

An additional note on morphology and stem anatomy of *Calamus meghalayensis* Henderson

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Abstract: A taxonomic study carried out in Assam and recorded additional features in *Calamus meghalayensis* that included the length of the stem, nature of leaf, inflorescence branching order and the first report on extended bracts of inflorescence rachis. In stem anatomy, few metaxylem were observed with more than one vessels, and also found filled with tylose-like structure.

Keywords: *O. Beccari*, variety, species, North-east India

Introduction

Beccari (1908) described the variety *Calamus floribundus* var. *depauperatus* Beccari based on C. B. Clarke's collection which was around one meter long, and cited a plate (No. 48) of the specimen composed of leaf, stem and staminate inflorescences branched to two or three orders. Later this variety was upgraded to a new species *Calamus meghalayensis* Henderson by Henderson and Henderson (2007) with some new features but reported that the staminate inflorescence was branched to two orders. The species distributed in Meghalaya (Henderson and Henderson, 2007; Renuka and Sreekumar, 2012) and also reported from Kamrup (Rural) district (Mehmud and Roy, 2021) and Gibbon Wildlife Sanctuary of Jorhat district by Bora *et al.*, (2012) in Assam. While exploring the family Arecaceae in Assam, additional morphological features were noted in total eleven individuals among five clusters of *C. meghalayensis*

in Kamrup (Rural) district only. The habitats of these populations were found in sloppy areas and near streams and flowering observed during the month of September to March and fruiting during November to January. The stem of the samples were selected for anatomical study. Some new anatomical features were also observed. The additional features recorded both on morphology and stem anatomy are discussed and substantiated here with suitable photo-plates (Figs. 1-5).

Materials and Methods

Collections during field exploration preceded the entire process of voucher preparation by following the standard technique and methods (Dransfield 1986). The collected specimens were then compared with the holotype (digital images!) and other voucher specimens of the species housed in ASSAM and CAL herbaria of Botanical Survey of India. Slides of fine freehand transverse sections were prepared following Chamberlain (1924); observed under light microscope and internal features were recorded.

Results

Morphological features:

- Stem : Up to 6.5 m long.
 Leaf sheath : Spines 7–9 mm long. Ocrea with black or brown bristles, 0.6–2 cm long (Fig. 1 b).
 Leaf : Pinnae up to 8 per side (Fig. 1 c). Basal pinnae ca. 27 × 4 cm; middle pinnae ca. 37 × 5.3 cm; & terminal pinnae ca. 29 × 5.2 cm and connate at the base from 2–5.2 cm.

