

New Species of *Calamus* (Palmae) from Vietnam

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1. *Calamus acaulis*,
short-stemmed habit
and clustered pinnae.

Nine new species of *Calamus* from Vietnam are described and their relationships discussed.

Calamus is the largest genus of palms, currently thought to contain 374 species (Govaerts & Dransfield, 2005). There is no revision of the entire genus, except for the century-old works of Beccari (1908, 1913). The standard work on Vietnamese *Calamus* has been the *Flore Générale de l'Indo-Chine* (Gagnepain & Conrard, 1937), based on earlier works by Beccari (1908, 1910, 1913) and Magalon (1930). The treatment of *Calamus* in both Gagnepain and Conrard (1937) and Magalon (1930) has been criticized by Evans et al. (2002). These authors have reviewed most of the available *Calamus* specimens from the Indochina region and presented a new synopsis. Evans et al. recognize 18 species from Vietnam, and we follow this here in describing the following nine new species.

In order to put these new species in the context of the whole genus, we also attempt to place them in subgroups. The subgeneric classification of *Calamus* is in a state of flux (Beccari, 1908; Furtado, 1956; Dransfield, 1979; Kramadibrata, 1992; Baker et al., 2000), and Beccari's (1908) system, as modified by Furtado (1956) and Dransfield (1979), is still used pending a modern treatment of the problem. Beccari recognized 16 informal groups of species, and we use these to place the new species.

Calamus acaulis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *Calamo acanthophyllo* ocreis prominentibus dense brunneo-setosis, paribus apicalibus pinnarum per longitudinem sui paene totam junctis et pinnis ad margines minute setosis, venis esetosis praeditis differt. Typus. Vietnam. Phu Yen: Tuy Hoa District, route number 1 at Ca Pass near border with Khanh Hoa, 12°51'N, 109°23'E, ca. 100 m, 22 Jul 2007, A. Henderson & Ninh Khac Ban 3451 (Holotypus: HN! Isotypi: K! NY!). Fig. 1.

Stems solitary, non-climbing, short and subterranean or visible above ground for about 5 cm, 3–3.5 cm diameter without sheaths, green. Leaves 9–12; leaf sheaths open, green with brown tomentum, with scattered, yellowish spines to 6 cm long, borne singly or in small groups; ocreas prominent, 4–10 cm long, densely brown bristly; knees absent; flagella absent; petioles 46–60 cm long, spiny as the sheaths; rachis 53–64 cm long, with few, straight spines abaxially; cirri absent; pinnae 21–25 per side of rachis, 22–30 cm long, 2–2.5 cm wide at the middle, lanceolate, borne in distant clusters of 2–6 pinnae, each pinna of a cluster spreading in a different plane, the

apical pair joined for almost their entire length, minutely bristly on the margins, not bristly on the veins, yellowish at the bases. Staminate inflorescences to 1 m long, erect, branched to 3 orders, with at least 7 partial inflorescences; prophylls 14 cm long; partial inflorescence bracts tubular, not splitting laterally, with a prominent lobe at the apex; rachillae not known in their entirety; rachillae bracts 1.5 mm high, apiculate; floral bracteoles cupular, 2-lobed; old staminate flowers 3 mm long; calyx 1.5 mm long, split for half its length into 3 lobes; corolla 3 mm long, split to the base into 3 valvate petals; pistillate inflorescences 77 cm long, erect, not flagellate, branched to 2 orders, with 4–5 partial inflorescences; prophylls not known; partial inflorescence bracts tubular, splitting laterally as the fruits develop; rachillae 1–13, 1–3 cm long; rachillae bracts 1.5 mm high, apiculate; floral bracteoles cupular, 2-lobed; flowers 3.5 mm long (post-anthesis); calyx 2 mm long, split for about half its length into 3 lobes; corolla 2.5 mm long, split for most of its length into 3 valvate petals; fruits immature, yellowish.

Local names and uses: None recorded.

Distribution and habitat: Known only from Phu Yen in central Vietnam, on steep rocky slopes in disturbed forest.

Notes: The specimens cited here will key in Evans et al. (2002) to *Calamus acanthophyllus* Becc. *Calamus acaulis* differs from that species in its prominent, densely brown bristly (versus obscure, non-bristly) ocreas; apical pair of pinnae joined for almost their entire length (versus not joined); and pinnae with minutely bristly margins and non-bristly veins (versus conspicuously bristly margins and veins). However, the short, green stem observed on one specimen of *C. acaulis* indicates that a taller stem could develop. If this were the case, it would key to *C. thysanolepis* Hance. It differs from that species in its solitary (versus clustered) stems and apical pair of pinnae joined for almost their entire length (versus not joined).

