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RESEARCH COMMUNICATION

The little-known *Fissidens axilliflorus* Thwaites & Mitt. (Fissidentaceae: Bryophyta) - new to the moss flora of India

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ABSTRACT
Fissidens axilliflorus, so far known from Sri Lanka and Laos, has been discovered in the Western Ghats in India. A description with line drawings, a photo plate and a key to distinguish *F. axilliflorus* from the similar *F. crenulatus* are provided.

Introduction

Currently, there are about 450 species of *Fissidens* Hedw. World-wide (1). In India there are 78 valid species (2) while in the Western Ghats there are 59 (3). The discovery of *Fissidens axilliflorus* Thwaites & Mitt. while surveying the Southernmost Western Ghats for bryophytes adds one more species to the genus in India and the Western Ghats raising the number to 79 and 60 respectively. Thwaites and Mitten (4) described *Fissidens axilliflorus* based on a material collected from Ceylon. This species was later reduced to a synonym of *F. crenulatus* Mitt. (5). However, it was resuscitated as *F. axilliflorus* since it differs from *F. crenulatus* in possessing sharply unipapillose laminal cells and a one-cell thick (unistratose) limbidium (6). In addition, differentiating and consistent features such as the presence of a wedge-shaped dorsal lamina base and papillose spores observed in the present material can be attributed to the distinctiveness of this species.

Taxonomic key distinguishing *F. axilliflorus* from *F. crenulatus*

1a. Dorsal lamina wedge-shaped at base; leaf laminal cells sharply mammillose to unipapillose, rarely bipapillose; spores papillose.....***F. axilliflorus***

1b. Dorsal lamina rounded at base; leaf laminal cells bluntly mammillose with 1 or 2 low papillae; spores sparsely papillose..... ***F. crenulatus***

Fissidens axilliflorus Thwaites & Mitt., J. Linn. Soc. Bot. 13: 325. 1873; Tad. Suzuki & Z. Iwats., Hattoria 4: 52. 2013. - Type: Ceylon (Sri Lanka), Central Province, *G.H.K. Thwaites* 8, *s.d*. Herb. Mitt. (NY). (Figs 1 & 2).

Plants dioicous, scattered or in loose mats, green, pinnate, 4–9 mm tall, 1.5–1.7 mm wide. Stems simple, 0.098–0.14 × 0.084–0.10 mm in cross section, ovate, 8–10 cells across, with a faint central strand, greenish-white above, pale reddish-brown below; cortex 1–2-layered, with 4–12 × 6–16 µm, thick-walled cells; medullary cells 12–20 × 14–16 µm, thin-walled; axillary nodules not developed. Rhizoids basal. Leaves 4–10 pairs, imbricate to distant, slightly crispate when dry, obliquely spreading when moist, oblong to oblong-lingulate, 0.4–1.3 × 0.1–0.2 mm, 4 to 5 times as long as wide, narrowing dorsally, reaching the point of insertion or ending well above, wedge-shaped at base, not decurrent, crenulate at margin throughout due to projecting papillae, acute to acuminate at apex; apical and median cells 6–10 × 4–8 µm, moderately thick-walled, sharply mammillose to unipapillose, sometimes with a few bipapillose ones; basal cells 12–20 × 10–16 µm, quadrate-rectangular. Limbidium present on vaginant laminae of well-developed leaves, reaching the apex of vaginant laminae