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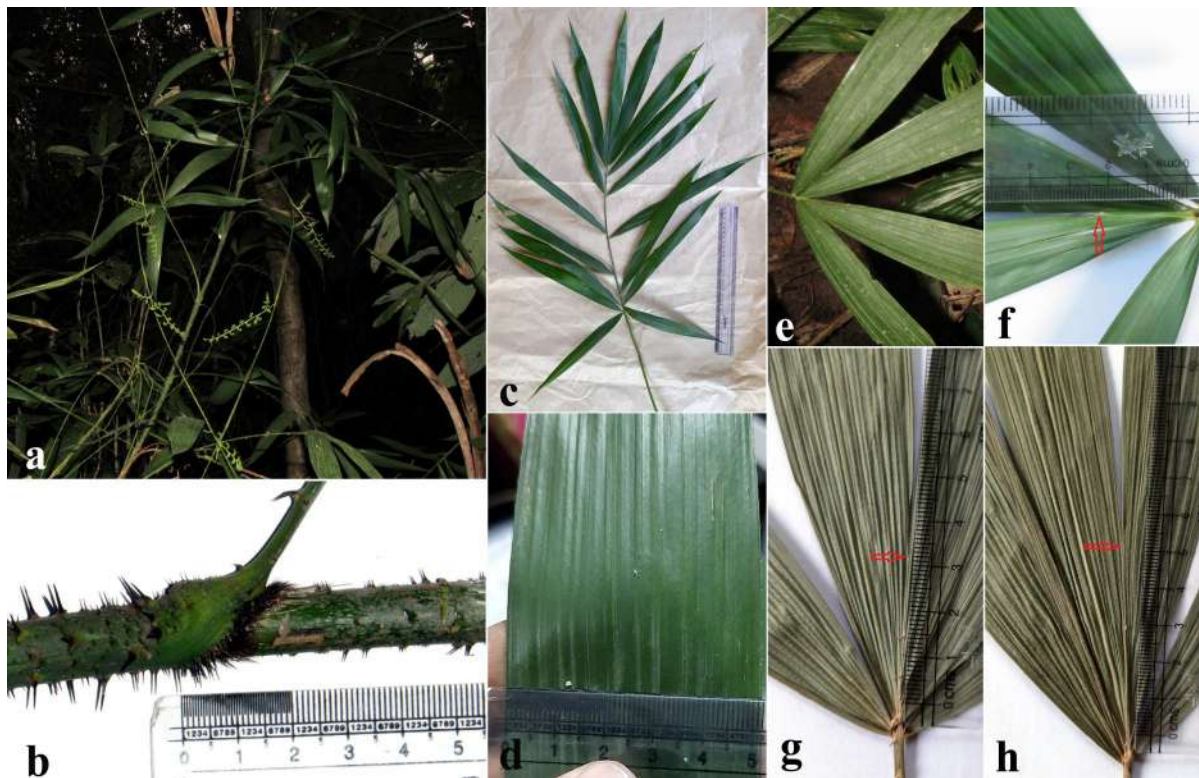


Fig 1: Habit with staminate inflorescences (a); Stem (b); A complete leaf (c); Width of a middle pinnae (d); Free terminal pinnae (e); Terminal pinnae connate at different length (arrow) (f-h).