The staminate flowers of *C. acaulis* appear not to be always distichously arranged, but sometimes in groups. Unfortunately the staminate inflorescence is too old to observe this easily.

By its non-climbing habit, eflagellate sheaths, ecirrate leaves, eflagellate inflorescences, and non-pedicellate floral bracteoles, *Calamus*

acaulis appears to belong to Beccari's (1908) Group II. Another non-climbing Vietnamese species is included in this group – *Calamus dongnaiensis* Pierre. *Calamus acaulis* differs from this in its solitary (versus clustered) stems and apical pair of pinnae joined for almost their entire length (versus not joined).

Additional specimens examined. VIETNAM. PHU YEN: Tuy Hoa District, route number 1 at Ca Pass near border with Khanh Hoa, 12°51'N, 109°23'E, ca. 100 m, 22 Jul 2007, *Henderson & Ninh Khac Ban 3452* (HN, NY).

Calamus bachmaensis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *Calamo dioico* petiolis longis, ocreis brevibus, pinnis lanceolatis plus minusve regulariter dispositis, paribus basalibus trans vaginas non retrocurvis atque paribus apicalibus ad bases sui coalitis differt. Typus. Vietnam. Thua Thien-Hue: Bach Ma National Park, 16°14'N, 107°52'E, ca. 100 m, 12 Apr 2007, *A. Henderson, Nguyen Quoc Dung, Phan Doan Vong, Phan Quyet, & Le Van Bo 3263* (Holotypus: HN! Isotypi: K! NY!).

Stems clustered, climbing, 10 m tall, 1.3 cm diameter with sheaths. Leaf sheaths closed and tubular, green, without tomentum, with densely arranged, reddish-brown, flattened spines to 1 cm long, interspersed among many smaller spines; ocreas ca. 1 mm high, densely covered with reddish-brown, needle-like spines to 0.8 cm long; knees obscure; flagella 1 m long; petioles 8–15 cm long, with recurved spines on the margins and abaxially; rachis 24–25 cm long, spiny as the petioles; cirri absent; pinnae 4–6 per side of rachis, 14–30 cm long, 2–3.5 cm wide at the middle, lanceolate, more or less regularly arranged, the apical pair joined at their bases for ca. one third their length, sparsely bristly on the margins and veins adaxially. Staminate inflorescences to 80 cm long, pendulous, flagellate, branched to 2 orders, with 1–3 partial inflorescences; prophylls 15–17 cm long, tubular, split at apex only, scarcely spiny; partial inflorescence bracts tubular, not splitting laterally; rachillae 6–9, 2–5 cm long; rachillae bracts 1.5 mm high, apiculate; floral bracteoles cupular, 2-lobed; staminate flowers 5.5 mm long; calyx tubular, 2.5 mm long, briefly 3-lobed; corolla 5.5 mm long, split almost to the base into 3 valvate petals; stamens 6; filaments inflexed at the apices; pistillode minute; pistillate inflorescences 80–104 cm long, pendulous, flagellate, branched to 2 orders, with 1–2 partial inflorescences; prophylls 17 cm long; partial inflorescence bracts tubular, splitting

laterally, densely spiny on outer surfaces; rachillae 14–19, 1.5–4 cm long; rachillae bracts 1 mm high, apiculate; floral bracteoles cupular, 2-lobed; old pistillate flowers 2 mm long; calyx 2 mm long, briefly 3-lobed at the apex; corolla 1.5 mm long; fruits immature.

Local names and uses: *may cam tre, may tre.*

Distribution and habitat: Central Vietnam in Thua Thien-Hue in Bach Ma National Park, in lowland forest on limestone soils at low elevations.

Notes: In Evans et al. (2002) the specimens cited here will key to *Calamus dioicus* Lour. The neotype of this (*Pierre 4834*, designated by Evans et al., 2002) comes from the southern part of Vietnam, “in montibus Chiao-Xhan,” in present-day Bien Hoa. Identical specimens have been recently recollected from nearby Dong Nai (*Henderson et al. 3402, 3406*). Interpreted from the neotype and these two recent collections, *Calamus dioicus* is a small rattan having distinctive leaves with 4 cm long, membranous ocreas, no petioles, and linear pinnae arranged in three (rarely two), distant groups along the rachis with the basal pair of pinnae swept back across the sheath and the apical pair of pinnae not joined. We have examined another specimen of *C. dioicus* cited by Evans et al., *Poilane 5042* at P and VNM, and these are also an exact match. However, we have not seen the P sheet of *Poilane 5042* with a staminate inflorescence, which Evans et al., because of the long inflorescence, considered might belong to another species. However, Gagnepain and Conrard (1937) described this inflorescence as 1.5 m long, and we have seen such long staminate inflorescences of *C. dioicus* in the field.

