



## Research article

# Observation of adventitious shoot in three wild palms from Assam, India

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**Abstract:** Present communication deals with field-based observation on the adventitious shoots and roots of three wild palms from Assam viz. *Calamus flagellum*, *Calamus floribundus* and *Pinanga sylvestris*. Adventitious shoots in different stages found restricted in the internodal zone of *Calamus flagellum* and *C. floribundus* whereas in *Pinanga sylvestris* confines to the nodes.

**Keywords:** Adventitious shoot - Roots - Palms - Assam.

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## INTRODUCTION

Adaptation or specialization or peculiarities in shoot to perform specialize function like reproduction, storage, protection, support or assimilation is quiet common among different groups of angiosperm. Palms distributed throughout the tropical and subtropical regions of the world (Baker & Couvreur 2012). The presence of buds in the group is not an abnormal feature, as occurrence of vegetative bud has already been mentioned in *Calamus*, *Ceratolobus* and *Plectocomiopsis* (Fisher & Dransfield 1979). Branching of *Plectocomia himalayana* Griff., reported only from Manipur (Bora *et al.* 2012) in North-east India; abnormal and lateral branching from West Bengal (Nath 2014) in three species of *Arecaceae* i.e. *Areca catechu* L. with dichotomous branching, *Cocos nucifera* L. with lateral branches and *Phoenix sylvestris* Roxb. with six to thirteen crown branching. The genus *Calamus* represents 3 types of branching, out of total five reported in palms (Edelman & Richards 2018).

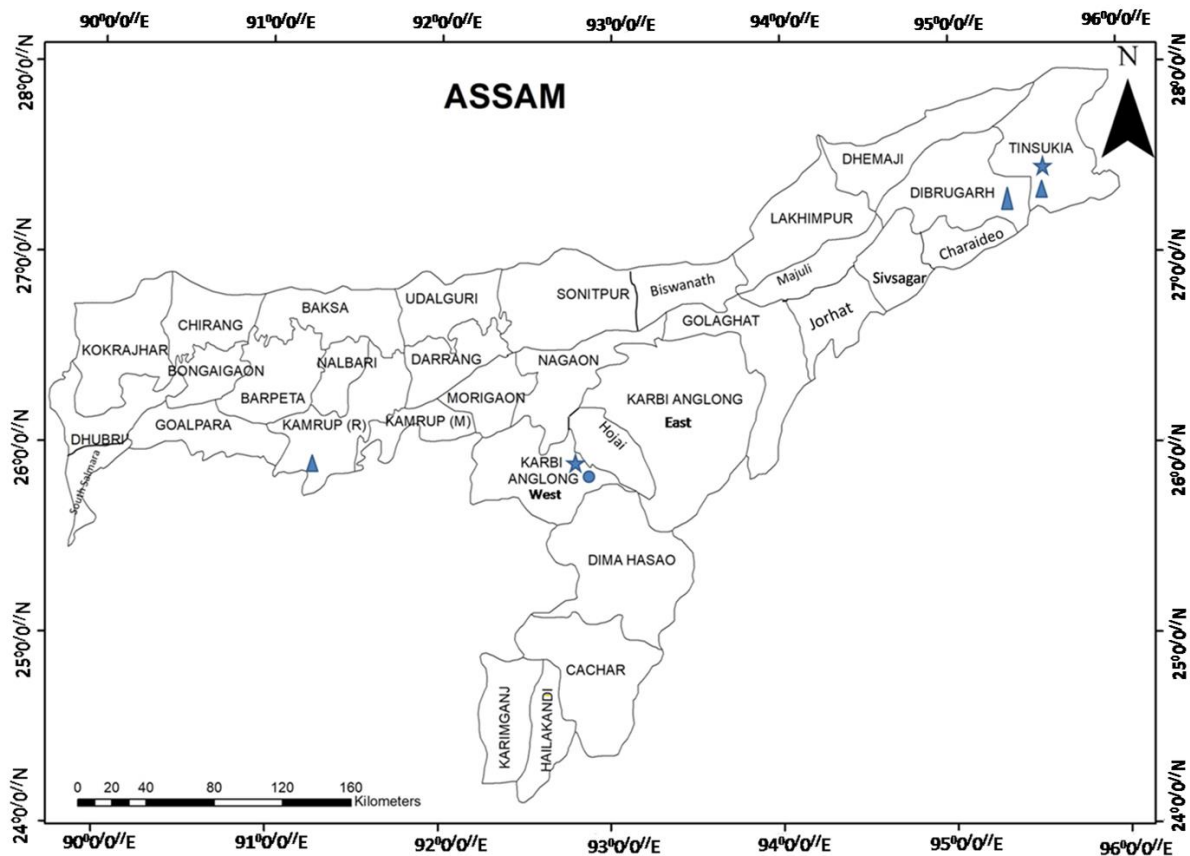
The present report is an outcome of a study on the family *Arecaceae* in Assam undertaken from 2017 to 2019. The branching behavior reported in the study on three wild species of palm, i.e. *Calamus flagellum* Griff. ex Mart., *C. floribundus* Griff. and *Pinanga sylvestris* (Lour.) Hodel is first record for Assam. In India the wild palms are gradually decreasing due to habitat loss, overexploitation as well as other issues related to monocarpic flower, poor seed germination and seedlings establishment (Renuka & Shreekumar 2012). The rattans are propagated mainly by seed, cuttings and tissue culture (Renuka *et al.* 2010). There are relation between branching and phylogeny of the group (Edelman & Richards 2018). Therefore any information on adventitious shoot may prove to be useful in phylogenetic study of the group along with providing an opportunity for the naturalist or conversationalist to facilitate the propagation of the group by natural or artificial means.