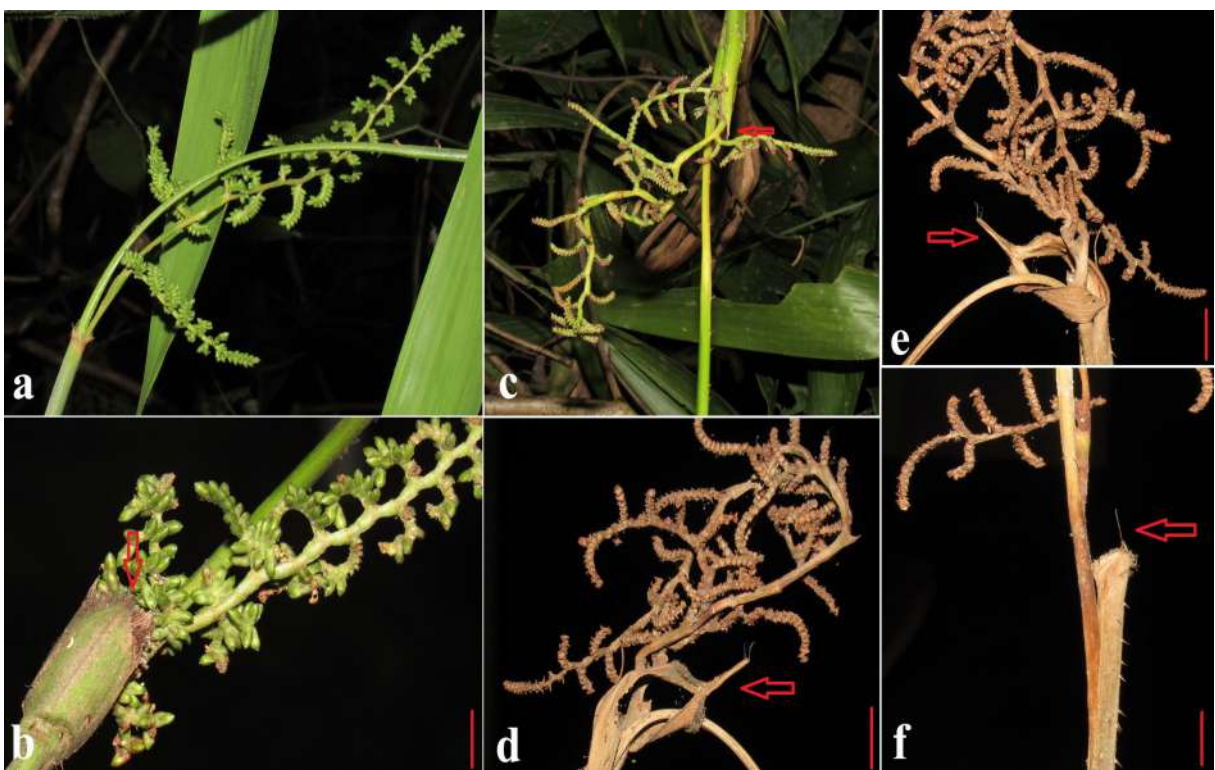


Fig 2. Staminate partial inflorescences without extended apex of rachis bract (arrow) (a-b); Staminate partial inflorescences with extended apices of rachis bracts (c-f). (Scale bar: 1 cm).

Inflorescence rachis bracts: The mouth of the rachis bract is bristly (Henderson, 2020) but sometimes the apex of the bracts extends and bristles terminally. Prophyll is with (Fig. 3 b) or without such extension (Fig. 3 a). The extended apices are either single rod-like (Figs. 2 c-e; Figs. 3 e-f, i) or terminally united but middle portion splits longitudinally (Figs. 3 c-d, g) or bifurcated (Figs. 3 b, h) or bristles like (Fig. 2 f).

Staminate Inflorescences: Branching orders 2–3; extended apices of rachis bracts ca. 1 cm long; partial inflorescences up to 11 in numbers; rachillae

8-11 per side, basal rachillae 1.5-2.5 cm and terminal rachillae 1.5-2.3 cm long. Flowers trimerous, ca. 3 mm; calyx united and three lobed, ca. 2 mm; corolla free, ca. 2.3 mm; stamens 6, ca. 2 mm, bilobed; pistillodes 3, ca. 1 mm.

Pistillate inflorescences (Figs. 3 a-k): Branching orders 1-2; extended apices of rachis bracts 1.2-4.8 cm long. Partial inflorescences up to 6 in numbers; rarely basal and middle partial inflorescences up to 23 cm long; rachillae 5-9 per side, 1-8 cm long, sometimes terminal rachilla 5–8 cm long; and rarely partial inflorescences are terminally unbranched



Fig 3: Prophyll of pistillate inflorescences (a-b); Pistillate partial inflorescences with extended apices of rachis bracts (arrow) of (c-i); A complete pistillate inflorescence (j); Pistillate partial inflorescence without extended apex of rachis bract (k); Dry infructescences with extended apices of rachis bracts (arrow) (l-n); Infructescences without extended apices (arrow) of rachis bracts (o-p); (Scale bar (red): 1 cm)

Fig. 3 j). Pistillate flowers trimerous, ca. 4 mm; calyx united and three lobed, ca. 3 mm; corolla free, ca. 2.5 mm; staminodes 6, arranged in a whorl, ca. 2 mm; ovary 2 mm. Neuter flowers trimerous, ca. 2.5 mm; calyx united and three lobed, ca. 2.5 mm; corolla free, ca. 2 mm; staminodes 6, free, ca. 1.5 mm; pistillode 2-3, ca. 1.5 mm.

Infructescences (Figs. 3 l-p): The extended apices of rachis bracts are present (Figs. 3 l-n) or absent Figs. 3

o-p). Fruits (Figs. 3 n-o) ellipsoid, around (1.5-1.7 cm; scales grooved, vertically 15 rows.

Additional anatomical features of the stem:

The epidermal lumina (Fig. 5 a) and fibro-vascular bundles (Fig. 5 d) are found similar as reported by Mathew and Bhat (1997) and Renuka *et al.*, (2010). Few metaxylems were with more than one vessel (Figs. 5 b-c); and few metaxylem vessel were also found filled with tylose-like structure (Fig. 5 e).

