

Two Species of *Plagiochila* New to Western Himalaya, India

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ABSTRACT

Two species of the genus *Plagiochila* (Dumort.) Dumort. viz., *P. flexuosa* Mitt. and *P. sisparensis* Steph., discovered from district Pithoragarh, Kumaon Hills, Uttarakhand, Western Himalaya. In India, *P. flexuosa* Mitt. is earlier reported from South India and Eastern Himalaya while *P. sisparensis* Steph. is reported only from South India. Both the species are reported here from western Himalaya for the first time. The present report shows the extended distribution of the species from Eastern Himalaya and South India to Western Himalaya in India. Both the species have been described and illustrated herewith.

INTRODUCTION

Plagiochila (Dumort.) Dumort. is one among the largest leafy liverworts. About 1600 species of *Plagiochila* are listed in the 'Index Hepaticarum' from all over the world (Geissler and Bischler, 1989; So and Grolle, 2000; Singh and Singh, 2007). In Asia, 480 species were reported, out of which 132 species were recognized valid (So and Grolle, 2000). Singh et al. (2016) reported 82 taxa from India, out of which 60 taxa from Eastern Himalaya, 42 taxa from South India and 22 taxa from Western Himalaya (see also Parihar, 1961-62; Dixit, 1995; Rawat and Srivastava, 2007).

Plagiochila is a large genus that has been divided variously into subgenera and sections, time to time (Lindenberg, 1839-1844; Mitten, 1861; Schiffner, 1893-95; Stephani, 1901-1906, 1917-1924; Inoue 1965; So, 2001; Rawat and Srivastava, 2007).

Inoue (1965) provided a compiled account of Himalayan species of *Plagiochila* and listed 53 species from different localities of the Himalayan region, which were segregated in to 2 subgenera and 14 sections. All these Himalayan taxa were arranged in single subgenus *Plagiochila* and 14 sections: *Carringtoniae* Inoue, *Frondescentes* Spruce, *Peculiares* Schiffn., *Zonatae* Carl, *Cardotiae* Inoue, *Plagiochila* Carl, *Bidentes* Carl, *Yokogurenses* Inoue, *Capillares* Carl, *Poeltiae* Inoue, *Ciliatae* Schiffn., *Firmae* Carl, *Belangerianae* Carl, *Contiguae* Carl.

While describing *Plagiochila* in China, So (2001) recognized 14 sections of the subgenus *Plagiochila*: *Carringtoniae* Inoue, *Zonatae* Carl, *Dendroideae* Gott., Lindenb. et Nees, *Caducilobae* Inoue, *Subtropicae* Carl,

Cobanae Carl, *Tayloriae* Carl, *Ciliatae* Schiffn., *Poeltiae* Inoue, *Firmae* Carl, *Cardotiae* Inoue, *Contiguae* Carl, *Choachinae* Spruce, *Plagiochila* (Nees) Nees (see also Rawat and Srivastava, 2007).

Söderström et al. (2015) divided *Plagiochila* into 28 Sections on the basis of morphological and molecular studies i.e. *Adianthoideae* Lindenb., *Africanae* Heinrichs, *Arrectae* Carl, *Caducifoliae* J.J. Engel et G.L. Merr., *Cardotiae* Inoue, *Cobanae* Carl, *Cucullatae* Schiffn., *Denticulatae* Schiffn., *Durae* Carl, *Duseniae* Carl, *Flexicaules* Carl, *Fruticosae* Inoue, *Fuscoluteae* Carl, *Glaucescens* Carl, *Hylacoetes* Carl, *Jacquiniotiae* Hässel, *Kaalaasiae* Carl, *Longiflorae* Carl, *Oligodontes* Carl, *Peculiares* Schiffn., *Plagiochila* (Nees) Nees, *Poeltiae* Inoue, *Rutilantes* Carl, *Strombifoliae* Inoue et R.M. Schust., *Tayloriae* Carl, *Trabeculatae* S. Hatt. ex Inoue, *Vagae* Lindenb., *Zanteniae* (Inoue) Inoue (See also Söderström et al. 2016).