## METHODS AND MATERIALS

### Study area

The area of the state Assam is 78,438 sq. km situated between 24° 44' N to 27° 45' N latitude and 89° 41' E to 96° 02' E longitude (Baishya *et al.* 2015). Survey carried throughout the state, occurrence of the species recorded from different parts and their location included in figure 1. *Calamus flagellum* was collected from Dibrugarh during flowering season (Fig. 2A–B), Tinsukia and Kamrup (R); *Calamus floribundus* from Tinsukia and Karbi Anglong; *Pinanga sylvestris* from Karbi Anglong districts of Assam.

Samples collected were studied, preserved and processed for herbarium (Dransfield 1986, Jain & Rao 1977). Taxonomic identity of the voucher specimens ascertained with the help of review of literature (Basu 1992, Henderson 2009, Renuka *et al.* 2010, Renuka & Shreekumar 2012) and herbaria consultation (CAL, ASSAM). Voucher specimens kept in the departmental herbaria, Department of Botany, Cotton University.



**Figure 1.** Map of study area: *Calamus flagellum* Griff. ex Mart. showing blue triangle symbol; *Calamus floribundus* Griff. with blue star; *Pinanga sylvestris* (Lour.) Hodel blue round symbol.

## RESULTS AND DISCUSSIONS

### 1. *Calamus flagellum* Griff.

(Fig. 2&3)

*C. flagellum* is clustered commonly found in dense forest near streams, locally known as “Raidang Bet” among Assamese and is a good source of cane for both commercial and domestic uses (Fig. 2A–B). Stem up to 20 m or more, flagella ca. 3–4 m, internodes 10–30 cm in length and 1.5–2.5 cm in diameter. In the present communication, collected sample of *C. flagellum* were classified into four categories viz. Category–I, –II, –III and –IV based on the stem behavior.

Category–I was collected near a seasonal stream in Saraipung of Dibrugarh district. Different stages of bulbil-like adventitious shoots distinct in the internodes of *C. flagellum* (Fig. 2C–G) were recorded. Interestingly, the shoots were both with leaves and roots. Shoots near soil established contact with the soil and with young leaf attained a height up to 30–40 cm (Fig. 2F). Shoots failed to establish ground contact were simply dried (Fig. 2G). Specific habitat features *i.e.* availability of water probably induces initiation of such shoots in *C. flagellum* as observed in the study area.

Category–II of *C. flagellum* collected from Margherita of Tinsukia district in Assam. Here, a terminal portion of stem of 20 cm was peculiar in bearing crowded or compact nodes and internodes. A distinct injury was noted below the peculiar portion of stem. The internodal region measures only 1.0–1.5 cm in length. Adventitious roots arose from the nodes and immature adventitious shoots of 2×1 cm from the internodes (Fig. 2H–J).

Almost alike observation was made in Category–III of the *C. flagellum* collected from Rajapara of Kamrup (R) district in Assam. Here, a detached stem was found followed by a compact zone of nodes and internodes where terminal nodes were rooted (Fig. 3A–B). Category–IV recorded from same place as Category–III with an erect stem, rooting at terminal position and without injury (Fig. 3C–D). Except Category–I, all other samples of the species were found without flagella.

