



Four new species of *Calamus* (Arecaceae) from Vietnam

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Abstract

Four new species of *Calamus* (Arecaceae) are described and illustrated and compared with similar species.

Key words: Palmae, rattan

With its 374 species, *Calamus* Linnaeus (1753: 325) is by far the largest genus of palms (Govaerts & Dransfield 2005). It is widely distributed from India eastwards to Fiji, with one disjunct species in tropical Africa. The highest concentration of species is in the Asian tropics, especially in the Malay Peninsula, Borneo, and Sumatra, with other centers of diversity in Indochina and New Guinea. The only monograph of the whole genus is that of Beccari (1908, 1913, 1914). These monumental works are unrivalled for their clarity and detail, but are now out-of-date. Although various regional treatments of *Calamus* have been recently published (e.g., Evans *et al.* 2001a for Laos), there is no comprehensive revision of the whole genus. Because of this, and its economic importance as a source of rattan cane, Henderson is currently carrying out a revision of the genus. In the course of this revision, the following new species have been collected in Vietnam.

Calamus batoensis Henderson & N. Q. Dung *sp. nov.* (Fig. 1)

It differs from related species by its rachis bracts which are swollen at the apices and recurved pistillate rachillae which have the dyads arranged in alternate rows but not opposite so one side of the rachillae is without flowers.

Type:—VIETNAM. Quang Ngai: Ba To District, road from Ba To to Ba Cung, steep slope in forest near road, 14°44'N, 108°53'E, ca. 600 m, 24 April 2013, *A. Henderson & Nguyen Quoc Dung 3881* (holotype, VFM! isotype, NY!).

Stems clustered, 1–10 m long, 0.5–0.8 cm diameter with sheaths, ca. 0.6 cm without sheaths. Sheaths greenish-white, longitudinally striate, not tomentose, with scattered, brown-tipped spines to 0.2 cm long; ocreas short, membranous, early deciduous; knees present; flagella 72 cm long; petioles 2.5–11 cm long, spiny along the margins and abaxially; rachises 12.5–30 cm long with 3–4, elliptic pinnae per side, these arranged in remote clusters, the proximal pair oriented towards the sheath, the distalmost few (usually four) in a cluster with the distalmost pair oriented away from the sheath and the adjacent pair oriented at a 45° angle to the rachis, the apical pair joined for 8.5–12.7 cm, middle pinnae 15–26 cm long, 3.7–4.7 cm wide at widest point, minutely spiny along the margins and with a few spines at the apices, not spiny on the veins. Staminate inflorescences 76 cm long, flagellate, the first partial inflorescence subtended by the prophyll; prophyll and rachis bracts tubular, swollen at the apices, just covering the bases of the partial inflorescences; partial inflorescences branched to 2 orders; rachillae 0.5–1 cm long; staminate flowers not seen; pistillate inflorescences 31–62 cm long, similar to staminate but branched to 1 order; rachillae 1.5–2 cm long; dyad bracteoles obscure, campanulate, one side of mouth acuminate, visibly ribbed, the base free from the preceding neuter flower and without an impression of its bracteole; dyads arranged in alternate rows but not

opposite, one side of the rachillae without flowers, the rachillae recurved; pistillate flowers 6 mm long (post anthesis); calyx 2.5 mm long, tubular, lobed at the apices; corolla 4 mm long, tubular, with 3, valvate lobes at the apices; fruits (immature) globose, 1.1 cm long, 0.9 cm diameter, 1-seeded; endosperm homogeneous or scarcely ruminant; embryo basal.