As far as west Himalayan flora is concerned, at present, there are 23 taxa of *Plagiochila* reported so far which belong to 9 sections (Söderström et al. 2015, Söderström et al., 2016; Singh et al., 2016; Ellis et al. 2018a, 2018b, See Table -1).

During the investigation of liverworts collected from Pithoragarh, Kumaon Hills, Uttarakhand, two species of *Plagiochila* have been discovered which have been identified as *P. flexuosa* Mitt. and *P. sisparensis* Steph. In India, *P. flexuosa* Mitt. is earlier known from South India and Eastern Himalaya, while *P. sisparensis* Steph. is earlier known from South India only (Dixit, 1995; Rawat and Srivastava, 2007; Verma et al., 2015). Both the species are the addition to the west Himalayan bryophytic flora.

Table 1: Current Status of the genus *Plagiochila* (Dumort.) Dumort. and its sections in Western Himalaya (Söderström et al. 2016)

S.N.	Name of the Species	Name of the Section	Distribution in India
1.	<i>Plagiochila sciophila</i> Nees ex Lindenb.	<i>Cucullatae</i> Schiffn.	EH, WH, SI
2.	<i>Plagiochila fruticosa</i> Mitt.	<i>Fruticosa</i> Inoue	EH, WH, SI
3.	<i>Plagiochila devexa</i> Steph.	<i>Peculiares</i> Schiffn.	EH, WH, SI
4.	<i>Plagiochila dorellii</i> Schiffn.	<i>Peculiares</i> Schiffn.	EH, WH, SI
5.	<i>Plagiochila pseudopoeltii</i> Inoue.	<i>Peculiares</i> Schiffn.	EH, WH
6.	<i>Plagiochila semidecurrens</i> (Lehm. & Lindenb.) Lehm. & Lindenb.	<i>Peculiares</i> Schiffn.	EH, WH, SI
7.	<i>Plagiochila asplenoides</i> (L.) Dumort	<i>Plagiochila</i> (Nees) Nees	WH
8.	<i>Plagiochila chinensis</i> Steph.	<i>Plagiochila</i> (Nees) Nees	EH, WH, SI
9.	<i>Plagiochila elegans</i> Mitt	<i>Plagiochila</i> (Nees) Nees	EH, WH, SI
10.	<i>Plagiochila korthalsiana</i> Molk.	<i>Plagiochila</i> (Nees) Nees	WH, SI
11.	<i>Plagiochila mundaliensis</i> Steph.	<i>Plagiochila</i> (Nees) Nees	EH, WH
12.	<i>Plagiochila ovalifolia</i> Mitt.	<i>Plagiochila</i> (Nees) Nees	EH, WH, SI
13.	<i>Plagiochila uniformis</i> Mitt.	<i>Plagiochila</i> (Nees) Nees	EH, WH
14.	<i>Plagiochila duthiana</i> Steph.	<i>Poeltiae</i> Inoue	EH, WH, SI
15.	<i>Plagiochila retusa</i> Mitt.	<i>Poeltiae</i> Inoue	EH, WH
16.	<i>Plagiochila defolians</i> Grolle & So	<i>Rutilantes</i> Carl	EH, WH
17.	<i>Plagiochila ghatiensis</i> Steph.	<i>Rutilantes</i> Carl	WH, SI
18.	<i>Plagiochila gracilis</i> Lindenb. & Gott.	<i>Tayloriae</i> Carl	EH, WH, SI
19.	*<i>Plagiochila. flexuosa</i> Mitt.	<i>Trabeculatae</i> S. Hatt. ex Inoue	EH, WH, SI
20.	<i>Plagiochila fordiana</i> Steph.	<i>Vagae</i> Lindenb.	EH, WH
21.	<i>Plagiochila parvifolia</i> Lindenb.	<i>Vagae</i> Lindenb.	EH, WH, SI
22.	<i>Plagiochila khasiana</i> Mitt.	<i>Vagae</i> Lindenb.	EH, WH, SI
23.	<i>Plagiochila nepalensis</i> Lindenb.	<i>Vagae</i> Lindenb.	EH, WH, SI
24.	<i>Plagiochila salacensis</i> Gott.	<i>Vagae</i> Lindenb.	WH
25.	*<i>Plagiochila. sisparensis</i> Steph.	<i>'Incertae sedis'</i>	SI, WH