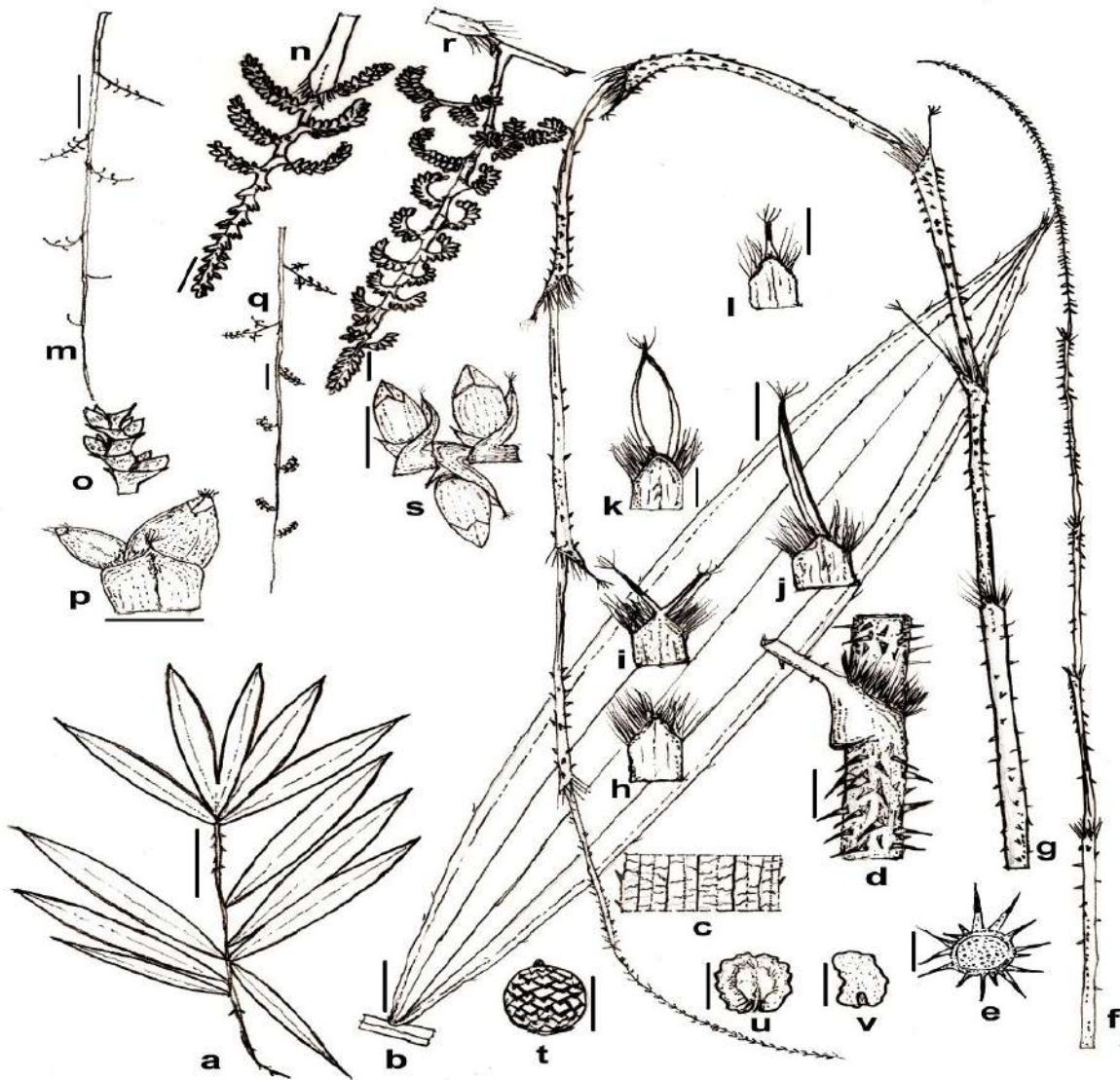


Fig 4: A complete leaf [scale bar: 10 cm] (a); Leaflet [scale bar: 1 cm] (b); Venation (c); Stem [scale bar: 1 cm] (d); Transverse cut of a stem highlighting the spines [scale bar: 1 cm] (e); Flagellum (f); Young inflorescence with extended tips of rachis bract (g); Prophyll (h); Extended tips of rachis bracts [scale bar: 1 cm] (i-l); Pistillate inflorescence [scale bar: 10 cm] (m); Pistillate rachilla [scale bar: 1 cm] (n); Pistillate rachilla without extended tips of rachis bract [scale bar: 4 mm] (o); Staminate inflorescence [scale bar: 10 cm] (p); Staminate rachilla with flowers [scale bar: 3 mm] (s); Fruit [scale bar: 1 cm] (t); Seed [scale bar: 5 mm] (u); Longitudinal cut of a seed [scale bar: 5 mm] (v).