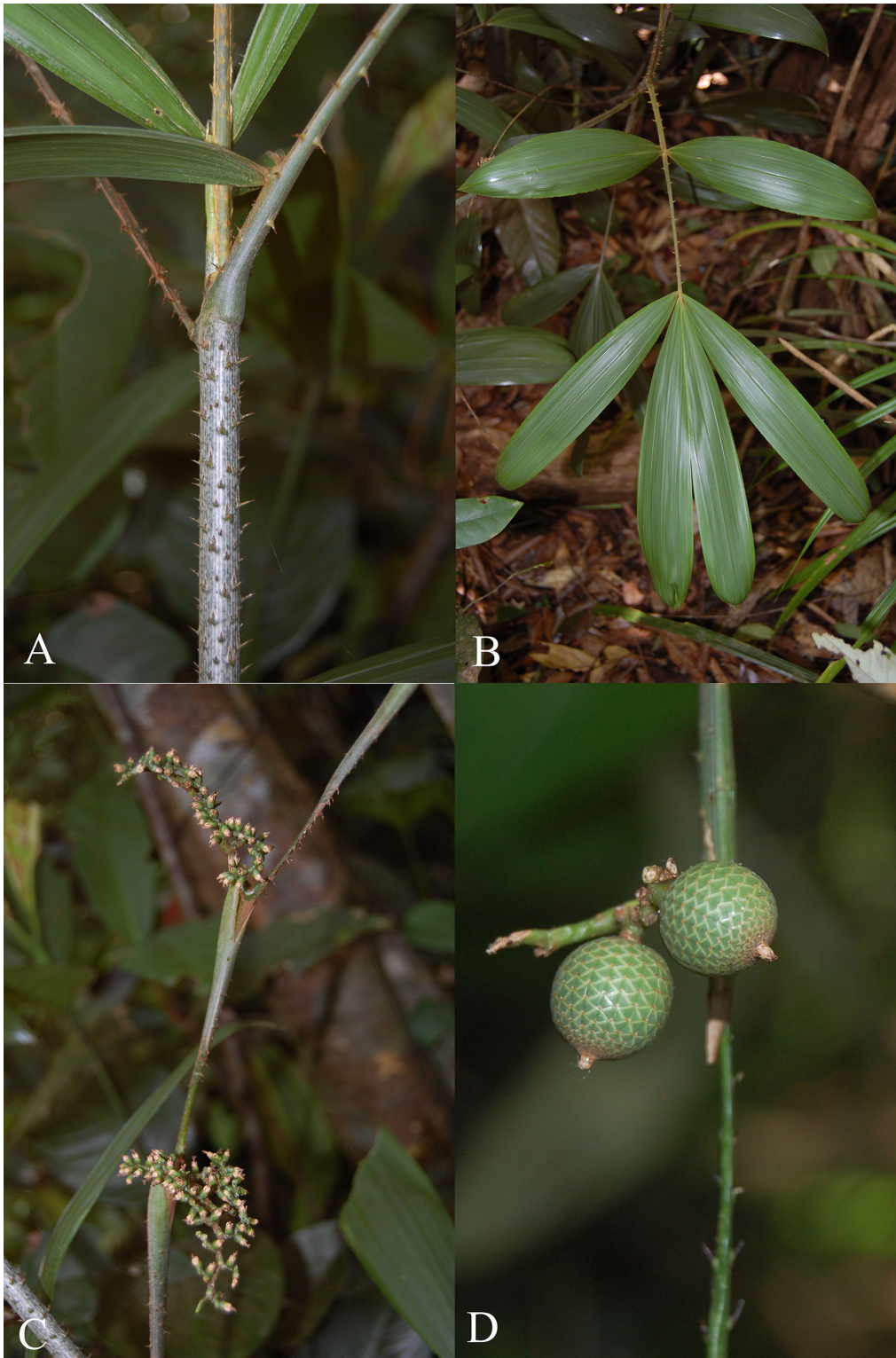


FIGURE 1. *Calamus batoensis*. **A.** Leaf sheath, with proximal pinnae oriented towards the sheath. **B.** Distalmost pinnae, showing cluster of pinnae with the distalmost pair oriented away from the sheath and the adjacent pair oriented at a 45° angle to the rachis. **C.** Pistillate inflorescence showing swollen rachis bracts and recurved rachillae. **D.** Fruits. (A–C from *Henderson et al.* 3809, D from *Henderson et al.* 3808).

Distribution and habitat:—Endemic to central Vietnam in Quang Ngai Province in secondary, evergreen forest at 600 m elevation.

Local names and uses:—*may rac*. No uses recorded.

Additional specimens examined:—VIETNAM. Quang Ngai: Ba To District, road from Ba To to Ba Cung, steep slope in forest near road, 14°44'N, 108°53'E, ca. 600 m, 18 July 2012, *Henderson et al.* 3808 (NY, VFM); same locality, same date, *Henderson et al.* 3809 (NY, VFM); same locality, 14 September 2011, *Nguyen Quoc Dung* 2036 (NY, VFM).

