Species

To Cite:
Islam SR, Pradhan S, Saadi SMAI, Mondal AK. *Philonotis thwaitesii* Mitt. (Bartramiaceae: Bryophyta) - An addition to the Bryoflora of Jharkhand, India. *Species* 2026; 27: e10s3270
doi:

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Peer-Review History
Received: 21 August 2025
Reviewed & Revised: 30/September/2025 to 12/April/2026
Accepted: 18 April 2026
Published: 29 April 2026

Peer-Review Model
External peer-review was done through double-blind method.

Species
pISSN 2319–5746; eISSN 2319–5754

Philonotis thwaitesii Mitt. (Bartramiaceae: Bryophyta) - An addition to the Bryoflora of Jharkhand, India

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ABSTRACT

Philonotis thwaitesii Mitt. is reported for the first time from Jharkhand. It was previously recorded in Gujarat, Sikkim, Odisha, Rajasthan, Himachal Pradesh, Tamil Nadu, and West Bengal. An illustrated description along with ultrastructural details of the peristome teeth and spores, is provided to facilitate easy identification.

Keywords: New addition, *Philonotis*, Peristome, SEM, Spore, Jharkhand

1. INTRODUCTION

Bartramiaceae Schwägr is a large and cosmopolitan family with almost 400 species worldwide. The family is represented by 48 species under 8 genera in India (Gangulee 1978-80; Dandotiya et al., 2011). Genus *Philonotis* Brid. is represented by 244 species worldwide, of which 25 species have been documented from India (Dandotiya et al., 2011).

During the course of studies on the bryoflora of Jharkhand, one interesting specimen of *Philonotis* was collected from Jharkhand, East Singhbhum district in 2022. Subsequent morphotaxonomic study of the specimens and relevant literature (Alam 2013; Alam et al., 2014; Alam et al., 2015; Chaudhary et al., 2006; Dabhade 1998, Magdum et al., 2017; Mishra et al., 2016; Rawat et al., 2016; Singh and Ghosh 2007; Palani et al., 2017; Chaudhary and Sharma 2007) revealed it as *P. thwaitesii* species earlier known from Gujarat, Himachal Pradesh, Odisha, Rajasthan, Sikkim and Tamil Nadu.

2. METHODOLOGY

The collected specimens were initially stored in blotting paper packets, with a portion preserved in 70% alcohol containing a trace of glycerol. External morphology was examined using a stereo zoom dissecting microscope (model Stemi-508). Anatomical details were studied with the help of a phase-contrast microscope (model Primostar). SEM photomicrographs were obtained using a scanning electron microscope (ZEISS FESEM SUPRA-40). The studied specimens have been deposited in the Cryptogamic Section of the Vidyasagar University Herbarium, Medinipur, West Bengal, India.

3. RESULTS

Taxonomic Treatment

Philonotis thwaitesii Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1:60, 1859. (Figures 1, 2 & 3).

Plants are green to yellowish green, growing in loosely tufted, 1.5 – 3 cm long. Stem reddish brown, tomentose below, branched in subfloral whorls, 0.6–1.5 cm long, trans section rounded, central strand surrounded by the 3–4 layered inner cortex of large thin-walled cells, outer cortex 2–3 layered thick of small thick cells bounded by a single layered epidermis. Rhizoids are smooth to densely rugose. Leaves erect, dense, stiff, curled and more appressed when dry, triangular-linear lanceolate, 1.2–2 × 0.3–0.5 mm, apex acuminate; margin slightly reflex, finely dentate in the lower half. Costa well-defined, 50–110 μm wide, excurrent; in cross-section at leaf showing a row of 3 guide cells and sub-steridal band below it; upper laminal cells linear elongate, 25–40 × 3–6 μm, mamillose or papillose at upper or sides, somewhat obscure at upper; towards base the cells become rectangular and less papillose, 24–30 × 5–9 μm; at extreme basal cells quadrate, 8–13 μm wide, without any papilla.