* New Report, WH= Western Himalaya, EH= Eastern Himalaya, SI= South India

TAXONOMIC DESCRIPTION

1. *Plagiochila flexuosa* Mitt., J. Proc. Linn. Soc., Bot. 5: 94. 1861 (Fig.: 1:1-19. & Fig. 2:1-11)

Plants medium-large, 40–120 mm long, 4–5.7 mm wide with leaves, dark brown, creeping rhizome not seen; branching very rare, lateral intercalary. Stem 308–364 µm in diameter and 18–20 cells across; cortical cells 3–4 layered, thick-walled, 16–24×12–16 µm; medullary cells thin-walled, 24–33×20–24 µm. Leaves distant-loosely imbricate, oblong-ovate, 1.84–2.31×0.84–0.99 mm, broadest at base; dorsal base moderately decurrent, ventral base short decurrent, arched, not ampliate, ventral margin entire, dorsal margin entire; apex rounded, teeth 6–9, confined to apex, teeth 4–7 cells long, uniseriate at apex,

mostly with 1–4 cells, 2–4 cells wide at base; apical cells of leaf 24–33×24–29 µm, median cells of leaf 33–45×29–33 µm, basal cells of leaf 41–57×29–37 µm; trigones nodulose; paraphyllia not seen, underleaves vestigial.

Plants dioicous (known), male plants not seen, gynoecia terminal, with 1–2 innovations. Female bracts one pair; apical cells of female bract 33–45×29–37 µm, median cells of female bract 49–57×37–45 µm, basal cells of female bract 45–61×25–33 µm. Perianth long campanulate, mouth ciliate-dentate, apical cells of perianth 33–45×29–37 µm, median cells of perianth 33–49×29–33 µm, basal cells of perianth 57–74×24–33 µm. Sporophyte not seen.

Habitat: Terrestrial, in association with mosses.

Type Locality: India: Sikkim (Grolle and So, 1999).