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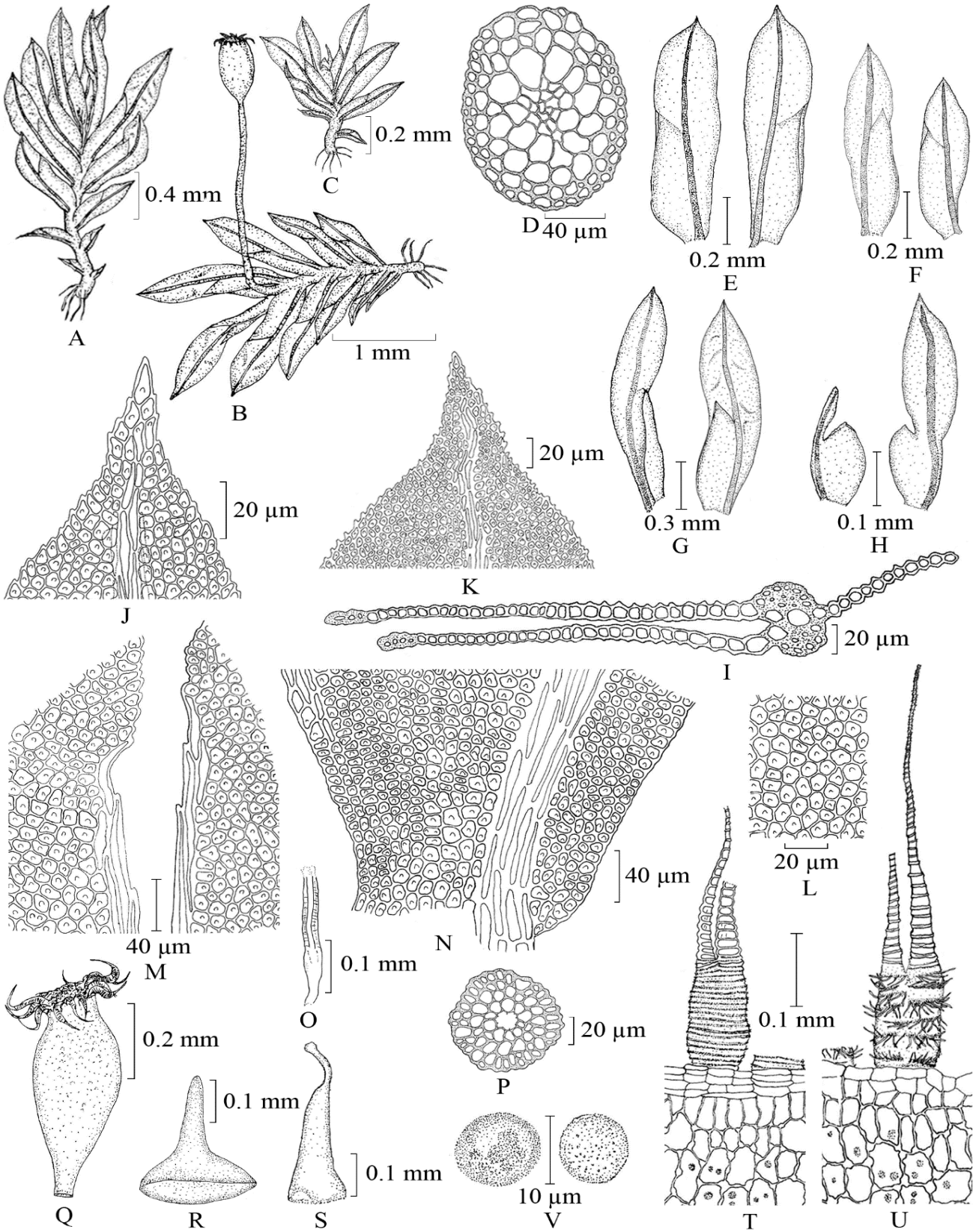

Fig. 1. *Fissidens axilliflorus* Thwaites & Mitt. **A**. Vegetative plant **B**. Sporophytic plant **C**. Male plant **D**. Cross-section of stem **E**–**F**. Leaves **G**. Perichaetial leaves **H**. Perigonial leaves **I**. Cross-section of leaf **J**–**K**. Leaf apical cells **L**. Leaf median cells **M**. Ending of limbidium **N**. Leaf basal cells **O**. Archegonium **P**. Cross-section of seta **Q**. Capsule with peristome teeth **R**. Operculum **S**. Calyptra **T**. Peristome teeth outer side **U**. Peristome teeth inner side **V**. Spores (*R. Sreebha 211, 260*).

or ending 8–12 cells below, marginal or weakly and irregularly intramarginal towards the base, composed of 2–4 rows of hyaline, elongate, smooth, thin-walled cells, unistratose, absent on young leaves and leaves of male plant; vaginant laminae 1/3 as long as leaf, subequal to unequal; costae ending below leaf apex to shortly excurrent, with 2 or 3 guide cells in cross section. Perigonia and perichaetia terminal; perigonia bud-like, on 0.6–1 mm tall male plants at base of female plants (rhizautoicous); perichaetial leaves longer and narrower than vegetative ones, 1–1.3 × 0.16–0.25 mm, broadly constricted at middle, crenulate at margin due