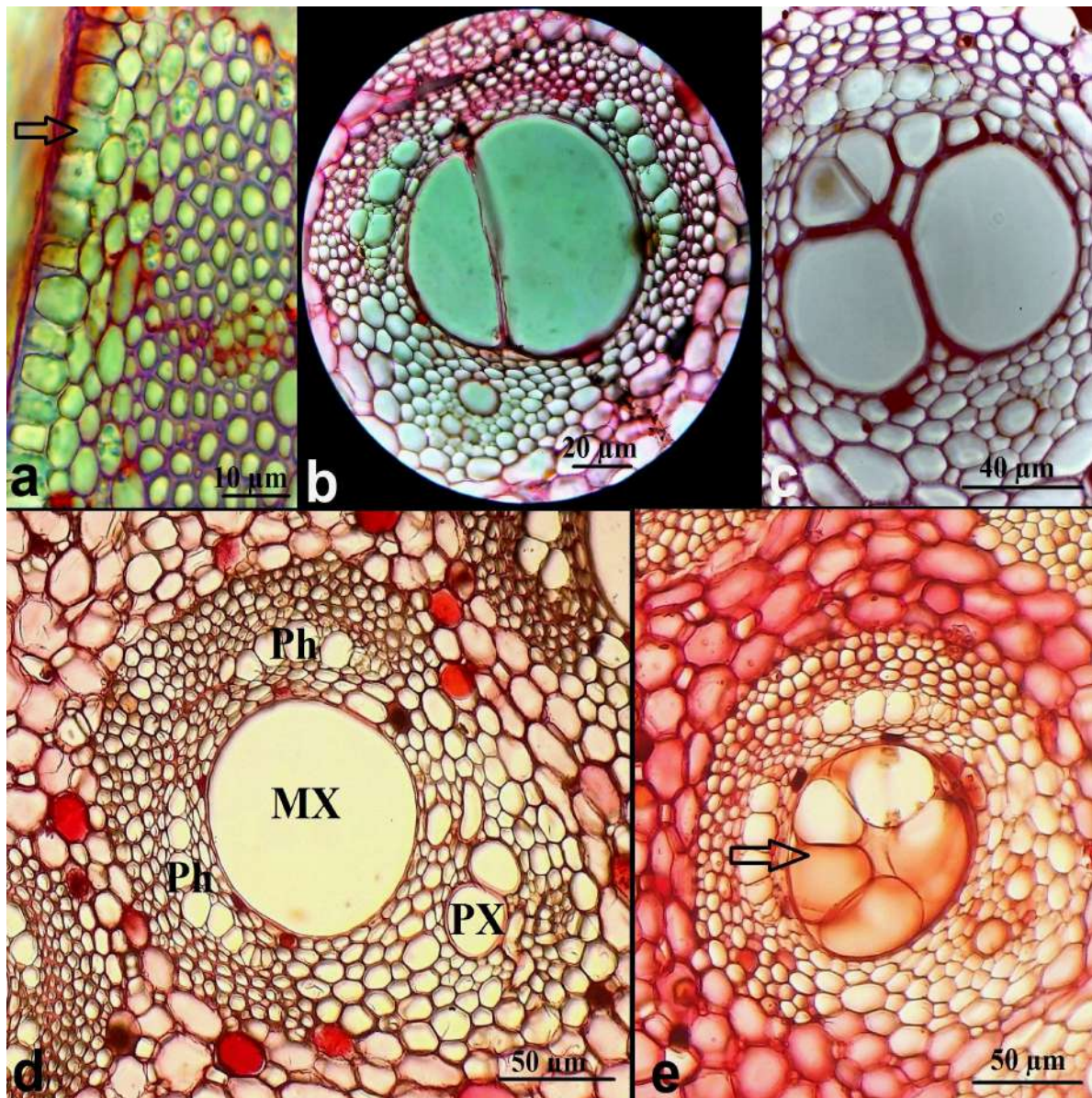


Figure 5: Epidermis (arrow) (a); Metaxylem vessels more than one (b-c); A complete fibrovascular bundle (d); A fibro-vascular bundle with tylose like structures in the vessels (arrow) (e).

Discussions

The species *Calamus meghalayensis* is similar to *C. hukaungensis* Henderson but differs in leaf sheath spines only (Henderson and Henderson, 2007). The pinnae of *C. meghalayensis* are 2–3.5 cm wide, and terminally free or briefly joint (Henderson and Henderson, 2007). In the type specimen (digital image FI060134!) terminal pinnae were connate up to around 5 cm. We recorded middle pinnae around 5.3 cm wide (Fig. 1 d) and terminal pinnae also free (Fig. 1 e) or connate up to 5.2 cm (Fig. 1 h).

The occurrences of such extension of apices of rachis bracts in the inflorescences was not uniform in the same individual; and when such apices present their length and nature (i.e. solitary or split) were not consistent throughout an inflorescence (Figs. 3 c-f). Interestingly rachis bract of one staminate inflorescence in the type specimen (digital image FI060133!) of *C. meghalayensis* was probably with such extension of bract's apex similar to our observations (Fig. 2 f; Figs. 3 f, l). In fruits, the number of the 15 vertical rows of scales was recorded. These morphological features were previously not reported in *C. meghalayensis*

(Henderson and Henderson 2007; Basu 1992; Renuka *et al.*, 2010; Renuka and Sreekumar 2012; Henderson 2020; Mehmud and Roy 2021) and such extended apices of bracts were not reported in other species of *Calamus* (Henderson 2020).