Range: Bhutan, China, India, Japan, Nepal, Sri Lanka,

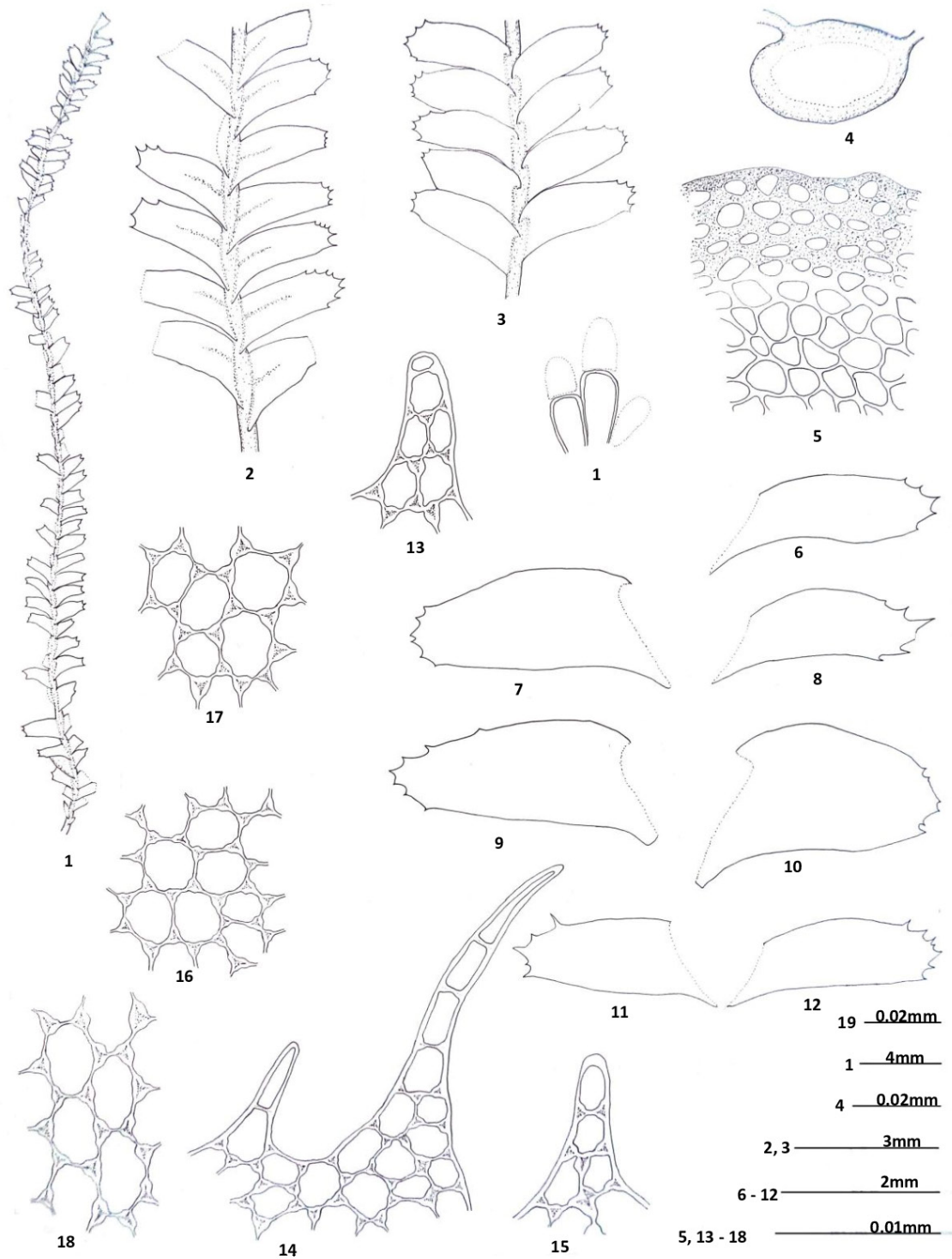


Figure 1: *Plagiochila flexuosa* Mitt. 1. Habit of plant. 2. A portion of plant (dorsal view). 3. A portion of plant (ventral view). 4. Cross-section of stem (diagrammatic). 5. Cross-section of stem (a portion – cellular). 6–12. Leaves. 13–15. Dentitions. 16. Apical cells of leaf. 17. Median cells of leaf. 18. Basal cells of leaf. 19. Underleaf. All figures drawn from 9790/88 (LWU).

