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A new species of *Calamus* (Arecaceae) from Eastern Himalaya, India

S. Mondal¹, S. K. Basu², M. Chowdhury^{1*}

¹ Taxonomy of Angiosperm and Biosystematics Lab., Department of Botany, University of North Bengal, Rajarammohunpur, Darjeeling, West Bengal 734013, India. E-mails: mono_malda@yahoo.co.in*, mondasujit.bgc@gmail.com

² The Agri Horticultural Society of India, Kolkata, West Bengal 700027, India, E-mail: shymalkbasu@gmil.com

*Corresponding author

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Summary. *Calamus mahanandensis* S. Mondal, S. K. Basu et M. Chowdhury (Arecaceae), a new species that differs from the similar indigenous species *C. leptospadix* and South-East Asian species *C. tetradactyloides* (Vietnam, Hainan) by its height, pinnae numbers, dense unique tomentose bristly spines located at leaf sheath, ocrea and knee base only; straight, glabrous rachis spines; partial male and female inflorescence sizes, bracts sizes, rachillae characters; beaked fruits with reddish-brown scales in 20–21 vertical rows with prominent brown margin is described here with illustrations.

Новый вид *Calamus* (Arecaceae) из Восточных Гималаев, Индия

С. Мондал¹, С. К. Басу², М. Чоудхури¹

¹ Лаборатория таксономии покрытосеменных и биосистематики, отдел ботаники, Университет Северной Бенгалии, г. Раджараммохунтур, Дарджилинг, Западная Бенгалия, 734013, Индия

² Сельскохозяйственное садоводческое общество Индии, г. Калькутта, Западная Бенгалия, 700027, Индия

Ключевые слова: новые таксоны, речные местообитания, ротанг.

Аннотация. В статье приведено иллюстрированное описание *Calamus mahanandensis* S. Mondal, S. K. Basu et M. Chowdhury (Arecaceae) – нового вида, отличающегося от похожих аборигенного *C. leptospadix* и юго-восточноазиатского *C. tetradactyloides* (Вьетнам, Хайнань) высотой, числом листочков, густыми уникальными войлочными щетинистыми колючками, расположенными только в листовых влагалищах, по краю и в основании листьев; прямыми гладкими гребнями рахисов; размерами мужских (частично) и женских соцветий, размерами прицветников, характером черешков; клювовидными плодами с красновато-коричневыми чешуями в 20–21 вертикальных рядах с заметным коричневым краем.

Introduction

Calamus L. is the largest genus under the subfamily Calamoideae of Arecaceae, distributed mostly in India, South China through Malay Archipelago to Northern Australia, Fiji and Africa (Dransfield, 1979; Baker, Dransfield, 2014, 2016; Voronstova et al., 2016). Species of *Calamus* are

mostly spiny, climbers having scaly fruits and is taxonomically considered as complex group. Various tropical forests of South and South-East Asian countries (India, China, Myanmar, Indonesia, Thailand, Laos, Cambodia, Vietnam, Philippines) are quite rich with different species of rattans (Evans et al., 2001; Peters et al., 2014; Barfod, Dransfield, 2013). Beccari and Hooker f. (1894) initially

accounted 72 species of *Calamus* from undivided British India and presently, around 37 species and three varieties of *Calamus* were reported from various habitats of the Himalaya, Western Ghats and the Andaman & Nicobar Islands of India (Renuka, 1987; Basu, 1992; Mondal et al., 2019). The tropical forests of lower hills and foothills of Himalaya of West Bengal are also favourable habitats for 18 rattans that include 14 *Calamus* species (Mondal, Chowdhury, 2018).