Dioicous (?). Perichaetial leaves triangular lanceolate, subtended by a whorl of branches, 1.2–1.5 × 0.3–0.6 mm. Seta erect, reddish-brown, slender, 1.6–2.1 cm long, cross-section rounded, 2–3 layered central strand, semi-rounded, thin-walled cells, 3–4 layered inner cortex, quadrate to hexagonal, 2–3 layered outer cortex of thick-walled cells bounded by a single-layered epidermis. Capsule erect to inclined, spherical to sub-spherical when mature, 2–4 × 3 mm furrowed when dry, reddish-brown, striated when wet; exothecial cells quadrate to rectangular, sometimes irregularly arranged, thick-walled, 25–55 × 17–30 μm; inside the capsule spongy photosynthetic tissue extend above the apophysis, spongy tissue consist of elongated aerenchyma cells forming an interconnected network of intracellular space; stomata distributed in the apophysis of mature capsule, covered by smooth thin cuticle that is thicker along the outer ledges of the guard cells, actinocytic. Operculum convex, rounded-rectangle. Peristome double, reddish-brown, exostome teeth lanceolate, fenestrated and bordered, 250–350 × 50–70 μm, outer surface median line straight in upper and zig-zag pattern in lower part; endostome segment 3/4 the length of the exostome, 1 or 2 short cilia. Calyptra not seen. Spores globose to sub-globose, 20–26 μm in diameter.

Peristome teeth and spores under SEM:

Peristome diplolepidous; exostome teeth lanceolate-narrow lanceolate, bordered 5–10 μm wide, median line zig-zag shaped to nearly straight in the upper part, outer surface finely reticulate pattern showing a rounded-polygonal appearance, ventral trabeculae 17–20, thin, with a finely projections; endostome segments 3/4 the length of the exostome split along the median line. Spore globose-subglobose, proximal surface curved, rounded cup-like with coarsely granules reaching to the periphery than center; distal surface usually densely granules and fused.

Habitat and ecology:

Lithophytic, growing on soil covered with rocks associated with *Bryum* Hedw.

Specimens Examined:

India: Jharkhand, East Singbhum district, Jhatijharna forest, 22°42′31.36′′ N, 086°33′ 02.34′′ E, 280 m, 21.11.2022, Sk. R. Islam 01013 (Vidyasagar University Herbarium).

Distribution:

India: Gujarat, Sikkim, Odisha, Rajasthan, Western Himalaya (Himachal Pradesh), South India (Tamil Nadu), Jharkhand – present study; Borneo, Ceylon, China, East Nepal, Guinea, Hong Kong, Japan, Korea, Papua New Guinea, Sumatra, Taiwan.

4. DISCUSSION

Philonotis thwaitesii Mitt. is distinguished by its finely denticulate leaves and leaf cells that are mammillose or papillose at the apices or along the sides; toward the base, the cells become less papillose, and the extreme basal cells lack papillae. In India, the genus *Philonotis* is widely distributed, with 12 taxa in the Eastern Himalaya, 7 in the Western Himalaya, 4 each in the Gangetic plains and the Western Ghats, 2 in Central India, and only one species in the Andaman Nicobar Island (Figure 4).