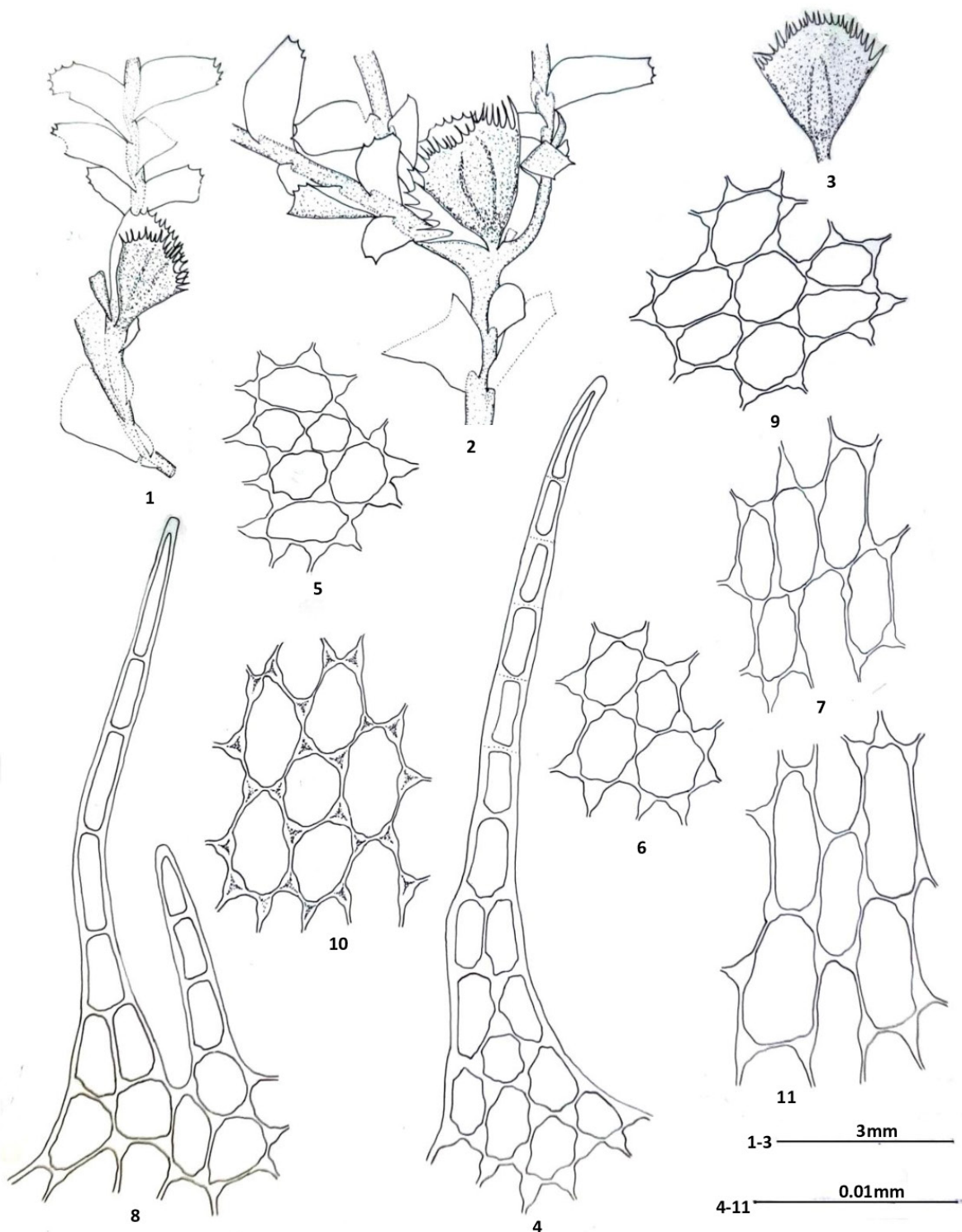


Figure 2: *Plagiochila flexuosa* Mitt. 1, 2. Portions of plant with perianth. 3. Perianth. 4. Dentition of bract. 5. Apical cells of bract. 6. Median cells of bract. 7. Basal cells of bract. 8. Dentition of perianth. 9. Apical cells of perianth. 10. Median cells of perianth. 11. Basal cells of perianth. All figures drawn from 9790/88 (LWU).