Materials and methods

During the exploration of palm and cane flora of Eastern Himalaya, some interesting specimens of *Calamus* were collected from the Choklong forest (Darjeeling district) and Rongo Forest (Jalpaiguri district) at an altitude between 300–600 m. For reproductive structures all the locations were visited repeatedly in various seasons and plant parts were collected for the detailed study. The GPS (GERMIN) reading for latitudes, longitude and altitude of the population were recorded and sufficient photographs of habit and parts of species were also taken. The collected specimens were further processed through the conventional herbarium technique (Jain, Rao, 1977; Paul et al., 2020) and finally mounted on herbarium sheets to prepared type specimens that will be deposited at the herbaria of CAL (Central National Herbarium), CUH (Calcutta University Herbarium) and NBU (North Bengal University Herbarium) for further reference. The collected species have close affinity with *Calamus leptospadix* Griff. and *Calamus tetradactyloides* Burret that are growing in the almost same type of habitat but after extensive morphological examination, matching with various herbarium specimens of key herbaria (CNH, ASSAM, BSIH and NBU) and extensive literature search (Beccari, Hook. f., 1894; Renuka, 1987; Pei et al., 1991; Basu, 1992; Noltie, 1994; Baker, Dransfield, 2014; Voronstova et al., 2016), the specimen was found to a new species. Frequent surveys were conducted in similar types of habitats during the last few years (2016–2019) to understand the population size and also to measure the possible physical threats to the species. The new species is carefully described here accompanied by photographs and illustrations.

Calamus mahanandensis S. Mondal, S. K. Basu et M. Chowdhury, **sp. nov.** (Figs. 1, 2)

Type: “INDIA. West Bengal: Darjeeling district, Choklong forest (Mahananda wildlife sanctuary)

at hill slopes along the Mahananda rivers near Shivkhola temple 26°51'48.25"N, 88°21'43.38"E, 308 m, 30 IV 2018. S. Mondal & M. Chowdhury 1046” (holo – CAL, iso – CUH).

Paratype: “West Bengal, Jalpaiguri district, near Nasksal khola bridge, Kumai, Rongo forest, 27°00'33.61"N, 88°52'04.80"E, 340 m. 10 IV 2019. S. Mondal & M. Chowdhury 1058” (NBU).

Stems clustered, climbing, 2–4 m long, stem 4–7 cm in diameter with sheath, internodes 12.5–20.6 cm long. **Leaf sheaths** tubular, greenish brown, rusty, 19–23 cm long; knee conspicuous, glabrous sometimes with few, scattered, minor, flat, subulate, brownish to blackish spines basally only; leaf sheath spines dense, tomentose ferruginously, rusty with flat conical green base, 2–3 cm long; *ocrea* conspicuous, scarcely developed, tightly sheathing, tomentose, 3–5 cm long, with spines and fine bristles at the opening, individual spines upto 1.8 cm long; *flagella* upto 2 m long, armed with claw. **Leaves** ecirrate, 1–1.5 m long; *petiole* 20–24 cm long, 1.2 cm wide at middle, glabrous, occasionally with few flat, subulate spines along the edges; *rachis* 1–1.3 m long with sparsely straight and black spines on both sides, 2.4–3 cm long; pinnae 61(55–64) per side of rachis, regular alternate arrangement, spreading in the same plane, linear to ensiform, 10.4–30 cm long, 0.6–1.5 cm wide, middle pinnae 24.6–30 cm long, 0.4–0.6 cm wide at middle, apical pinnae 10.2–11.5 cm long, 1.6–2.1 cm wide and terminal leaflets joined basally, leaflets 3 veined, bristles adaxially, 0.1–0.2 mm long. **Inflorescences** flagelliform, upto 2 m long, slightly armed with claws, primary bracts tubular, empty, obliquely truncate; *staminate inflorescences* 1.2–1.95 m long, partial inflorescence 3–6, 17–22 cm long, branched upto 3 orders, basal bracts cylindrical, 27–29 cm long and 2–2.3 cm wide, open, subtended, green at first, later brown papery after drying, tomentose at the opening; second branch 18–20, 2.2–6 cm long, 1–2 cm wide, with 22–29 rachillae each, alternate, 0.8–1.5 cm long, 0.3–0.5 cm wide, recurved, basal bract rhombic, 1–1.5 cm long and 0.3–0.6 cm wide, rachillae with 15–24 staminate flowers; staminate flowers 0.2–0.3 cm long, calyx 0.1–1.5 mm long, sepals 3, stamens 6; *pistillate inflorescence* shorter than staminate inflorescence, 0.9–1.25 m long, partial inflorescence 2–3, 18–26 cm long, branched upto 2 order, bracts green at first, later brown papery after drying, not subtending, tubular, 2–7.5 cm long and 0.5–0.7 cm wide, open, each carrying 24–36 rachillae, individual rachillae 1.3–1.8 cm long,