### 2. *Calamus floribundus* Griff.

(Fig. 4)

The species *C. floribundus* is similar to *C. flagellum* in habitat, stems up to 10–13 m, flagella 2–3 m, internodes are 5–18 cm, 1.5–2.5 cm in diameter, canes are used commercially. Samples of *C. floribundus* with injured stem collected from Padumani of Tinsukia district and Hamren of Karbi Anglong district of Assam and



**Figure 2.** *Calamus flagellum* Griff.: **A**, Habitat; **B**, Inflorescence; **C–E**, Different stages of adventitious shoots in internodes [Scale 3 cm]; **F**, Established at soil; **G**, Shoots failed to established soil contact and dried; **H**, An injured stem; **I**, Injury in the stem; **J**, Compact nodal zone [Scale 5 cm].

were grouped as Category–I and –II respectively. Category–I (Fig. 4A–D) represent single (Fig. 4D) to multiple mature branching in internodes with distinct root and leaves (Fig. 4A–C). Category–II (Fig. 4E–F) represent a segmented stem rooting at nodes was found near the parent plant without any branching.

### 3. *Pinanga sylvestris* (Lour.) Hodel

(Fig. 5)

*P. sylvestris* is clustered or solitary, un-branched, 3–4 m long palm found in sloppy and shady areas near stream in dense forest (Fig. 5A). Plant samples of *P. sylvestris* collected from Hamren of Karbi Anglong district, fruit (Fig. 5B) as masticator and known as “Koibir” among Karbi. Samples were classified as Category–I, –II and –III. Creamy yellowish shoots of 6–7 cm arises from the rhizome and are covered with hairs (Fig. 5C). Category–I includes elongated green or reddish adventitious shoots of 2–3 × 1.0–1.5 cm in the basal nodes (Fig. 5D–E) and few dried immature adventitious shoots were also observed with roots (Fig. 5F). Category–II with compact zone of nodes and internodes found with leaf opposed buds (Fig. 5G). In Category–III, growth of

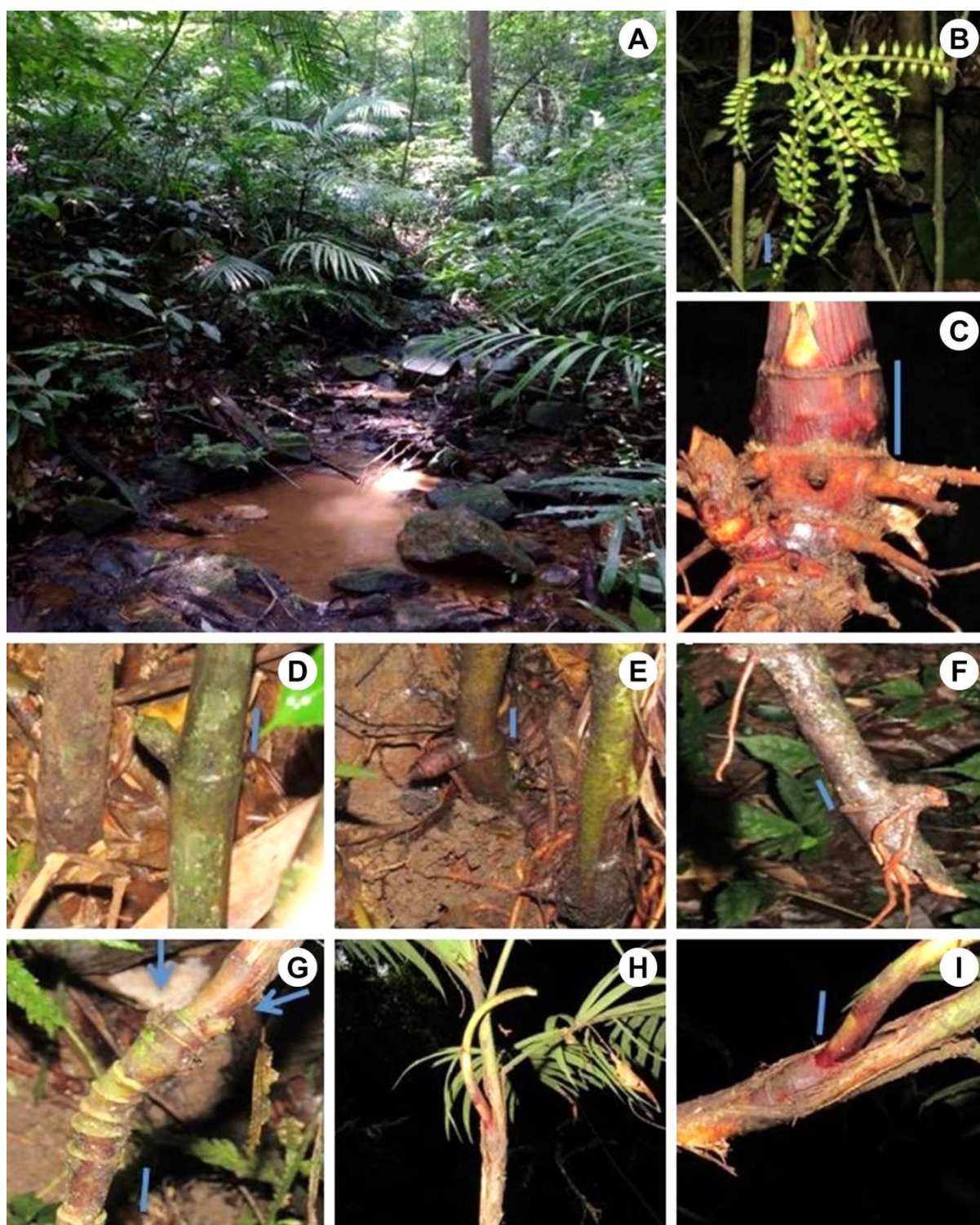
normal leaf from injured crownshaft and such leaf when young is covered by a 5–6 cm long tubular, cylindrical spathe (Fig. 5H–I).