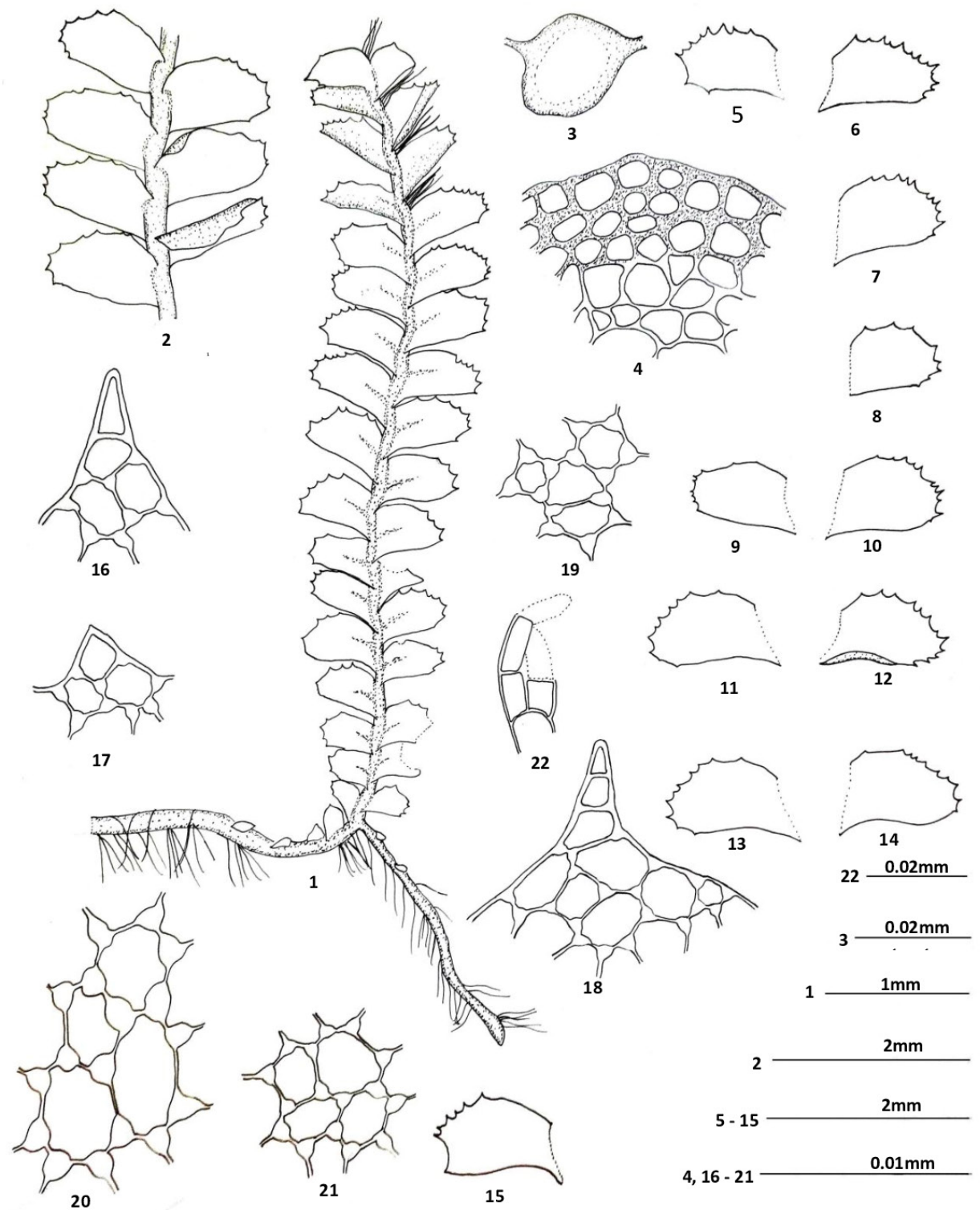


Figure 3: *Plagiochila sisparensis* Steph. 1. A plant (Dorsal view). 2. A portion of plant (ventral view). 3. Cross-section of stem (Diagrammatic). 4. Cross-section of the stem (a portion – cellular). 5–15. Leaves. 16–18. Dentitions. 19. Apical cells of leaf. 20. Median cells of leaf. 21. Basal cells of leaf. 22. Underleaf. All figures drawn from 20232/07 (LWU).

Thailand, Taiwan, Vietnam (Grolle and So, 1999; Rawat and Srivastava, 2007; Singh et al., 2016).