Evans et al. (2002) cited another specimen of *Calamus dioicus* (*Newman 158*) from Bach Ma National Park, at least 500 km north of Bien Hoa and Dong Nai. However, this, and an additional specimen from Bach Ma (*Henderson et al. 3263*) differ from *Calamus dioicus* in their 1 mm long ocreas, 8–15 cm long petioles, and lanceolate pinnae more or less regularly arranged with the basal pair of pinnae not swept back across the sheaths and the apical pair of pinnae joined at their bases for ca. one third their length. These two specimens are recognized here as a new species, *C. bachmaensis*.

Unfortunately, Evans et al. (2003) used *Pierre 4834* and *Newman 158* to provide a description

of *Calamus dioicus* – their description thus becomes a mixture of *C. dioicus* (leaves) and *C. bachmaensis* (leaves and staminate inflorescences).

By its climbing stems, flagellate sheaths, ecirrate leaves, flagellate inflorescences, tubular partial inflorescence bracts, and non-pedicellate floral bracteoles, *Calamus bachmaensis* belongs to Beccari's (1908) Group V.

Additional specimens examined. VIETNAM. THUA THIEN-HUE: Bach Ma National Park, Khe Don, 200 m, 19 Jan 1990, *Newman 158* (K).

Calamus centralis Henderson, N. K. Ban & N. Q. Dung, *sp. nov.*, a *Calamo palustri* habitu tenero, pinnis paucioribus et rachillis staminatis pistillatisque brevioribus differt. Typus. Vietnam. Nghe An: Pu Huong Nature Reserve, 19°19'N, 105°03'E, ca. 200 m, 8 May 2007, A. Henderson, Bui Van Thanh, Tran Duc Dung, Chu Van Dai, & Vu Ba Hung 3352 (Holotypus: HN! Isotypi: K! NY!). Fig. 2.

Stems clustered, climbing, to 20 m long, 0.8–1 cm diameter with sheaths. Leaf sheaths closed and tubular, green, without tomentum or with mottled brown tomentum, with few, scattered, yellowish-green or brown, flattened spines to 2 cm long, sometimes shorter spines interspersed; ocreas obscure, membranous; knees prominent; flagella absent; petioles absent or 2–3 cm long; rachis 38–82 cm long, with solitary or paired, recurved spines abaxially; cirri 40–76 cm long; pinnae 3–7 per side of rachis, 10–27 cm long, 1–4.5 cm wide at the middle, linear-lanceolate, distantly and irregularly arranged, the basal pair swept back across the sheath, minutely bristly along the margins with longer bristles at the apices, the veins not bristly. Staminate inflorescences to 36 cm long, erect or arching, not flagellate, branched to 2 orders, with 5–10 partial inflorescences; prophylls 1–5 cm long; partial inflorescence bracts tubular, not splitting laterally, with a prominent lobe at the apex;



2. *Calamus centralis*, leaf sheaths and inflorescence.

rachillae 1–10, to 1 cm long; rachillae bracts 1 mm high, apiculate, ciliate; floral bracteoles cupular, 2-lobed; staminate flowers 5 mm long; calyx tubular, 3 mm long, split for about half its length into 3 lobes; corolla 5 mm long, split almost to the base into 3 valvate petals; stamens 6; filaments inflexed at the apices; pistillode minute; pistillate inflorescences 28–30 cm long, erect, not flagellate, branched to 2 orders, with 4–5 partial inflorescences; prophylls 4 cm long; partial inflorescence bracts tubular, not splitting laterally; rachillae 4–6, 1–2 cm long; rachillae bracts 2 mm high, apiculate, ciliate; floral bracteoles cupular, 2-lobed; pistillate flowers 4.5 mm long; calyx 4.5 mm long, briefly 3-lobed at the apices; corolla 4 mm long, split for about half its length into 3 valvate petals; staminodes 6, the filaments cupular; fruits not known.

Local names and uses: *may, may mat.*

Distribution and habitat: Central Vietnam in Nghe An and Ninh Binh, in lowland forest on limestone soils.

Notes: The specimens cited here will key to *Calamus palustris* Griff. in Evans et al. (2002). *Calamus centralis* and *C. palustris* occur together in central Vietnam, and are most easily distinguished by the more slender stems of *C. centralis* (stems 0.8–1 cm diameter versus stems to 5 cm diameter), its fewer (3–7 versus 12–25) pinnae, shorter (to 1 cm long versus to 3.5 cm long) staminate rachillae, and shorter (1–2 cm long versus to 6 cm long) pistillate rachillae.

By its climbing habit, eflagellate sheaths, cirrate leaves, eflagellate inflorescences, tubular partial inflorescence bracts, *Calamus centralis* appears to be a member of Beccari's (1908) Group XV.