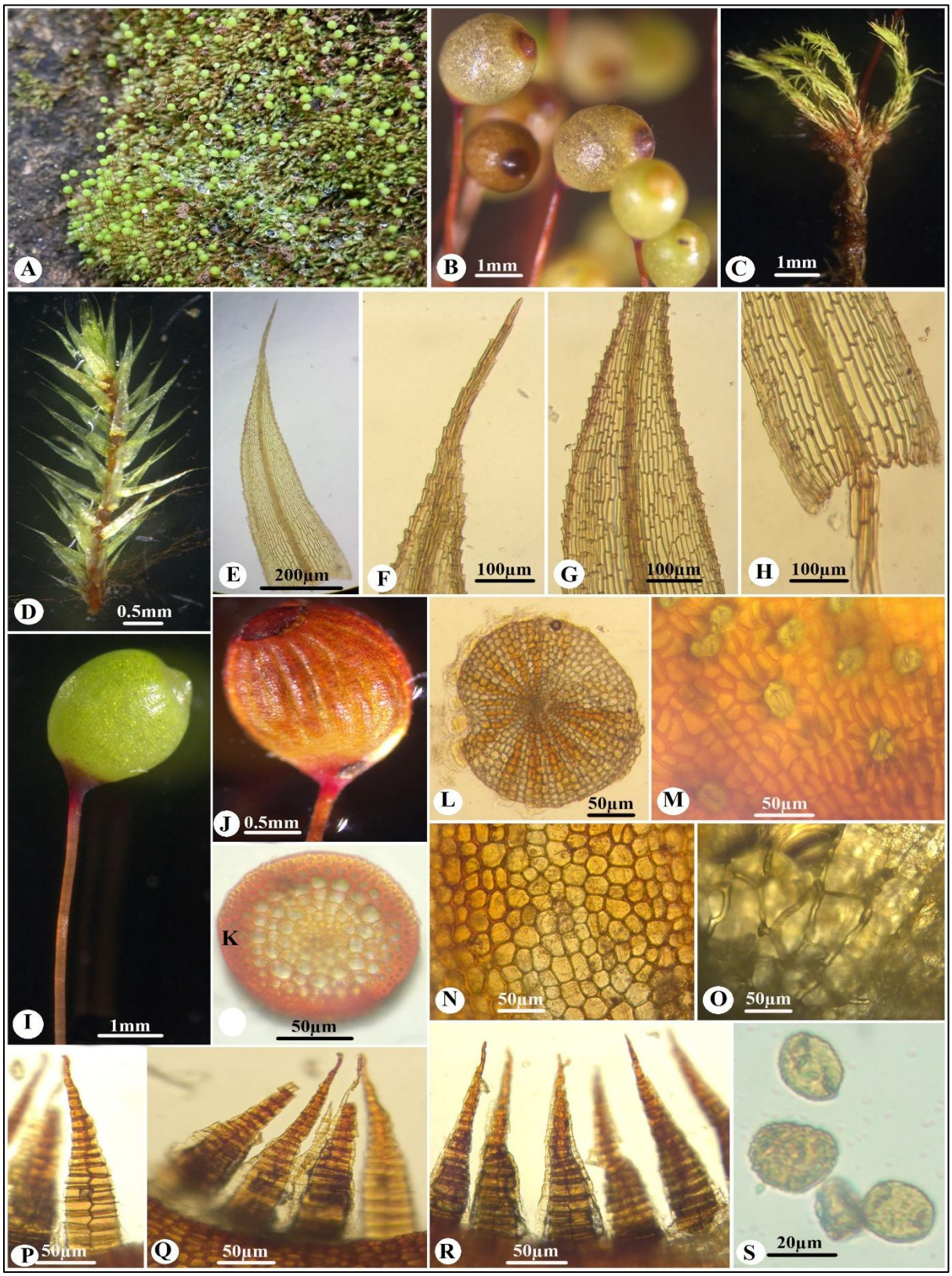

Figure 1: ***Philonotis thwaitesii*** **Mitt., A.** Habit, **B.** A portion of the same enlarged, **C.** stem branches, **D.** A portion of stem, **E.** leaf, **F.** Apical laminal cells, **G.** Median laminal cells, **H.** Basal laminal cells, **I.** Immature capsule, **J.** Mature capsule, **K.** Transverse section of seta, **L.** Operculum, **M.** Stomata, **N.** Capsule upper wall, **O.** Capsule inner wall, **P.** Exostome outer peristome teeth, **Q & R.** Exostome and endostome peristome teeth, **S.** Spores [All photomicrographs from Sk. R. Islam 01013 (Vidyasagar University Herbarium)]