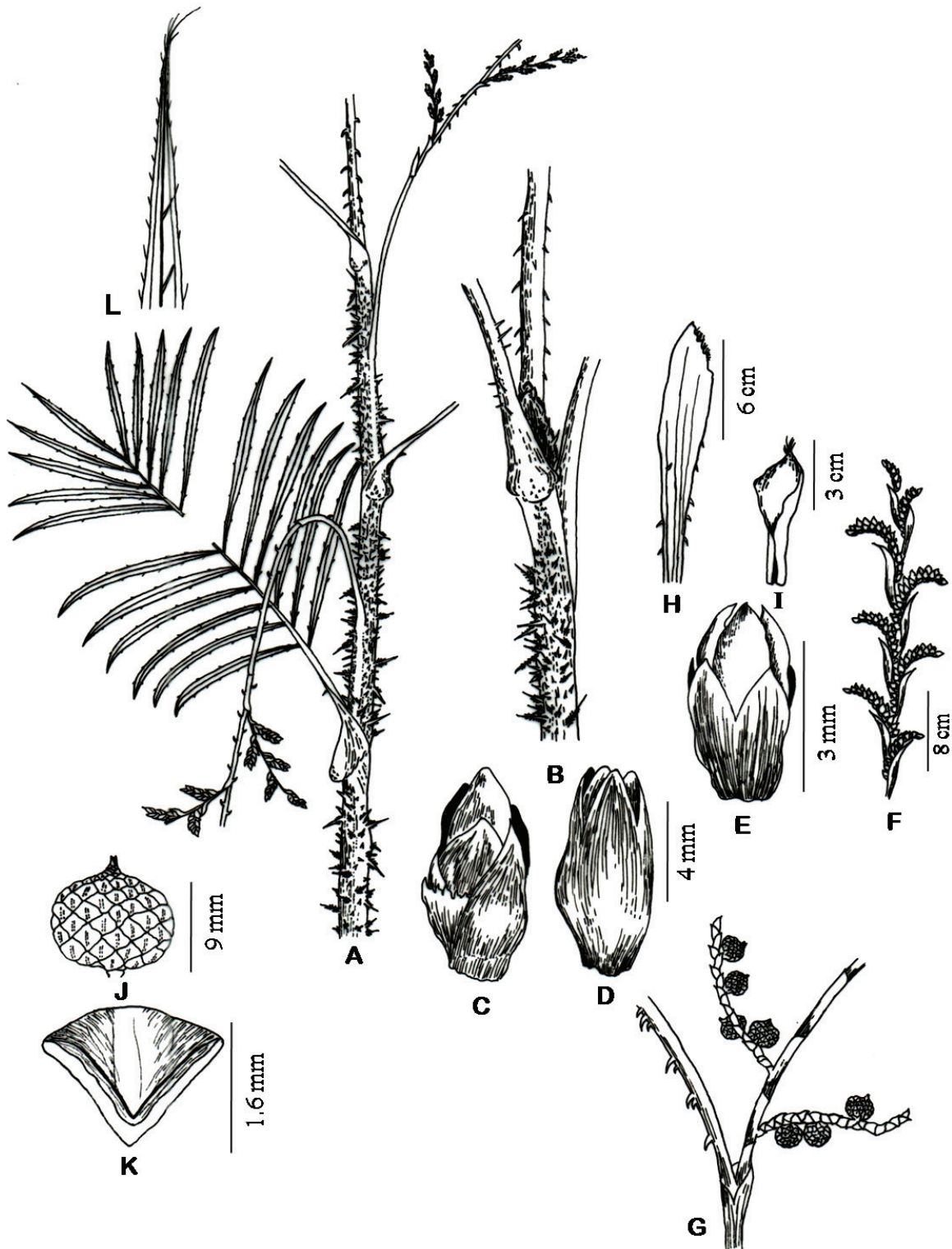


Fig. 1. *Calamus mahanandensis* sp. nov.: A and B – Habit with leaves and inflorescence; C and D – Female flower; E – Male flower; F – Male inflorescence; G and J – Fruit; H – Primary bract; I – Basal rhombic bract; K – Scales; L – Leaflet margin.

0.5–0.6 cm wide, each with 9–20 pistillate flowers, bracts shortly cup-like, truncate, sinuous to dented marginally; pistillate flowers 4–5 mm long, calyx 1.5–2.4 mm long, sepals 3, petals 3 lobed. **Fruits** globose, 0.8–0.9 × 0.9–1 cm in diameter, green,

beaked, 1–1.5 mm long, covered by triangular scales, inserted in 20–21 distinct rows, 1.5–1.6 mm × 2–2.2 mm, scales irregular, entire with brown margins. **Seeds** 0.6–0.7 × 0.7–0.8 cm diameter, with whitish sarcotesta, on one side flattened with