Discussion:—In Evans *et al.*'s (2001a) treatment of *Calamus* in neighboring Laos, *C. batoensis* (named for the district in which it occurs) would key to a group of three species: *C. oligostachys* Evans *et al.* (2001b: 242), *C. solitarius* Evans *et al.* (2000: 932), and *C. tetradactylus* Hance (1875: 289), based on the presence of a flagellum and strongly grouped pinnae lying in one plane. *Calamus batoensis* differs from all of these in its swollen rachis bracts and recurved pistillate rachillae. In the course of a revision of *Calamus* (Henderson, in prep.), phylogenetic analysis of morphological data comprising 110 characters taken from 3133 specimens representing 316 species of *Calamus*, five of *Ceratolobus* Blume ex Schultes & Schultes (1830: lxxx), five of *Daemonorops* Blume in Schultes & Schultes (1830: 1333), one of *Retispatha* Dransfield (1980a: 529), and three of *Pogonotium* Dransfield (1980b: 763), with *Plectocomia* Martius & Blume in Schultes & Schultes (1830: 1333) as outgroup, shows that *Calamus batoensis* is placed in a clade of 11 species, all from Laos and Vietnam, characterized by the short, membranous ocrea. These are: *C. oligostachys*, *C. solitarius*, *C. tetradactylus*, *C. parvulus* Henderson & Nguyen Quoc Dung (2010: 30), *C. crispus* Henderson *et al.* (2008: 191), *C. dioicus* Loureiro (1790: 211), *C. kontumensis* Henderson *et al.* (2008: 193), *C. bimaniferus* Evans *et al.* (2000: 936), and two new species described below (*C. flavinervis*, *C. quangngaiensis*). *Calamus batoensis* differs from all of these by its rachis bracts which are swollen at the apices and recurved pistillate rachillae which have the dyads arranged in alternate rows but not opposite so one side of the rachillae is without flowers. Although these two character states occur in unrelated species of *Calamus*, they only occur in this clade in *C. batoensis*.

Calamus flavinervis Henderson & N. Q. Dung *sp. nov.* (Fig. 2)

It differs from related species by its densely spiny, tomentose leaf sheaths and distinctive, yellow cross veins.

Type:—VIETNAM. Khanh Hoa: road 653B from Nha Trang to Da Lat, 54 km from Nha Trang, 67 km before Da Lat, near border with Lam Dong province, Hon Giao mountain, 12.180N, 108.733E, undisturbed forest on steep slope, 1000 m elevation, 21 April 2013, *A. Henderson & Nguyen Quoc Dung* 3869 (holotype, VFM! isotypes, AAU!, NY!).

Stems clustered, to 8 m tall, 1–1.3 cm diameter with sheaths, ca. 0.6 cm without sheaths. Sheaths densely brown tomentose initially, green, densely covered with greenish-yellow spines to 1.1 cm long, these tomentose as the sheaths; ocreas short, membranous, early deciduous; knees present; flagella 190 cm long; petioles 8–22 cm long, spiny along the margins and abaxially; rachises 38–60 cm long with 7–10, oblanceolate pinnae per side, these arranged in remote clusters, leathery, with prominent, yellow cross-veins, the basal pair oriented towards the sheath (especially on more apical leaves), distalmost few (usually four) in a cluster with the distalmost pair oriented away from the sheath and the adjacent pair oriented at a 45° angle to the rachis, the apical pair joined for 7.5–8.5 cm, middle pinnae 15–23.5 cm long, 3.4–4.3 cm wide at widest point, minutely spiny along the margins, not spiny on the veins. Staminate inflorescences 300 cm long, flagellate; rachis bracts tubular, terminating well below the partial inflorescences; partial inflorescences branched to 2 orders; rachillae 2.5–4.5 cm long; staminate flowers not seen; pistillate inflorescences similar to staminate but branched to 1 order; rachillae 2.5–2.7 cm long; dyad bracteoles obscure, campanulate, one side of mouth acuminate, visibly ribbed, the base free from the preceding neuter flower and without an impression of its bracteole; pistillate flowers 3.5 mm long before anthesis; calyx 3.5 mm long, tubular, lobed at the apices; corolla 3 mm long, tubular, with 3, valvate lobes at the apices; fruits (immature) globose to ellipsoid, 0.9 cm long, 0.7 cm diameter, 1-seeded; endosperm homogeneous or scarcely ruminant; embryo basal.