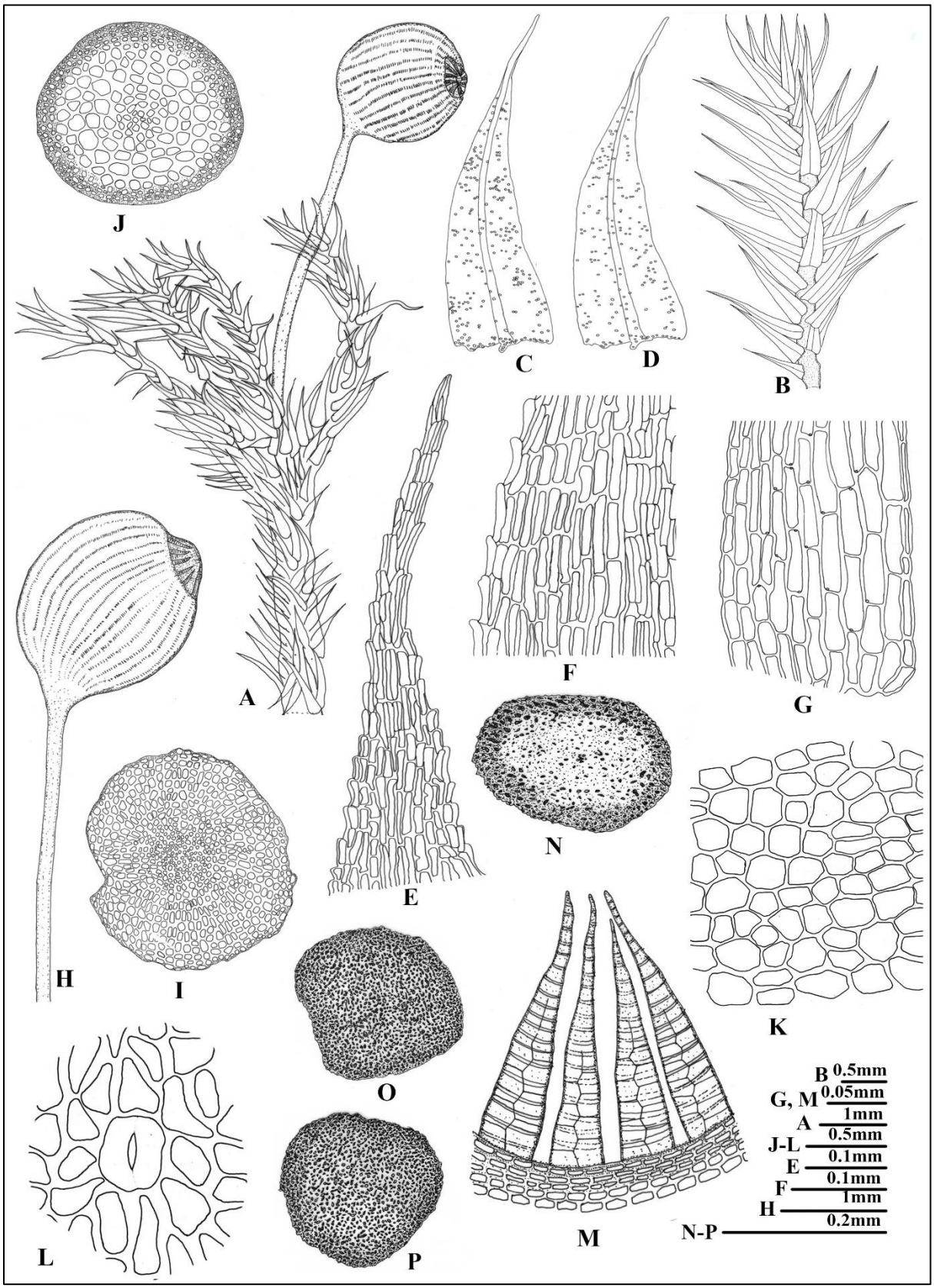

Figure 2: ***Philonotis thwaitesii*** **Mitt., A.** Habit, **B.** Stem, **C&D.** Leaves, **E.** Apical laminal cells, **F.** Median laminal cells, **G.** Basal laminal cells, **H.** Capsule, **I.** Operculum, **J.** Transverse section of seta, **K.** capsule wall, **L.** Stomata, **M.** Peristome teeth, **N.** Spore in proximal view, **O & P.** Spore in distal view [All photomicrographs from Sk. R. Islam 01013 (Vidyasagar University Herbarium)].