Additional specimens examined. VIETNAM. NINH BINH: Nho Quan District, Cuc Phuong National Park, trail near Bong, 20°35'N, 105°60'E, ca. 300 m, 5 May 2007, *Henderson et al.* 3334 (HN, NY). **NGHE AN:** Pu Huong Nature Reserve, 19°18'N, 105°07'E, ca. 250 m, 7 May 2007, *Henderson et al.* 3347 (HN, NY); Pu Huong Nature Reserve, 19°19'N, 105°03'E, ca. 200 m, 8 May 2007, *Henderson et al.* 3352 (HN, NY); Pu Huong Nature Reserve, Cuom Village, 19°24'N, 104°58'E, ca. 300 m, 10 May 2007, *Henderson et al.* 3358 (HN, NY); Pu Mat National Park, road from Con Cuong to Thac Kem, 18°57'N, 104°48'E, ca. 100 m, 12 May 2007, *Henderson et al.* 3368 (HN, NY); Pu Mat National Park, road from Con Cuong to Thac Kem, 18°57'N, 104°49'E, ca. 100 m, 14 May 2007, *Henderson et al.* 3373 (HN, NY).

Calamus crispus Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *Calamo tetradactylo* ocreis brevibus, petiolis nullis, pinnis nitidis viridibus ad margines conspicue setosis, apicibus crispatis differt. Typus. Vietnam. Thua Thien-Hue: Bach Ma National Park, ca. 8 km from the summit, 16°13'N, 107°51'E, ca. 530 m, 13 Apr 2007, A. Henderson, Nguyen Quoc Dung, Phan Doan Vong, Phan Quyet, & Le Van Bo 3273 (Holotypus: HN! Isotypi: KI NY!).

Stems clustered, climbing, to 10 m tall, 1.5–1.8 cm diameter with sheaths. Leaf sheaths closed and tubular, green with brown tomentum, with scattered, green, downward-pointing spines to 1 cm long, with crescent-shaped, concave bases; ocreas 1 mm long; knees present; flagella 120 cm long; petioles absent on older plants; rachis 28–35 cm long, with solitary or paired, recurved spines marginally and abaxially; cirri absent; pinnae 9–10 per side of rachis, 9.5–14 cm long, 1–3 cm wide at the middle, broadly lanceolate, clustered in remote groups of 2 or 3 pinnae and spreading in different planes, glossy green, curled over at the apices, the basal pair of pinnae swept back across the sheath, the apical pair of pinnae joined for more than half their length, with conspicuous, yellow bristles along the margins, the veins not bristly. Staminate inflorescences 90–130 cm long, arching, not flagellate, with 8 partial inflorescences; prophylls 14 cm long, spiny; partial inflorescence bracts, tubular, not splitting laterally, spiny; rachillae ca. 20, 1 cm long (unexpanded); rachillae bracts 1 mm high, acuminate; floral bracteoles cupular; staminate flowers (immature) 1 mm long; calyx 1 mm long, split for about half its length into 3 lobes; corolla 1 mm long, split for most of its length into 3 valvate petals; stamens 6; pistillate inflorescences not known.

Local names and uses: *may tat, may tom.*

Distribution and habitat: Central Vietnam in Thua Thien-Hue and near Da Nang City, in Bach Ma National Park and Ba Na-Nui Chua Nature Reserve, on steep slopes in lowland rain forest at 500–800 m elevation.

Notes: In Evans et al. (2002) the specimens cited here will key to *C. tetradactylus* Hance. In Bach Ma National Park, where *Calamus crispus* and *C. tetradactylus* are sympatric, *C. crispus* differs most obviously from *C. tetradactylus* in its very short (versus well-developed) ocreas, lack of a petiole (versus well-developed petioles), basal pair of pinnae swept back across the sheath (versus not swept back), and glossy green pinnae with conspicuously bristly

margins and curled apices (versus green pinnae without conspicuously bristly margins and curled apices).

By its climbing habit, flagellate sheaths, ecirrate leaves, flagellate inflorescences, tubular inflorescence bracts, and non-pedicellate floral bracteoles, *Calamus crispus* appears to belong to Beccari's (1908) Group V.

Additional specimens examined. VIETNAM. Da Nang City, Hoa Vang District, Ba Na-Nui Chua Nature Reserve, 16°00'N, 108°01'E, ca. 800 m, 18 Apr 2007, *Henderson et al.* 3290 (HN, NY); Da Nang City, Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road to summit 16°00'N, 108°01'E, ca. 900 m, 23 Apr 2007, *Henderson et al.* 3317 (HN, NY).

