 2.5–3 cm diam, internodes 50–70 cm long, with flexuose, grey green stems. Young stems covered with soft, appressed, white hairs. Internode swollen above the node with one large sheath scar and a white powdery 2 cm high circle under the node. Base and stems solid, but branches gradually hollow and small branches with a very thin wall (as in *Schizostachyum*). Branches slender as in *Schizostachyum* and many to the node. *Culm sheaths* cylindrical, stiff, swollen at base, with soft, appressed, silvery white hairs; parallel veins conspicuous on upper part and smooth on lower part. Lower base truncate, 8.5–9.5 cm wide, 16–17 cm high; upper base 1.9–2.2 cm wide, two margins spreading downwards. Blade elongated triangular, 4.5–5 cm wide, 11–15 cm high, apex acute, base concave, 1 cm deep; base margin curved outwards. Leaf lanceolate, 28–32 by 4.5–5 cm, base rounded or slightly acute, oblique; veins 8 or 9 pairs. *Ligules* c. 0.2 cm high. Pseudopetiole c. 1 by 0.4 cm. Flowering branches flexuose, covered with dense and smooth pubescence up to the tip, usually flat and slightly concave on one side. Pseudospikelets very small, with a very short pedicel 3–4 by 3.5–4 mm, each with 2 opposite complete florets and one sterile in the middle; glumes 2 or 3, the largest (the upper one) c. 3 by 3 mm, covered with

long hairs; lateral veins 5, midrib conspicuous, apically swollen at the tip. Lemma 3–3.5 by 3–3.5 mm, outer surface tomentose; veins 5, midrib conspicuous, apically swollen at the tip. Palea keeled, clasping the styles and stamens, c. 3 by 2–2.5 mm, outer surface sparsely tomentose, margin with long hairs. Lodicules ovoid, c. 2 by 1.5 mm, margins with long hairs, veins 3. Stamens c. 3 by 1.5 mm. Style large, flat. *Stigmas* 3, flat, on the top of the styles, long, velutinous, pink when young and white when old. Ovary ovoid, densely velutinous. Fruits fleshy, spherical, up to 2 cm diam.

Distribution — Luong Thinh Commune, Tran Yen District, Yen Bai Province and Pha Din Pass, Dien Bien Province, Vietnam.

Habitat — Flowering and fruiting occurred in September 2004 and again in February and March 2005, with many seedlings. They occur with *Schizostachyum funghomii* McClure and *Maclurochloa* sp. in degraded natural forest in Yen Bai Province and around the Pha Din Pass (Dien Bien province).

Vernacular name — De yen bai.

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REFERENCES

- Bentham G. 1881. Notes on Gramineae. Journal of the Linnean Society, Botany 19: 134.
- Bentham G. 1883. Gramineae. In: Bentham G, Hooker JD (eds), Genera plantarum 3, 2: 1212. London.
- Clayton WD, Harman KT, Williamson H. 2008. GrassBase – The online world grass flora. <http://www.kew.org/data/grasses-db.html>.
- Dransfield S. 1981. The genus *Dinorchloa* (Gramineae: Bambusoideae) in Sabah. Kew Bulletin 36: 613–633.
- Guo Z-H, Li DZ. 2001. Revision of *Melocalamus* (Bambusoideae: Gramineae) in Yunnan, China. Acta Botanica Yunnanica 23: 177–180.
- Gamble JS. 1896. The Bambuseae of British India. Annals of the Royal Botanic Garden (Calcutta) 7: 84–95, t. 84.
- Hui C-M, Hsueh C-J. 1992. A study on the genus *Melocalamus* Benth. (Bambusoideae) from China. Acta Phytotaxonomica Sinica 30: 163–168.
- Li DZ. 2000. Taxonomy and biogeography of the Bambuseae (Gramineae: Bambusoideae). In: Rao AN, Rao V, Ramanatha (eds), Bamboo-conservation, diversity, ecogeography, germplasm, resource utilization and taxonomy: 14–23.
- Li DZ, Stapleton C. 2006. *Melocalamus*. Flora of China 22: 48–49. Beijing.
- McClure FA. 1936. The bamboo genera *Dinorchloa* and *Melocalamus*. Bulletin of Miscellaneous Information, Royal Gardens, Kew 1936: 251–254.
- Nguyen HN. 2006. Bamboos of Vietnam, Hanoi.
- Nguyen HN, Tran VT. 2006. Six new *Melocalamus* species for Vietnam. Vietnam Journal of Forest Science 3: 125–138.
- Ohrnberger D. 1999. The bamboos of the world: Annotated nomenclature and literature of the species and the higher and lower taxa: 306–308. Amsterdam, New York, Oxford, Tokyo.
- Pham HH. 1999. Vietnam's trees and grasses, Volume 3: 599–627. Ho Chi Minh.
- Seethalakshmi KK, Kumar MSM. 1998. Bamboos of India, a compendium: 141–150. Beijing, Eindhoven, New Delhi.