Distribution and habitat:—Endemic to southern Vietnam in Khanh Hoa Province in montane rain forest on steep slopes at 900–1000 m elevation.

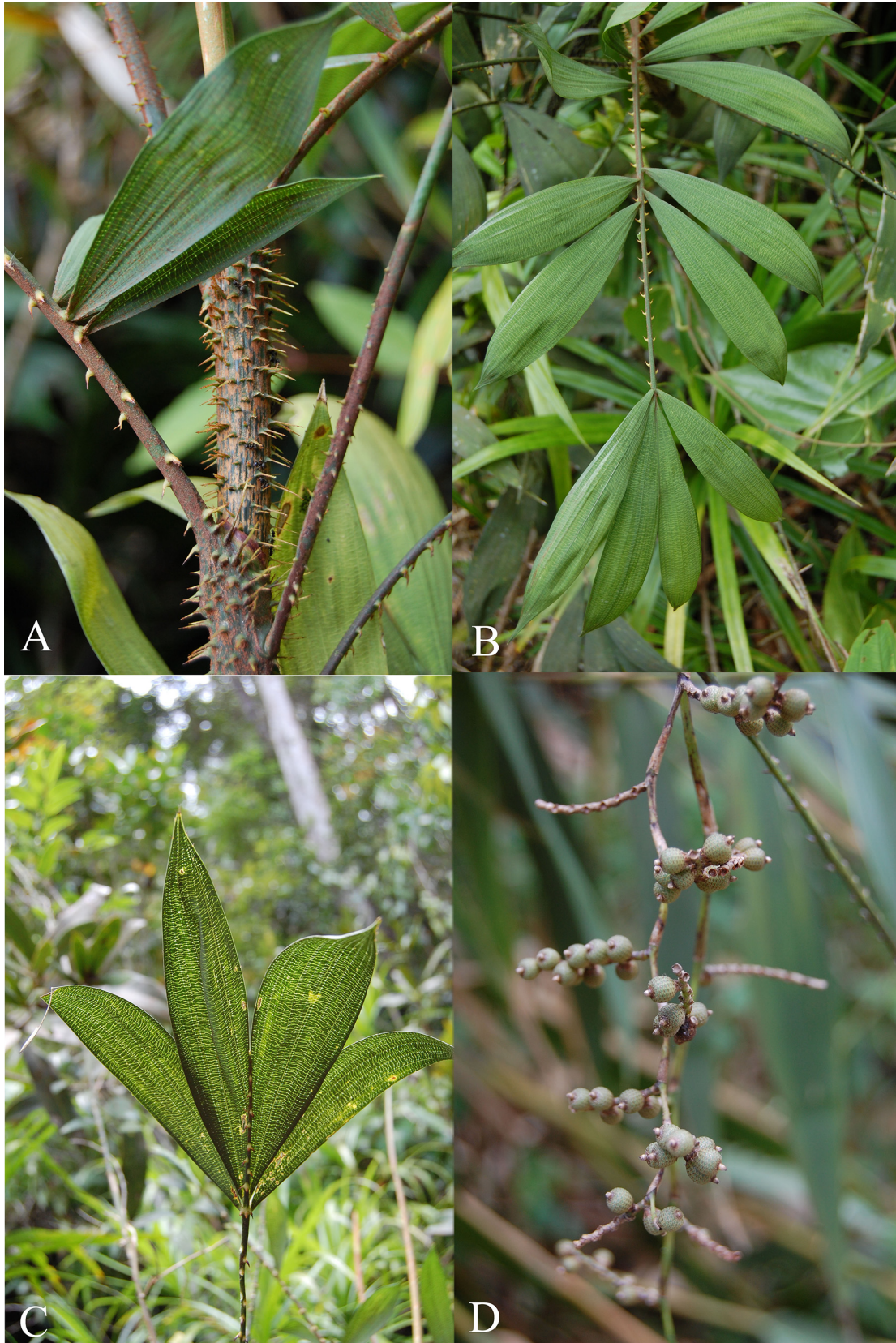


FIGURE 2. *Calamus flavinervis*. **A.** Leaf sheath, with proximal pinnae oriented towards the sheath. **B.** Leaf, showing clustered pinnae. **C.** Distalmost pinnae, showing cluster of pinnae with the distalmost pair oriented away from the sheath and the adjacent pair oriented at a 45° angle to the rachis. **D.** Partial pistillate inflorescence. (A–D from *Henderson & Nguyen Quoc Dung 3869*).

