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. khangensis*, *M. paceensis*, *M. truongsonensis* and *M. yenbaiensis*. The genus is new for Vietnam. Its diagnostic characters are scrambling stems and fleshy fruits.

**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.Dransf., *Dinochloa* Buse, *Melocalamus* Benth., *Melocanna* Trin. and *Sphaerobambos* S.Dransf.

*Melocalamus* was casually and invalidly mentioned by Bentham 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* Ohmb., *M. scandens* Hsueh & C.M.Hui (Ohrnberger 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* Ohmb. (cited from Ohrnberger 1999).

*Melocalamus gracilis* and *M. indicus* have been transferred to *Dinochloa* 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 *Dinochloa*), 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 Bentham & Hooker (1883: 1212). — Type: *Melocalamus compactiflorus* (Kurz) Benth.

Diagnostic characters (after Clayton et al. 2008): Perennial. Rhizomes short, pachymorph. Culms sympodial, scendent, 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. *Culms sheaths* persistent, stiff, base usually swollen, internodes hollow, arches 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: nh nghia@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).
KEY TO THE SPECIES OF MELOCALAMUS

1. Stigmas 3 .................................................. 2
2. Stigmas 2 .................................................. 5
3. Culm sheaths without auricles .................................................. 2
4. Culm sheaths without auricles .................................................. 2
5. Auricles glabrous or with soft hairs, adnate to the apex of the sheath .................................................. 3
6. Auricles symmetrical .................................................. 4
7. Auricles asymmetrical. — China .......................... M. scandens
8. Auricles not curved outwards, with soft hairs .................................................. 5
9. Auricles curved outwards, glabrous. — Vietnam ......................... 6
10. Culm sheath apically without projection .................................................. 7

KEY TO THE SPECIES OF MELOCALAMUS IN VIETNAM

1. Stigmas 3 .................................................. 2
2. Stigmas 2 .................................................. 5
3. Culm sheaths without auricles .................................................. 2
4. Culm sheaths with auricles .................................................. 2
5. Branches solid, stigmas have filament form, not originated from style, oblique .................................................. 2
6. Stigmas flat, originated from style, not oblique .................................................. 6
7. Branches hollow. Stigmas flat, originated from style, not oblique .................................................. 6
8. Branches solid .................................................. 9
9. Branches hollow. Apex of sheath not deeply concave .................................................. 10
10. Apex of sheath slightly concave. — China .......................... M. arrectus
11. Apex of sheath deeply concave 2. M. cucphuongensis

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.

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

Rhizomata sympodiala, culmi scandentes, 3.5–4 cm diam, internodis 45–55 cm longis. Vaginae culmorum coriaceae duraeae; auriculis nullis. Ligulis foliarum ad 0.15 cm altis. Inflorescentiis iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculis dissite glomeratis; lodiculae inaequales; stigmatibus 3, large, short, two on the top of the styles and stamens, 2–2.2 by 2–2.5 cm; outer surface covered with dense pubescence, margin with long hairs. Lodicules ovoid, 1.5–1.8 by 0.8–1.1 cm, 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.

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

Rhizomata sympodiala, culmi scandentes, 3.5–4 cm diam, internodis 45–55 cm longis. Vaginae culmorum coriaceae duraeae; auriculis nullis. Ligulis foliarum ad 0.15 cm altis. Inflorescentiis iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculis dissite glomeratis; lodiculae inaequales; stigmatibus 3, 2 epistylis, 1 epistigmatibus, plumosis — Typus: HN-LN 0423 (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, stiff hairs; 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).
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. Lodicles 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 broad-leaved 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 scendentia, 2–2.5 cm diam, internodis 55–58 cm longis. Ramis principalibus cavis. Vaginae culmorum coriaceae dureaque; auriculis conspicuis, revolutis, 0.3–0.5 cm altis, 2–2.5 cm latis. Auricula foliarum, apice strigis 0.4–0.6 mm altis; orbis vaginarum tomentosis; ligulis 0.1 cm altis. Inflorescentias iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae disiste glomeratae; lodiculae inaequalia; 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, 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. Pseudospikelets 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 cm, base concave, top slightly truncate; lateral veins 5, midrib conspicuous, apically swollen at tip. Leaf blade 2.5–2.5 cm, outer surface with dense pubescence; margin thin, tomentose; veins 5, midrib conspicuous, apically swollen at tip. Palea keeled, not clasping whole styles and stamens, 2.5–3 cm; 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 scendentia, 2–3 cm diam, internodis 58–60 cm longis. Ramis principalibus cavis. Vaginae culmorum coriaceae dureaque; 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 serratulato. Auriculae foliarum revolutis ad 0.1 cm altis, 0.3 cm latis, apice strigosis ad 1.5 cm longis. Inflorescentias iterauctantibus, spiculae parvae, 2-florae, secus ramos elongatos, paniculae disiste glomeratae; lodiculae inaequalia; 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, Son Thanh Nature Reserve, 28 August 2005.
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. Pseudopetirole 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 2–2.5 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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