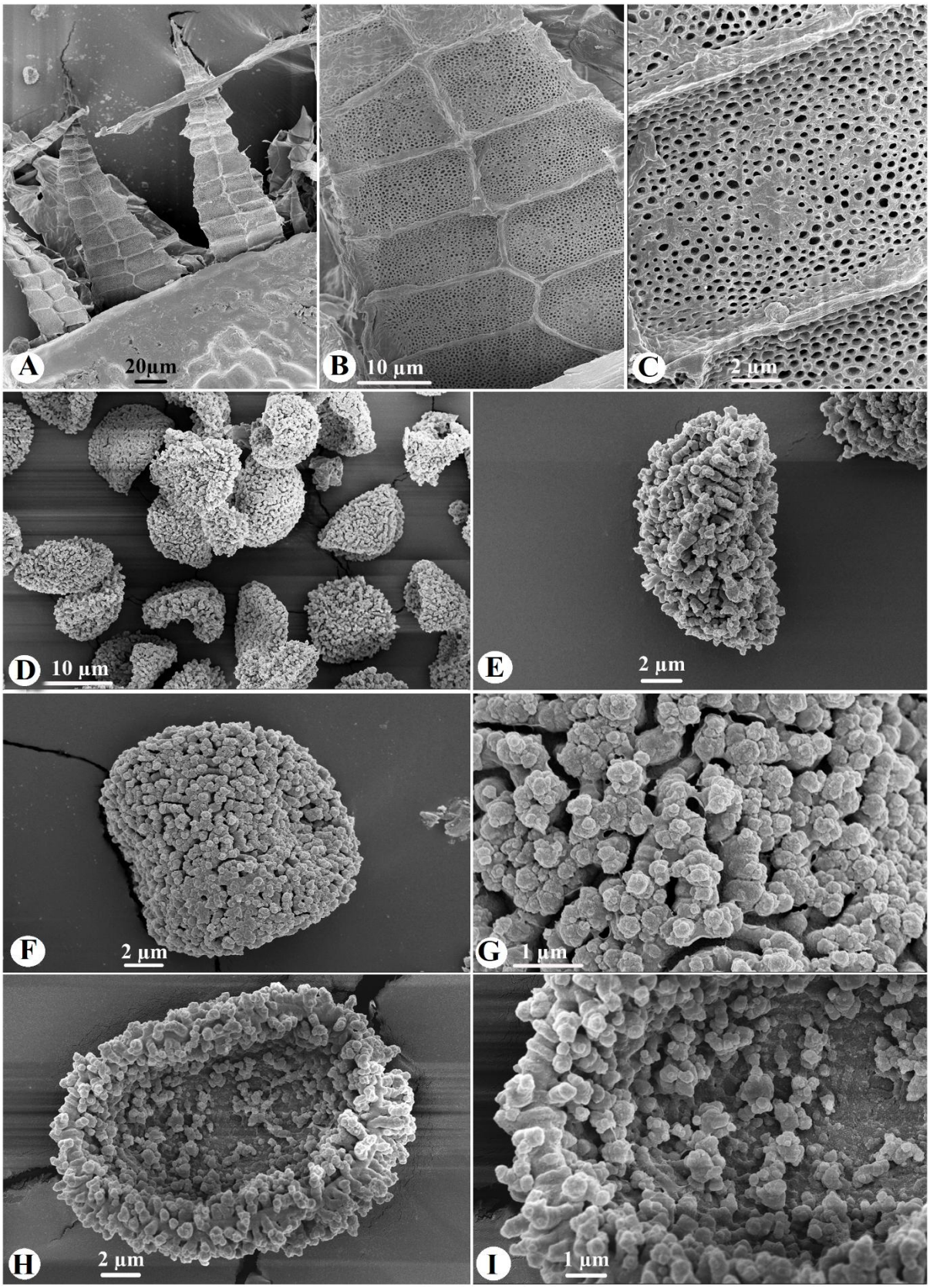

Figure 3: ***Philonotis thwaitesii*** **Mitt., A.** Peristome teeth, **B & C.** Magnified view of a portion of outer surface of exostome, **D.** Spores under SEM, **E.** Spore in lateral view, **F.** Spore in distal view, **G.** A portion of the same enlarged, **H.** Spore in proximal view, **I.** A portion of the the same enlarged [All photomicrographs from Sk. R. Islam 01013 (Vidyasagar University Herbarium)].