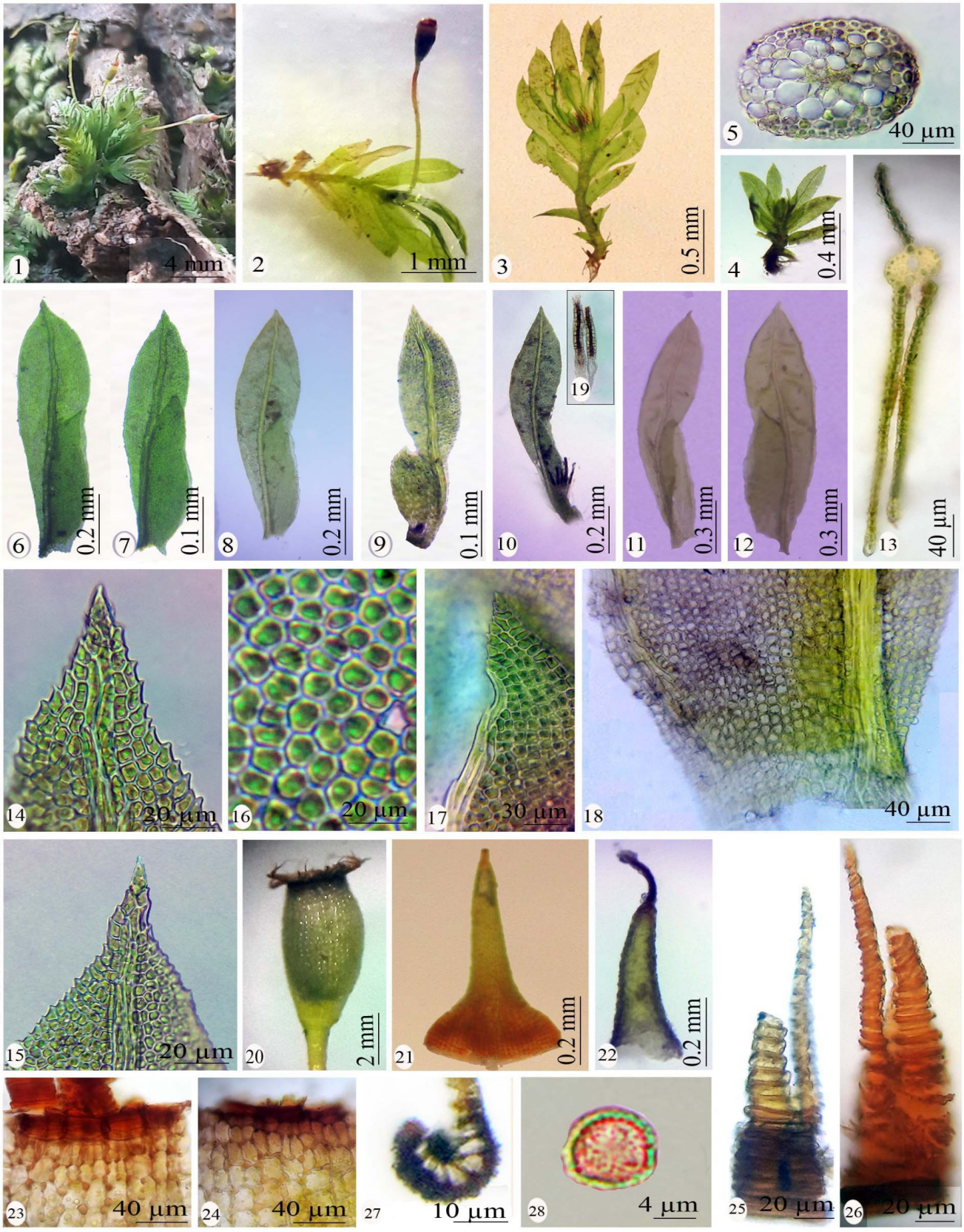

Fig. 2. *Fissidens axilliflorus* Thwaites & Mitt.**1**. Habitat **2**. Sporophytic plant **3**. Female plant with archegonia **4**. Male plant **5**. Cross-section of stem **6–8**. Leaves **9**. Perigonial leaf **10**. Perichaetial leaf with archegonia **11–12**. Perichaetial leaves **13**. Cross-section of leaf **14–15**. Leaf apical cells **16**. Leaf median cells **17**. Ending of limbidium **18**. Leaf basal cells **19**. Archegonia **20**. Capsule **21**. Operculum **22**. Calyptra **23–24**. Capsule outer and inner walls respectively **25**. Peristome teeth outer side **26**. Peristome teeth inner side **27**. Side view of the undivided basal part of peristome **28**. Spore (*R. Sreebha 211, 260*).

to projecting papillae. Sporophytes apical. Setae 4–5 mm long, erect, smooth. Capsules erect, asymmetric, 0.5–0.62 × 0.32–0.34 mm, ovoid-cylindric; operculum reddish-brown, 0.3–0.4 mm long; calyptrae cucullate, slightly scabrous. Peristome teeth of *scariosus*-type, 200–260 × 36–38 µm, reddish-brown. Spores 8–12 µm, globose, papillose, pale brown.