Distribution in India: Eastern Himalaya: Meghalaya - Shillong, Elephant falls, Mawphlong, Shillong peak; Sikkim- Yuksom; West Bengal- Tonglu, Kurseong-Mahaldram forest, Tiger hill, Llyod Botanical Garden, Senchal lake, Takdah, Ghoom-Senchal, Senchal- Tiger hill. South India: Karnataka- Kudremukh; Kerala- Vagavurrai; Tamil Nadu- Nilgiris 'Nilgherries'. Western Himalaya: Uttarakhand - Pithoragarh, Lilam to Bogdiyar. (Rawat and Srivastava, 2007; Singh et al., 2016; Verma et al., 2013).

Specimen Examined: Western Himalaya: Uttarakhand, Kumaon hills, Pithoragarh, Lilam to Bogdiyar, alt. ca. 1850–2450 m, 18.06.88, D. Sharma, 9790/88 (LWU).

2. *Plagiochila sisparensis* Steph., Sp. Hep. 6:207.

1921. (Figs. 3: 1–22.)

Plants small, 10–15 mm long, 3–3.5 mm wide with leaves, dark brown, creeping rhizome present; rhizoids present on ventral side of stem near apex and on rhizome; branching very rare, *Frullania*-type. Stem up to 210 µm in diameter and 11–12 cells across; cortical cells 2–3 layered, thick-walled 12–16×16–20 µm; medullary cells thin-walled, 16–20×29–33 µm, leaves distant-loosely imbricate, oblong-ovate, 1.12–1.44×0.76–0.96 mm; dorsal base moderately decurrent, ventral base short decurrent, arched, ventral margin dentate, dorsal margin entire, apex rounded, teeth 9–15, mostly at apex and on ventral margin, 1–4 cells long, 1–3 cells uniseriate, 2–3 cells wide at base; apical cells of leaf 20–29×20–33 µm, median cells of leaf 29–33×24–33 µm, basal cells of leaf 29–37×29–46 µm; trigones nodulose; paraphyllia not seen, underleaves vestigial. Plants vegetative.

Habitat: Terrestrial, association with *Jungermannia* sp. and Mosses.

Type Locality: India: Nilgherry Montes (Grolle and So, 1999).

Range: India and Sri Lanka (Stephani, 1921; Grolle and So, 1999; Inoue, 1979; Verma et al., 2015; Singh et al., 2016).

Distribution in India: South India: Tamil Nadu- Nilgiri hills 'Nilgherry montes', Sispara, Upper Bhavani, Avalanche. Western Himalaya: Uttarakhand- Pithoragarh, Mukteshwar. (Verma et al., 2015; Singh et al., 2016).

Specimen Examined: Western Himalaya: Uttarakhand, Kumaon hills, Pithoragarh, Mukteshwar, 5 km from IVRI alt. ca. 2298 m, 17.11.07, Murti and Mridula, 20232/07 (LWU).

DISCUSSION

Plagiochila flexuosa and *P. sisparensis* were earlier placed in the section *Tayloriae* (Inoue, 1965; 1984 Grolle

and So, 1999; Rawat and Srivastava, 2007; So, 2001). Söderström et al. (2015) provided infrageneric subdivision of *Plagiochila* based on morphological and molecular studies. They divided the genus into 28 sections (see also Söderström et al., 2016) and listed *P. flexuosa* in the section *Trabeculatae* S. Hatt. ex Inoue while placed *P. sisparensis* under "Incertae sedis".

The plants of *Plagiochila flexuosa* (Figures. 1 & 2) are medium-large, 40–120 mm long, 4–5.7 mm wide, with rare, lateral intercalary branching. The leaves are distant to loosely imbricate, oblong-ovate, broadest at the base, with a rounded apex and 6–9 dentitions at apex (Figure 1: 6–12). Trigones are large, nodulose and underleaves are vestigial (Figure 1: 16–19). While the plants of *P. sisparensis* (Figure 3) are small, 10–15 mm long, 3–3.5 mm wide, with *Frullania*-type branching. The leaves are distant to loosely imbricate and oblong-ovate, with 9–15 dentitions present at apex and ventral margin (Figure 3: 5–15). Trigones are nodulose and underleaves are vestigial (Figure 3: 19–22).

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