Local names and uses:—*may rac*. No uses reported.

Additional specimen examined:—VIETNAM. Khanh Hoa: Khanh Vinh district, road from Khanh Hoa to Da Lat, 12.200N, 108.733E, 900 m, 12 July 2010, *A. Henderson et al. 3711* (IEBR, NY).

Discussion:—In Evans *et al.*'s (2001a) treatment of *Calamus* in neighboring Laos, this palm would key to a group of three species: *C. oligostachys*, *C. solitarius*, and *C. tetradactylus*, based on the presence of a flagellum and strongly grouped pinnae lying in one plane. *Calamus flavinervis* differs from all of these in its pinnae with yellow cross-veins. In the same study of *Calamus* cited above (Henderson, in prep.), *Calamus flavinervis* is placed in the same clade of 11 species as *C. batoensis*. It differs from all of these by its densely spiny, tomentose leaf sheaths and pinnae with distinctive yellow cross-veins.

Calamus phuocbinhensis Henderson & N. Q. Dung *sp. nov.* (Fig. 3)

It differs from related species by its leaf sheaths without tomentum and with few spines, its rachises with recurved spines abaxially, and its short, membranous ocreas consisting of two lateral flanges, not developed above the petiole.

Type:—VIETNAM. Ninh Thuan: Phuoc Binh National Park, near park headquarters, disturbed forest by ecotourism trail, 11.986N, 108.747E, 323 m elevation, 18 April 2013, *A. Henderson & Nguyen Quoc Dung 3857* (holotype, VFM! isotype, NY!).



FIGURE 3. *Calamus phuocbinhensis*. **A.** Leaf sheath with lack of tomentum, few spines, and small ocrea. **B.** Pinnae, irregularly arranged and spreading in different planes. (A–B from *Henderson & Nguyen Quoc Dung 3853*).

Stems clustered, 8–15 m long, 1.3–2.1 cm diameter with sheaths, 1.2–1.4 cm diameter without sheaths. Sheaths completely green, with very few, flat, brown spines to 1.5 cm long; ocreas short, membranous, consisting of two lateral flanges, not developed above petiole, soon falling; flagella 165 cm long; knees present; cirri absent; petioles 4–8 cm long on upper leaves, to 24 cm long on lower leaves; rachises 97–125 cm

long with 44–45 pinnae per side, these irregularly arranged in clusters and spreading in different planes, linear, minutely spiny along the margins and mid-vein adaxially; middle pinnae 19.3–29.5 cm long, 1.2 cm wide; apical pair of pinnae joined for 0.2–0.5 cm. Staminate inflorescences not seen; pistillate inflorescence rachis bracts tubular, terminating below the partial inflorescences; flowers and fruits not seen.

Distribution and habitat:—Endemic to southern Vietnam in Ninh Thuan Province in seasonal forest at 323 m elevation.

Local names and uses:—*may*. No uses are reported.

Additional specimen examined:—Vietnam. Ninh Thuan: Phuoc Binh National Park, near park headquarters, disturbed forest by ecotourism trail, 11.986N, 108.747E, 323 m, 18 April 2013, *A. Henderson & Nguyen Quoc Dung 3853* (AAU, NY, VFM).