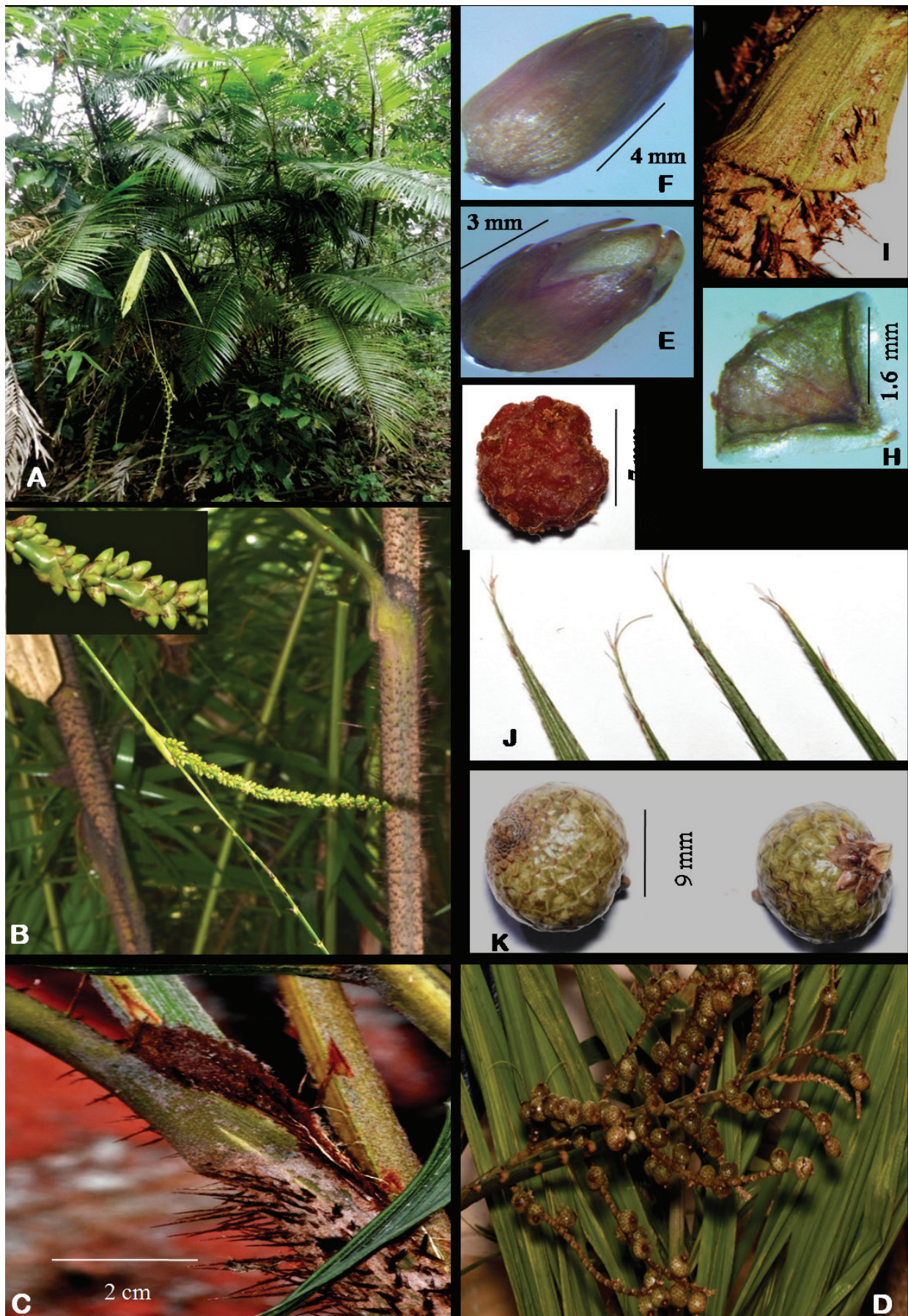


Fig. 2. *Calamus mahanandensis* sp. nov.: A and B – Habit; C – Ocrea with bristles; D and K – Fruits; E – Male flower; F – Female flower; G – Seed; H – Scale; I – Knee with tomentose spine; J – Leaflets margin.

deep germ pore, the other side convex other side, endosperm ruminant, reddish-brown.

Flowering: December – April.

Fruiting: March – May.

Etymology: The specific epithet is derived from the type locality, Mahananda Wildlife Sanctuary, Darjeeling, India.

Habitat: Riverine forest (Mahananda river) on hilly terrain.

Distribution: India; West Bengal (Darjeeling and Jalpaiguri district). Occurring in Sub-tropical forest in the hills of Eastern Himalaya (alt 300–600 m), associated with *Wallichia caryotoides* Roxb., *Phlogacanthus thyrsoformis* (Roxb. ex Hardw.) Mabb., *Tetrastigma leucostaphylum* (Dennst.) Alston, *Ficus squamosa* Roxb., *Syzygium formosum* (Wall.) Masom., *Pandanus nepalensis* H. St. John, *Lantana camara* L.

Discussion

This species is reminiscent of *Calamus leptospadix* Griff. and *Calamus tetradactyloides* Burret but differs in a number of characters (Table) and known from three populations with an average of 100–150 individuals from the Choklong forest in the Shivkhola area of Mahananda wildlife sanctuary (Darjeeling) as well as one population with 20 individuals from *Nasksalkhola bridge areas*, *Kumai in the Rongo forest* were traced. The type locality is situated in the Himalayan hotspot (Myers et al., 2000) and it is exposed to severe human impact from rapid extension of tea gardens, road and house construction, logging and ecotourism. The known habitat should be considered for *in situ* conservation by the relevant forest authorities.