Mathew and Bhat (1997) and Renuka *et al.*, (2010) reported tylose-like structures in vessels of *Calamus palustris* Griffith and *Korthalsia rogersii* Beccari from India, where they also mentioned that metaxylem vessels were solitary in *Calamus*, *Daemonorops* and *Korthalsia*, and single or double in *Plectocomia*. The presence of tylose-like structure was also reported in *Plectocomia bractealis* Beccari from Manipur of India by Sharma *et al.*, (2018). Tylose-like structures in the vessels (Fig. 5 e) and more than one number of vessels (Figs. 5 b-c) in the metaxylem were observed in the present study. These anatomical features were not reported earlier in *C. meghalayensis* (Mathew and Bhat 1997; Renuka *et al.*, 2010).

Specimen examined: India: Gari 1200 Garo Hills, 07.02.1886, *C. Clarke 43014* (holotype FI!). Meghalaya, Pontung, 10.09.2015, *A. H. Mir 289* (ASSAM! labeled as *Calamus erectus* Roxb.). Assam, Kamrup, Jara Reserve, 24.05.1957, *G. Panigrahi 9526* (CAL!); Kamrup (Rural), Muduki Village, near Chandubi Lake, 25°52'24" N, 091°28'04" E, 27 m, 26.10.2020, *S. Mehmud 265* (Herbarium of the Department of Botany, Cotton University); Kamrup (Rural), Rani, 26°02'27" N, 091°37'47" E, 260 m, 12.03.2020, *S. Mehmud 259* (Herbarium of the Department of Botany, Cotton University); Kamrup (Rural), Bokbaha Village, Near Ukiam, 25°53'52" N, 091°23'38" E, 23 m, 19.01.2020, *S. Mehmud 241* (Herbarium of the Department of Botany, Cotton University).

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