Habitat: Lignicolous (on roots of *Cocos nucifera* L. stumps); terricolous in degraded evergreen forests, ca 90 m above msl.

Distribution: Laos, Sri Lanka and India (3): the Western Ghats, Tamil Nadu, Kanniyakumari Dt. (present study) (Fig. 3).

Specimens examined : India, Western Ghats, Tamil Nadu, Kanniyakumari Dt., Kizhakkambhagam, Ponmanai, 8° 35' 0.62" N &77° 32' 0.84", ca 90 m, 05 October, 2019, *R. Sreebha 211* (SCCN); 06 December, 2019, *R. Sreebha 220* (SCCN); 14 January, 2020, *R. Sreebha 260* (SCCN).

Discussion

In a study (6), it was stated that *Fissidens axilliflorus* is characterized by sharply unipapillose laminal cells, percurrent costae and a one-cell thick (unistratose) limbidium. However, the present collection shows slight variations from these observations such as the laminal cells being sharply mammillose to uni-papillose, sometimes bipapillose and the costae ending below leaf apex to slightly excurrent. Moreover, the species is very similar to *F. crenulatus*. Both have mammillose laminal cells and unistratose limbidia on the vaginant laminae of all well-developed leaves. However, the limbidium of *F. crenulatus* is highly cartilaginous and yellowish whereas that of *F. axilliflorus* is hyaline and consists of thin-walled cells. Further differences between the two species are given in the key above.

In a study (7), there merged the *bryoides*- and *scariosus*-type of peristome into one, the *fissidens*-type and therefore indicated the peristome type in *Fissidens axilliflorus* as a *fissidens*-type (6). However, here we follow another study (8) and indicate this peristome as a *scariosus*-type.

Authors' contributions

RS: Collection, dissection and preparation of figure and photographic plates; AEDD: Preparation of the MS.

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Conflict of interests

The authors declare that they have no competing interests.

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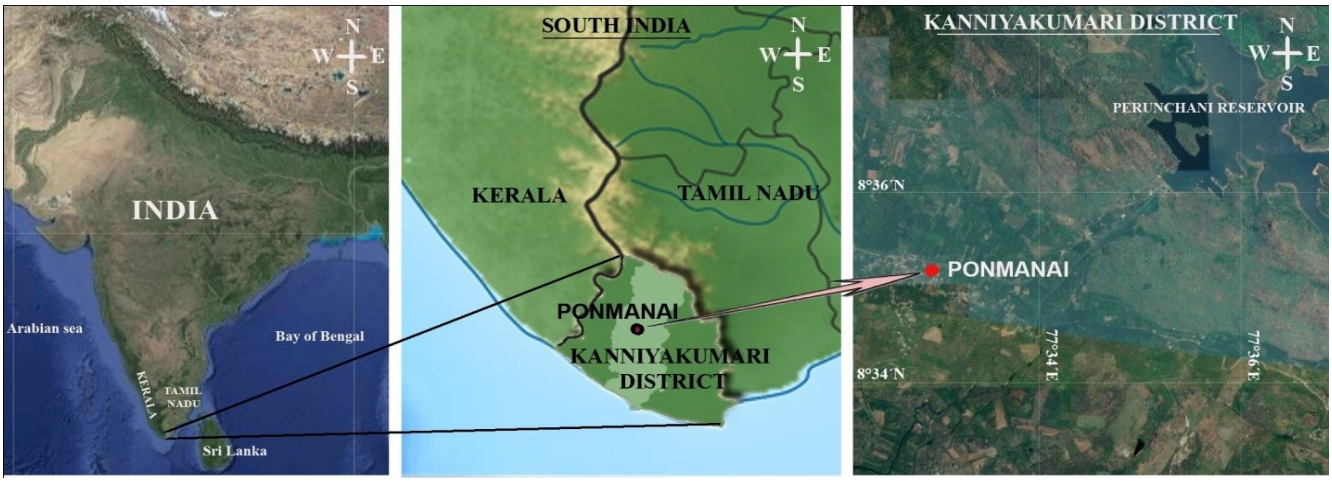

Fig. 3. Location-map of *Fissidens axilliflorus* Thwaites & Mitt. in India.

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