**Figure 3.** *Calamus flagellum* Griff.: A–B, A detached stem with rooting terminally; C–D, Erect non injured stem with rooting (arrow marked) terminally.



**Figure 4.** *Calamus floribundus* Griff.: A–B; Branching in injured (arrow marked) stems; C, Branches in injured stem (arrow marked); D, Branch at internodes (arrow marked) of injured stem; E–F, Rooting from nodes in injured stem.



**Figure 5.** *Pinanga sylvestris* (Lour.) Hodel: **A**, Habit; **B**, Fruiting; **C**, Normal shoots from rhizome; **D–E**, Adventitious shoots; **F**, Adventitious shoots with rooting; **G**, Compact internodal zone with buds (arrow marked); **H**, Growth of leaf from injury; **I**, Tubular structure of outgrowth. [Scale 2 cm]

## CONCLUSIONS

Palms being solitary find it difficult to survive once stem injured. Therefore, palms response to the injury. The occurrence of adventitious shoots and its attempt in some cases or successful establishment of some others to the ground to behave as an individual may indicate a mean, gradually adopting for vegetative propagation as observed in Category–II, –III and –IV of *C. flagellum* and in Category–I and –II of *C. floribundus*. Habitat peculiarities may also significant in this case as specific habitat features *i.e.* availability of water might have induced initiation of such shoots as observed in Category–I of *C. flagellum*.

Well-developed adventitious branching with leaves from internodal region of rheophytic species *Pinanga rivularis* Becc. was reported from Borneo (Dransfield 1992). Present study not only agreed Dransfield (1992) [www.tropicalplantresearch.com](http://www.tropicalplantresearch.com)

but also extends the occurrence of such branching further in *Calamus flagellum*, *C. floribundus* and *Pinanga sylvestris* which were all collected some or other way near stagnant or running water bodies, thus showing similarity with rheophytic environment. Further, a species needs lots of energy, resource and effort to reproduce sexually. Development of vegetative shoots from male inflorescence as reported in *Calamus castaneus* Griff. (Ruppert *et al.* 2012), probably a behavioral change of the inflorescence for the vegetative mode of propagation to save energy, resource and efforts needed for sexual reproduction. However, origin and development of adventitious branches and/or rooting in nodes in some cases or internodes in some other cases, whether to respond different injuries or because of habitat peculiarity is a matter of future study. Observation made in all the palm species is summarized (Table 1).

**Table 1.** Adventitious shoot in three wild palms from Assam, India.

S.N.	Category	<i>Calamus flagellum</i>	<i>Calamus floribundus</i>	<i>Pinanga sylvestris</i>
1.	Habitat peculiarity (found near stream)	Yes	Yes	Yes
2.	Origin of adventitious branching	Internodes	Internodes	Nodes
3.	Adventitious branching with rooting	Common	Common	Common
4.	Rooting in the stem	From nodes	From nodes	Not seen
5.	Injury found associated with	Compact internodal zone with branching and rooting.	Branching and rooting	Leaf growth from injured crown shaft
6.	Compact internodal zone without injury	Not seen	Not seen	Present

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