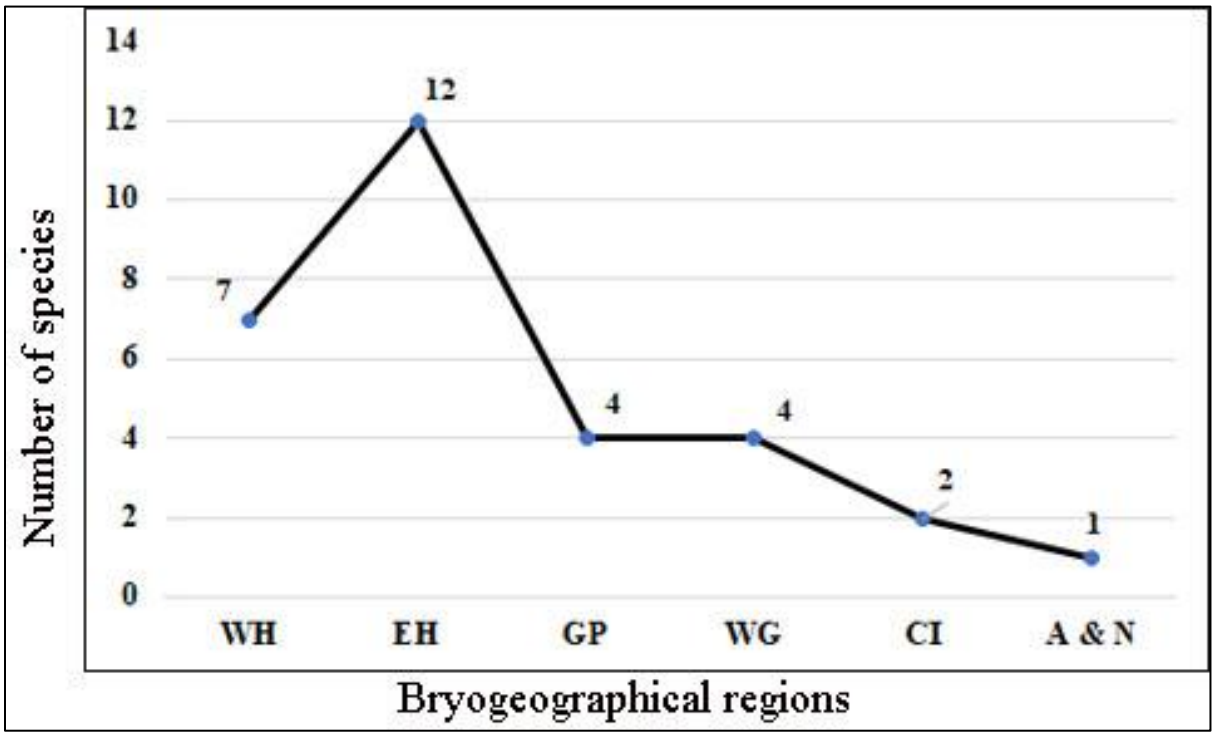

Figure 4: Distribution of genus *Philonotis* Brid. in different bryogeographical regions of India. WH = Western Himalaya; EH = Eastern Himalaya; GP = Gangetic Plains; WG = Western Ghats; CI = Central India; A & N = Andaman Nicobar Island

5. CONCLUSION

So far, very limited work has been carried out on the bryoflora of Jharkhand; therefore, the present record of *Philonotis thwaitesii* Mitt. from this region represents a significant extension of its known distribution range.

Acknowledgement

The authors are also thankful to Tamás Pócs, Bryonet group expert for confirming the genus identity and providing valuable literature. We are also thankful to IIT, Kharagpur for providing SEM facilities and department of USIC for providing microscopic facilities.

Author contributions

This manuscript has been read and approved by all the authors. Each of the authors believes that this manuscript represents honest work done by us.

Funding

This study was financially supported by the Government of West Bengal under grant number 118/11/BT(Estt)/1P4/2013.

Conflict of Interest

The authors declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

Informed consent

Not applicable.

Ethical approval & declaration

In this article, as per the plant regulations followed in the Vidyasagar University, Midnapore, West Bengal, India; the author observed the occurrence and distribution of *Philonotis thwaitesii* Mitt. (Bartramiaceae: Bryophyta) from Jharkhand. The ethical guidelines for plants & plant materials are followed in the study for species collection & identification.

Data and materials availability

All data associated with this study are present in the paper.

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