Discussion:—Although the two specimens are incomplete and lack both flowers and fruits, and with only an old, decaying inflorescence present, we have no doubt that they represent an undescribed species. In fact, the sheaths and leaves of this species are the most distinctive and easily recognized of all Vietnamese palms. In Evans *et al.*'s (2001a) treatment of *Calamus* in neighboring Laos, this palm would key to *C. viminalis* Willdenow (1799: 203), based on its presence of a flagellum and irregularly arranged pinnae lying in different planes. In the same study of *Calamus* cited above (Henderson, in prep.), *C. phuocbinhensis* (named for the National Park in which it occurs) is placed in a clade comprising two other species; *C. viminalis* and *C. siamensis* Beccari (1902: 203), characterized by the rachis with straight spines abaxially and the very short staminate rachillae with the flowers arranged in glomerules. *Calamus phuocbinhensis* differs from both of these in its leaf sheaths without tomentum and with few spines, its rachises with recurved spines abaxially, and in particular its short, membranous ocreas consisting of two lateral flanges, not developed above the petiole. In both *C. viminalis* and *C. siamensis* the ocrea is completely tubular and developed above the petiole.

Calamus quangngaiensis Henderson & N. Q. Dung *sp. nov.* (Fig. 4)

It differs from related species in its more numerous, regularly arranged lanceolate pinnae.

Type:—VIETNAM. Quang Ngai: Ba To District, road from Ba To to Ba Cung, steep slope in forest near road, 14°44'N, 108°53'E, ca. 600 m. 24 April 2013, *A. Henderson & Nguyen Quoc Dung 3880* (holotype, VFM! isotype, NY!).

Stems clustered, 3–4 m long, 1–1.5 cm diameter with sheaths, 0.7 cm without sheaths. Sheaths densely brown tomentose initially, green, densely covered with greenish-yellow, flattened spines to 1.2 cm long; ocreas short, membranous, early deciduous; knees present; flagella present; petioles 18–44 cm long, spiny along the margins; rachises 45–50 cm long with 8–13, lanceolate pinnae per side, these regularly arranged, middle pinnae 28–31 cm long, 1.9–2 cm wide at widest point, minutely spiny along the margins, not spiny on the veins, apical pair joined for 8.5–8.7 cm. Staminate inflorescences to 150 cm long, flagellate; rachis bracts tubular, splitting near insertion of partial inflorescences or terminating just below them; partial inflorescences branched to 2 orders; rachillae 2–5.5 cm long; staminate flowers 4 mm long; sepals 2 mm long, tubular proximally, lobed distally; petals 4 mm long, valvate; pistillate inflorescences to 200 cm long, flagellate, branched to 1 order; rachis bracts tubular, terminating well below the partial inflorescences; rachillae 3–6 cm long; dyad bracteoles obscure, campanulate, one side of mouth acuminate, visibly ribbed, the base free from the preceding neuter flower and without an impression of its bracteole; pistillate flowers 3 mm long before anthesis; calyx 3 mm long, tubular, lobed at the apices; corolla 3 mm long, tubular, with 3, valvate lobes at the apices; fruits (immature) ellipsoid, 1.1 cm long, 0.76 cm diameter, 1-seeded; fruiting perianths tubular; endosperm homogeneous or scarcely ruminant; embryo basal.

Distribution and habitat:—Endemic to central Vietnam in Quang Ngai Province in secondary, evergreen forest at 600 m elevation.

Local names and uses:—*may*. The canes are used locally in furniture making.

Additional specimens examined:—VIETNAM. Quang Ngai: Ba To District, road from Ba To to Ba Cung, steep slope in forest near road, 14°44'N, 108°53'E, ca. 600 m, 18 July 2012, *A. Henderson et al. 3811* (NY, VFM); same locality, 14 September 2011, *Nguyen Quoc Dung 2035* (NY, VFM).