Calamus fissilis Henderson, N. K. Ban & N. Q. Dung, *sp. nov.*, a speciebus aliis generis *Calami* cirris atque bracteis inflorescentiae paene ad basem fissis differt. Typus. Vietnam. Thua Thien-Hue: Bach Ma National Park, 16°14'N, 107°52'E, 100 m, 12 Apr 2007, *A. Henderson, Nguyen Quoc Dung, Phan Xuan Phuong, & Le Van Bo* 3266 (Holotypus: HN! Isotypi: K! NY!). Fig. 3.

Stems clustered, 7–10 m long, 1 cm diameter with sheaths. Leaf sheaths closed and tubular, green with dense, reddish-brown tomentum initially, with brown, flattened, horizontally spreading spines to 1 cm long, borne in short rows; knees present, obscure; ocreas obscure, less than 0.3 cm long, membranous; flagella absent; petioles absent or to 0.5 cm long; rachis 28–30 cm long, with few, recurved, solitary spines abaxially; cirri present, 40–45 cm long; pinnae 9–11 per side of rachis, 16.5–20 cm long, 1–1.2 cm wide at the middle, linear-lanceolate, regularly and distantly arranged, minutely spiny along the margins. Staminate inflorescences 10–19 cm long, arching, not flagellate, branched to 2 orders, with 3–6 partial inflorescences; prophylls 4–6 cm long, sometimes subtending the first partial inflorescence; partial inflorescence bracts 3–3.5 cm long, densely brown tomentose on the outer surfaces, split almost to their bases before anthesis; rachillae 1–5, 1–1.5 cm long; rachillae bracts 1.5 mm high, acuminate; floral bracteoles cupular; staminate flowers 3 mm long; calyx 2–2.5 mm long, cupular, shallowly lobed at the apex, glabrous except for



3. *Calamus fissilis*, leaves and inflorescences.

tomentum on lobes; corolla 2.5–3 mm long, split to the base into 3 valvate petals, glabrous; stamens 6, 2 mm long; pistillode absent; pistillate inflorescences and fruits not known.

Local names and uses: *may cam*; the canes are used for tying.

Distribution and habitat: Known only from central Vietnam in Thua Thien-Hue and near Da Nang City, on steep slopes in lowland rain forest.

Notes: In Evans et al. (2002) the specimens cited here will key to the couplet containing *Calamus guruba* Buch.-Ham. and *C. hypoleucus* (Kurz) Kurz. These two species belong to Beccari's (1908) Group VI, having the partial inflorescence bracts split open and becoming laminar. However, this group has flagellate sheaths and ecirrate leaves, unlike the eflagellate sheaths and cirrate leaves of *C. fissilis*. By its combination of eflagellate sheaths, cirrate leaves, and deeply splitting partial inflorescence bracts, *C. fissilis* does not fit into any of Beccari's groups.

Additional specimens examined. VIETNAM. Da Nang City, Hoa Vang District, Ba Na-Nui Chua Nature Reserve, 16°00'N, 108°01'E, ca. 800 m, 18 Apr 2007, *Henderson et al.* 3289 (HN, K, NY).

Calamus kontumensis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus aliis generis *Calami* prophylo alte in pedunculo inserto, bracteis partialibus inflorescentiae findentibus laceratisque atque basibus bracteolarum floralium tumidis et inaequis differt.

Typus. Vietnam. Kon Tum: Kon Plong Distr., Hieu Mun., Mang La Forest Enterprise, 14°39'N, 108°39'E, 1100–1200 m, 23 Apr 2000, *L. Averyanov et al.* VH 5697 (Holotypus: HN! Isotypus: MO!).

Stem branching not known, climbing, to 3 m tall, 0.8–0.9 cm diameter with sheaths. Leaf sheaths closed and tubular, brown tomentose initially, with scattered, yellowish, black-tipped, flattened spines to 1 cm long, or spines absent; ocreas 0.5 mm long, membranous, not bristly or spiny; knees present; flagella 20–22 cm long, with tattering bracts; petioles 9–10 cm long; rachis 15–23 cm long, with solitary, recurved spines abaxially; cirri absent; pinnae 5–6 per side of rachis, 7–13.5 cm long, 1–3 cm wide at the middle, broadly lanceolate, clustered in remote pairs, the apical pair of pinnae briefly joined at their bases, the veins

and margins not bristly except for a few bristles at apices of pinnae. Staminate inflorescences not known; pistillate inflorescences 25–50 cm long, not or only briefly flagellate, branched to 2 orders, with 1–4 partial inflorescences, these inserted well below the mouth of the partial inflorescence bract; prophylls 5–9 cm long, inserted 1.5–6 cm above the base of the peduncle, not spiny or with a few, straight spines, splitting and tattering almost to the bases; partial inflorescence bracts tubular, splitting and tattering almost to the bases, not spiny; rachillae 1–4, 2–7 cm long, zigzag, densely brown tomentose; rachillae bracts 1.5 mm high, acuminate; floral bracteoles cupular, lobed, borne on swollen, uneven bases; pistillate flowers not known; fruits 0.7 cm diameter, globose, prominently rostrate, brown, with the perianth forming a pedicellate base; endosperm homogeneous.