Table

Comparison of morphological characters among *Calamus leptospadix*, *C. tetradactyloides* and *C. mahanandensis*

Characters	<i>C. leptospadix</i> Griff.	<i>C. tetradactyloides</i> Burret	<i>C. mahanandensis</i> sp. nov.
<i>Habit</i>	5–8 m long	4–10 m long	2–4 m long
<i>Stem</i>	2.5–3.8 cm in diameter with sheath	0.8–0.8 cm in diameter with sheath	4–7 cm in diameter with sheath
<i>Leaf sheath</i>	green, scurfy outside, 9–16 cm long, spines flattened, 1.5–2 cm long, subulate, not-tomentose; ocrea 9.5 cm long	greenish brown with brown bristles, spines dense, light reddish-brown, spines needlelike, 0.6–1.2 cm long, ocrea short and densely bristly	greenish-brown, rusty, 19–23 cm long, spines dense, 2–3 cm long, straight, base flat, tomentose, bristly ocrea 3–5 cm long
<i>Leaves</i>	0.6–1.2 cm long, knee with dense spines at periphery only; petiole 9–14 cm long, spines straight and hooked; pinnae opposite (base) to alternate (upper), 35–38 on each side, 14–37 cm long and ×1.2–1.8 cm wide, 2 terminal leaflets joined basally	0.3–0.5 m long, knee with spines; petiole 10–14 cm long, spines needlelike; pinnae alternate or irregular, 4–10 on each side, 15–22 cm long and 1–2 cm wide, 4 terminal leaflets in cluster	1.0–1.5 m long, knee with rarely minor spines basally; petiole 20–24 cm long, spines few, flat, subulate, rarely on edges; pinnae alternate, rarely opposite at middle, 55–64 on each side, 10–30 cm long and 0.6–1.5 cm wide, 2 terminal leaflets joined basally
<i>Inflorescence Length</i>	2.30–2.90 m long	0.4–0.7 m long	0.9–1.95 m long
<i>Male Inflorescence</i>	partial inflorescence 7–12, 15–35 cm long, branched 3 order (decompounds), basal bracts large, subtended, 20–50 cm long and 0.6–2.6 cm wide, rachillae 10–18 cm long and 1.5–2 cm wide, flowers 9–12 per rachillae, basal bract absent	partial inflorescence 2–5, 10–20 cm long, branched 2 order, bracts small, not subtended, tubular. rachillae 5–13 cm long, 1–2 cm wide, flowers 10–20 per rachillae, basal bract flat	partial inflorescence 3–6, 17–22 cm long, branched 3 order, basal bract large, subtended, 2 flat, 7–29 cm long and 2–2.3 cm wide, rachillae 0.8–1.5 cm long, 0.3–0.5 cm wide, flowers 15–24 per rachillae, basal bract rhombic

Table (end)

Characters	<i>C. leptospadix</i> Griff.	<i>C. tetradactyloides</i> Burret	<i>C. mahanandensis</i> sp. nov.
Female Inflorescence	partial inflorescence 7–12, 10–30 cm long, branched 2 order, basal bract subtended 20–40 cm long and 0.9–2.9 cm wide, flowers 5–12 per rachillae	partial inflorescence 5–6, 10–20 cm long, branched 2 order, basal bract small, not subtended, tubular, flowers 10–22 per rachillae	partial inflorescence 2–3, 18–26 cm long, branched 2 order, basal bract not subtended, tubular, 2–7.5 cm long and 0.5–0.7 cm wide, flowers 9–20 per rachillae
Fruits	0.4–0.8 × 0.5–1 cm, reddish brown, beak absent, scales on 17–18 vertical rows, 2.5 mm diameter, scales pale brown with dark brown intra-marginal stripes	1 × 1.5 cm, whitish, beak present, scales on 18–20 vertical 1.5–2 mm long, rows, grass-yellow with reddish-brown at edge	0.8–0.9 × 0.9–1 cm, greenish, beak present, 1–1.5 m long, scales on 20–21 vertical rows, 1.5–1.6 × 2–2.2 mm diameter, scales green with brown at edge
Seeds	0.5–0.6 × 0.6–0.8 cm diameter, brownish, sarcotesta greenish–grey	0.7–0.8 × 0.6–0.7 cm diameter, egg whitish, sarcotesta whitish	0.6–0.7 × 0.7–0.8 cm diameter, reddish-brown, sarcotesta whitish

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