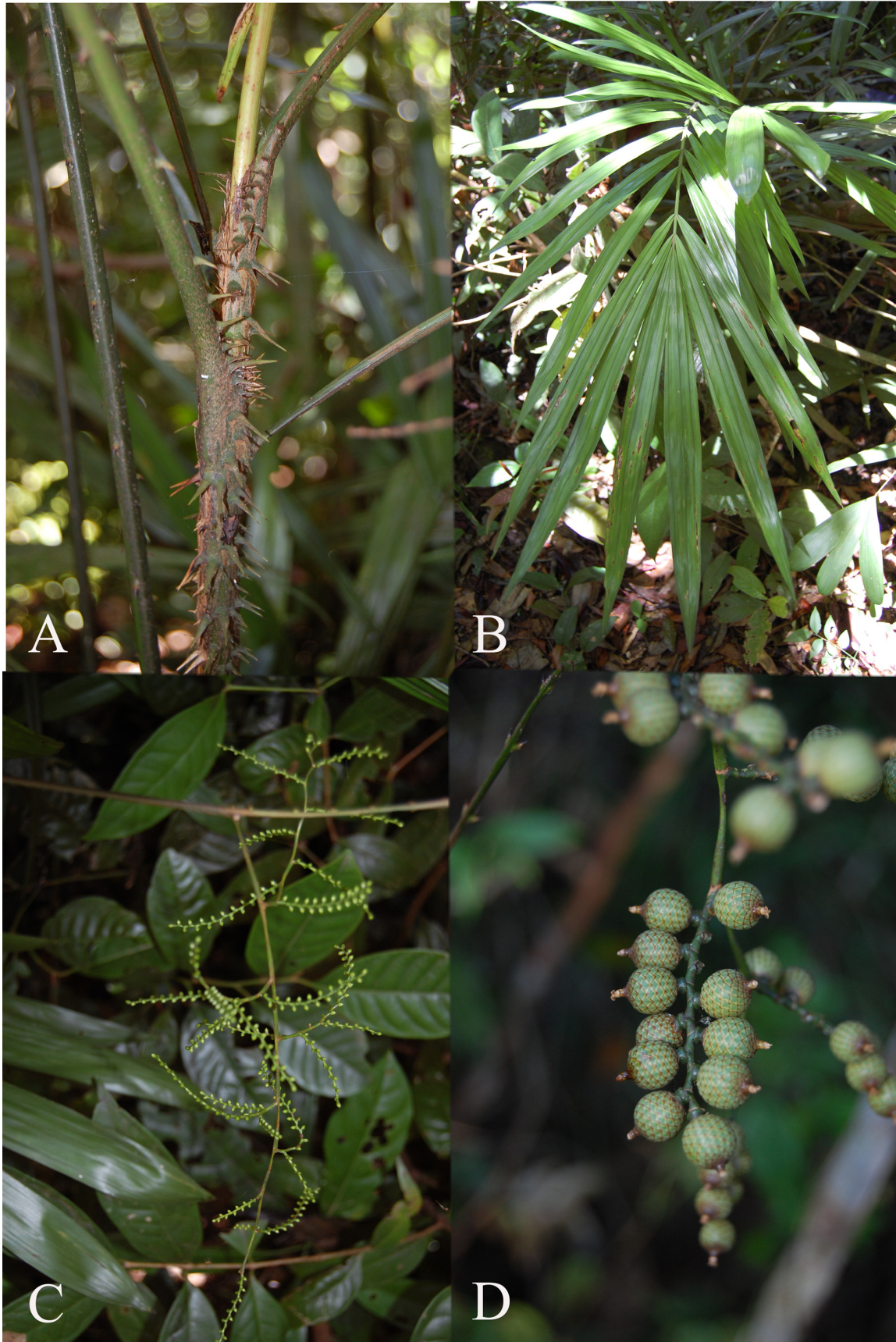


FIGURE 4. *Calamus quangngainesis*. **A.** Leaf sheath, densely brown tomentose with densely cover of spines. **B.** Leaf with regularly arranged pinnae. **C.** Partial staminate inflorescence. **D.** Partial pistillate infructescence with fruits. (A–D from *Henderson & Nguyen Quoc Dung 3880*).

Discussion:—In Evans *et al.*'s (2001a) treatment of *Calamus* in neighboring Laos, this palm will key to a group of clearly unrelated species; *C. siamensis*, *C. tenuis* Roxburgh (1832: 780), and *C. godefroyi* Beccari (1908: 267). In same study of *Calamus* cited under *C. batoensis* (Henderson, in prep.), *Calamus quangngaiensis* (named for the province in which it occurs) is placed as sister species to the clade including *C. batoensis* and related species. It differs from all of these in its more numerous, regularly arranged lanceolate pinnae.

Acknowledgments

Field work in Vietnam was supported by a grant from the National Geographic Society and carried out in collaboration with the Vietnam Forest Museum (VFM) of the Forest Inventory and Planning Institute (FIPI). We thank Dr. Ngo Ut, director of FIPI, Dr. Nguyen Huy Dung, director of Forest Resource and Environment Centre (FREC, under FIPI), and Mrs. Quach Quynh Nga and her staff at the VFM.

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