Local names and uses: None recorded.

Distribution and habitat: Central Vietnam in Kon Tum, in primary, broad-leaved, closed, evergreen, wet, mountain forest on steep sandstone slopes at 1100–1200 m elevation.

Notes: The specimen cited here will not key in Evans et al. (2002). *Calamus kontumensis* is a distinctive species, differing from other Indochinese *Calamus* in its prophyll inserted high on the peduncle and splitting and tattering partial inflorescence bracts (although in this it is remarkably similar to *C. bousigonii* Becc. subsp. *smitinandii* J. Dransf.). By its climbing habit, flagellate sheaths, ecirrate leaves, and swollen, uneven bases of the floral bracteoles ("involucrophores pedicellate" of Beccari), *Calamus kontumensis* might belong to Beccari's (1908) Group VIII. However, this group is said to have regularly arranged, elongate pinnae, flagellate inflorescences, and ruminant endosperm, none of which are found in *C. kontumensis*. Nor are its floral bracteole bases nearly as pronounced as those, for example, of *C. peregrinus* Furtado, a member of Group VIII. *Calamus kontumensis* is therefore not placed in any of Beccari's groups.

Calamus lateralis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *Calamo melanacantho* pinnis apicalibus longioribus, setis in paginis adaxialibus pinnarum longioribus et bracteolis floralibus prominentibus differt Typus. Vietnam. Dong Nai: Cat Tien National Park, trail to Crocodile Lake, lowland forest, 11°26'N, 107°26'E, 150 m, 27 May 2007, *A. Henderson, Bui Van Thanh, Vu Van Duy, Nguyen*



4. *Calamus lateralis*, leaf sheaths with reddish-brown tomentum and no spines.

Ngoc Quynh, & Phan Van Phuc 3400 (Holotypus: HN! Isotypi: K! NY!). Fig. 4.

Stems solitary, to 70 m long, 4–5.5 cm diameter with sheaths. Leaf sheaths closed and tubular, green with dense reddish-brown tomentum initially, without spines or with few, scattered, to 1 cm long spines; knees present, swollen; ocreas obscure; flagella to 5 m long; petioles 19–30 cm long, covered laterally and abaxially with recurved spines to 0.5 cm long; rachis 80–140 cm long, abaxially with spines as the petiole; cirri absent; pinnae 39–51 per side of rachis, 27–39 cm long, 1.5–2.2 cm wide at the middle, lanceolate, regularly arranged and spreading in the same plane, with 1 cm long, brown, yellow-based bristles on the two lateral veins adaxially, sometimes these on the mid-vein. Staminate inflorescences to 1.7 m long, erect or arching, not flagellate, branched to 3 orders, with to 8 partial inflorescences; prophylls not known; partial inflorescence bracts closely sheathing the main axis, without spines or with a few, recurved spines; rachillae number not known, 2.5 cm long; rachillae bracts 1 mm high, acuminate; floral bracteoles

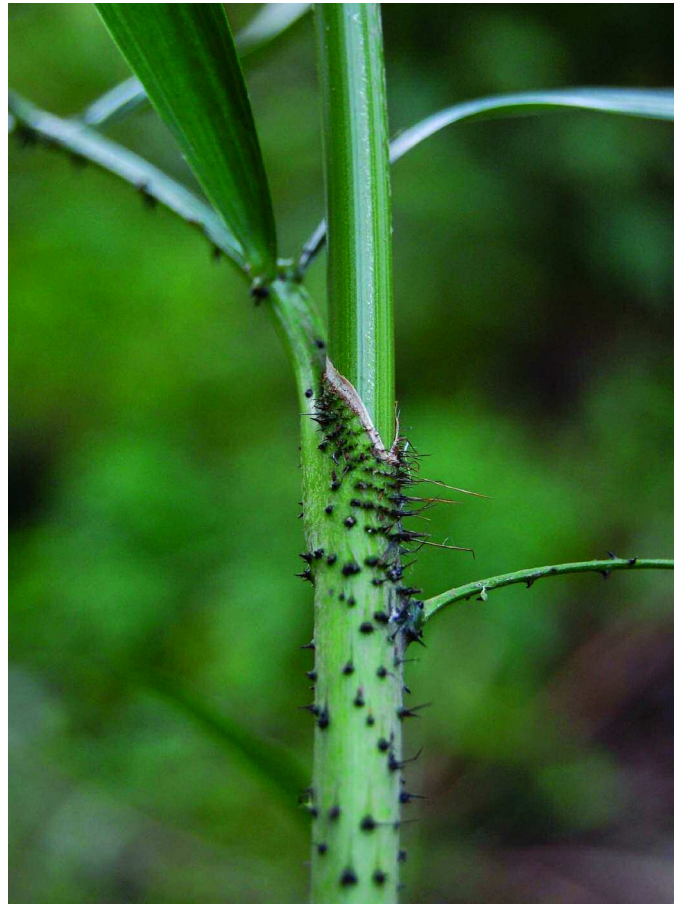
cupular, scarcely lobed; staminate flowers not known, arranged alternately and distichously along the rachillae; pistillate inflorescences to 2.8 m long, including an elongate flagellate extension to 1.8 m long, branched to 2 orders, with 2–5 partial inflorescences; prophylls not known; partial inflorescence bracts splitting laterally; rachillae 21–28, 2–10 cm long; rachillae bracts 1.5 mm high, acuminate; floral bracteoles cupular, scarcely lobed; pistillate flowers not known; fruits 2.5–3.5 cm long, 2 cm diameter, ellipsoid, orange, with the perianth forming a pedicellate base; endosperm ruminant; embryo lateral.

Local names and uses: *may xanh*, *may tu* (Vietnam). Produces one of the best quality, large diameter canes in Vietnam.

Distribution and habitat: Cambodia and southern Vietnam; lowland rain forest in Vietnam, semi-evergreen forest in Lao, at low elevations.

Notes: In Evans et al. (2002) the specimens cited here will key to *Calamus poilanei* Conrard. *Calamus lateralis* bears a close resemblance to

5. *Calamus spiralis* leaf sheaths.



C. poilanei, but differs in its fruits with ruminant (versus homogeneous) endosperm and lateral (versus basal) embryo. Ruminant endosperm and a lateral embryo is an unusual combination in *Calamus* (Beccari, 1908), and occurs in two Indochinese species placed in Beccari's Group IX – *C. gracilis* Roxb. and *C. melanacanthus* Mart.

Calamus lateralis presumably belongs in Group IX. It clearly differs from the slender, clustered stemmed *C. gracilis*, but is more similar to *C. melanacanthus*. This latter is poorly known, and we have seen only three, incomplete specimens from Tanintharyi in Myanmar, all of them lacking leaf sheaths and notes on stem branching. It is unlikely on biogeographic grounds that the two populations represent the same species, there being no precedent in palms for a species being disjunct between coastal Tanintharyi in Myanmar and southern Vietnam and adjacent Cambodia (with the subspecific exception of *Calamus bousigonii*, with subsp. *smitinandii* J. Dransf., in Peninsular Thailand, and subsp. *bousigonii* in Cambodia, southeast Thailand, and central and southern

Vietnam). Nevertheless, judging solely from the incomplete specimens of *C. melanacanthus*, *Calamus lateralis* differs in its longer apical pinna (27 cm versus 4 cm), longer bristles on the adaxial pinnae surfaces (1 cm versus 0.3 cm), and in its floral bracteoles (raised and forming an almost pedicellate base to the fruits versus flat against the rachilla). *Calamus lateralis* also appears to be a larger palm, with a stem to 70 m long and 4–5.5 cm diameter. *Calamus melanacanthus* is described on the label of one specimen as having a stem 10 m long and 2.5 cm diameter.

Additional specimens examined. CAMBODIA. MONDULKIRI: Keo Seimaa Distr., near Lapakhe village, O Pam valley, 12°07'N, 106°55'E, 140 m, *Evans 96* (K). VIETNAM. DONG NAI: Cat Tien National Park, road to north of park headquarters, 11°26'N, 107°23'E, 150 m, 25 May 2007, *Henderson et al. 3392* (HN, NY); Cat Tien National Park, trail to Crocodile Lake, 11°26'N, 107°26'E, 150 m, 27 May 2007, *Henderson et al. 3398* (HN, NY), *Henderson et al. 3399* (HN, NY), *Henderson et al. 3400* (HN, NY).

Calamus nuichuaensis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus aliis generis *Calami* habitu non scantenti, vaginis eflagellatis, foliis non cirratis, bracteis partialibus inflorescentiae profunde findentibus et dispositione florali pistillata non disticha differt. Typus. Vietnam. Ninh Thuan: Ninh Hai District, Nui Chua National Park, near summit of mountain, forest on rocky slopes, 11°48'N, 109°10'E, ca. 800 m, 27 Jul 2007, A. Henderson, Ninh Khac Ban, & A Ruc Cui 3468 (Holotypus: HN! Isotypi: K! NY!).

Stems solitary, non-climbing, to 5 m tall, 3 cm diameter without sheaths, green. Leaf sheaths open, brown with brown tomentum, with dense, yellowish-brown spines to 6 cm long, borne singly or more often in small groups; ocreas to 3 cm long, densely black bristly; flagella absent; petioles 60 cm long, spiny as the sheaths; rachis about 1 m long, reddish-brown tomentose, not spiny abaxially; cirri absent; pinnae 33 per side of rachis, 46 cm long, 1.8 cm wide at the middle, linear, regularly arranged and spreading in the same plane, with a single vein, scarcely bristly on the margins, with black bristles on the vein abaxially near the apices. Staminate inflorescences not known; pistillate inflorescences to 1 m long, arching below the leaves, branched to 1 or 2 orders, with at least 15 partial inflorescences; prophylls to 15 cm long; partial inflorescence bracts to 7 cm long, densely covered adaxially with soft, black bristles to 1 cm long, splitting to the base but ± persistent in fruit; rachillae 1 or 2, 2 cm long, densely brown tomentose; rachillae bracts 3 mm high, long acuminate; floral bracteoles cupular, scarcely lobed; flowers not known, the dyads closely spaced, borne in 2 parallel rows along one side of the rachilla; fruits 2 cm diameter, depressed globose, reddish-brown; endosperm ruminant; embryo basal.

Local names and uses: *sui*; no uses recorded.

Distribution and habitat: Known only from southern Vietnam in Ninh Thuan in Nui Chua National Park, on steep slopes in lowland rain forest at 800 m elevation.

Notes: The specimens cited here will not key in Evans et al. (2002). By its non-climbing habit, eflagellate sheaths, ecirrate leaves, deeply splitting partial inflorescence bracts, and non-distichous pistillate flower arrangement, *Calamus nuichuaensis* does not fit into any of Beccari's (1908) groups.

Calamus spiralis Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a Calamo palustri statura minore atque spinis vaginae foliaris aggregatis basaliter bulbosis differt. Typus. Vietnam. Thua Thien-Hue: Bach Ma National Park, 16°14'N, 107°52'E, 100 m, 15 Apr 2007, A. Henderson, Nguyen Quoc Dung, Phan Xuan Phuong, & Le Van Bo 3280 (Holotypus: HN! Isotypi: K! NY!). Fig. 5.

Stems climbing, clustered, forming large clumps, to 15 m long, 0.7 cm diameter with sheaths. Leaf sheaths closed and tubular, green with gray tomentum, with scattered groups of spines, each group bulbous-based with 3 (rarely more) black spines to 0.25 cm long, the central spine of a group longer than the two lateral ones, the groups denser at the sheath apex, sometimes with a few, longer, needle-like spines present at sheath apices; knees present, obscure; ocreas 0.5 cm long, with groups of spines as the sheath apices; flagella absent; petioles 0.5–1 cm long; rachis 9–20 cm long, with few, recurved, solitary spines abaxially; cirri 55 cm long; pinnae 3 per side of rachis, 13–18.5 cm long, 1.5–2 cm wide at the middle, linear-lanceolate, irregularly and distantly arranged, the basal pair of pinnae swept back across the sheath, not spiny on veins, spiny on margins near the pinnae apices. Staminate inflorescences not known; pistillate inflorescences 40 cm long, erect, not flagellate, branched to 1 or 2 orders, with 1 or 2 partial inflorescences; prophylls 10–13 cm long, closely sheathing the peduncle, split only apically; partial inflorescence bracts splitting only apically, closely sheathing the rachis; rachillae 5–7, 1–2 cm long; rachillae bracts 1.5 mm high, acuminate, glabrous; floral bracteoles cupular, not lobed; pistillate flowers 4 mm long, arranged distichously but irregularly along the rachillae, appearing spirally arranged in life; calyx 3.5 mm long, tubular, split for about half its length into 3 lobes, glabrous; corolla 3 mm long, split for about two thirds its length into 3 valvate petals, glabrous; staminodes 6; ovary 2.5 mm long; fruits 2.3 cm long, 1.4 cm wide, ellipsoid, reddish-brown, the scales faintly channeled, the perianth not tubular and pedicellate; endosperm homogeneous; embryo basal.

Local names and uses: *may cam mo*; the canes are used for tying.

Distribution and habitat: Known only from central Vietnam in Bach Ma National Park in Thua Thien-Hue, on steep slopes in lowland rain forest. It is apparently a rare plant in the Park.

Notes: In Evans et al. (2002) the specimens cited here will key to *Calamus palustris*. *Calamus spiralis* is clearly not that species, differing in the smaller size of all its parts (except the fruits – which do resemble those of *C. palustris*), and in its bulbous-based groups of leaf sheath spines.

By its climbing habit, eflagellate sheaths, cirrate leaves, eflagellate inflorescences, and tubular partial inflorescence bracts, *Calamus spiralis* appears to be a member of Beccari's (1908) Group XV.

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