

Research Article

**MORPHO-TAXONOMIC STUDIES ON GENUS SCAPANIA (DUMORT.)
DUMORT. : HEPATICAE IN NAGALAND, INDIA**

***Kazhuhrii Eshuo, SK Chaturvedi and Vaphuno Sale**

Department of Botany, Nagaland University, Hqs: Lumami, Nagaland-India.

**Author for Correspondence*

ABSTRACT

Four species of genus *Scapania* (Dumort.) Dumort. viz., *S. ligulata* Steph., *S. ferruginea* (Lehm. et Lindenb.) Gott., *S. griffithii* Schiffn. and *S. parva* Steph. have been described for the first time from the state of Nagaland, India. Sporophyte of the species *S. parva* Steph. has been described for the first time from the present investigated locality. Detailed illustrations and artificial key has been provided for easy identification.

Key Words: *Scapania, Morpho-Taxonomic, Hepaticae, Nagaland*

INTRODUCTION

The genus *Scapania* (Dumort.) Dumort. is a large genus of Hepaticae and mostly distributed in the Northern Hemisphere of the globe. In India, it is mostly distributed in the Himalayan region with 21 species (Kashyap, 1932; Chopra, 1938; Herzog, 1939; Amakawa, 1964; Hattori, 1966, 1971, 1975; Kachroo, 1969 and Long, 1979). Srivastava and Srivastava, (1994) reported two species of *Scapania* viz., *S. griffithii* Schiffn. and *S. angusta* Mitt. ex K. Müll. with sporophytes from Darjeeling, Eastern Himalayas. (Potemkin, 1998, 1999) has contributed on the genus *Scapania*. Singh and Nath, (2007) reported six species of *Scapania* viz., *S. okamurana* Steph. ex Amak., *S. stephanii* K. Müll., *S. verrucosa* Heeg., *S. parva* Steph., *S. angusta* Mitt. ex K. Müll. and *S. griffithii* Schiffn. from Meghalaya, India. Singh and Singh, (2009) have reported the occurrence of *Scapania* from Great Himalayan Park, Kullu Himachal Pradesh and described three species viz., *S. glaucocephala* (Taylor) Austin, *S. parva* Steph. and *S. ferruginea* (Lehm. et Lindenb.) Gott., Lindenb. et Nees. Potemkin, (2001) studied on India and China species of *Scapania* and reported three new species viz., *S. davidii* Potemkin, *S. sinikkae* Potemkin and *S. schljakovii* Potemkin. So far, there is not previous record of the occurrence of the genus *Scapania* from the state of Nagaland, North East India. Therefore, the present investigation deals with the occurrence of the genus *Scapania* and this is the first report of occurrence of genus *Scapania* from the state of Nagaland.

MATERIALS AND METHODS

The fresh specimens of genus *Scapania* were collected from their natural localities from Kohima and Mokokchung districts, Nagaland (Map 1). The morphological characters were studied under Leica digital Stereo-zoom (S6D). The anatomical studies of stem, leaf cells were studied under Leica digital Microscope (DM1000). The hand sections of stems and leaves were mounted in 30% aqueous solution of glycerin and observed under the Leica digital Microscope (DM1000). The photomicrographs and photomacrographs were taken under Leica digital Microscope (DM1000) and Leica stereo-zoom (S6D) respectively. The field photographs were taken with the help of Canon (SX120) digital Camera. The preserved specimens were deposited in the Department of Botany, Nagaland University.

Taxonomic Observations

Key to species of Scapania.

1. Plant large, 60-95 mm long, 3.5-7 mm wide, keel very short, cortical cells 3-4 thick layer, margin ciliate dentate throughout, 1-3 cells long..... *S. ferruginea*

Research Article

1a. Plant small, 10-30 mm long, 1-3 mm wide, keel moderate, leaf margin minute dentate or entire.....2

2. Leaves marginal teeth unicellular, cuticle papillose, ventral lobe ovate, apices acute or sub-acute with a point, base decurrent..... *S. parva*

2a. Leaf marginal teeth 1-3 cells long, cuticle verrucose or smooth, trigones large or minute, gemmae present..... 3

3. Plant 1.5-2 mm wide, leaves irregularly dentate towards apex, trigones minute or indistinct, leaf lobe cells quadrate..... *S. griffithii*

3a. Plants 2-3 mm wide, dorsal lobe large, cuticle verrucose, oil bodies 2-3 per leaf, gemmae bicelled..... *S. Ligulata*

Plant erect, prostrate, medium, 10-25 mm long, 2-3 mm wide including leaves, light to pale green, brownish green, branching rare, intercalary, terminal. Rhizoids hyaline, transparent, present at the basal part of the stem. Stem reddish to brownish red, circular, 0.6 x 0.8 mm in diameter, 14-16 cells across, 2-3 (4) thick cortical cells; cortical cells 6.1-14.6 µm long, 5-7.8 µm wide; medullary cells thin walled, larger, hexagonal, quadrate, 14.8-21.3 µm long, 7-17.2 µm wide. Leaves alternate to sub-opposite at apex, distant to slightly imbricate at apex, ovate, bilobed, lobes unequal, keel ½ the length of the ventral lobe, serrate; dorsal lobed 0.9-1.4 mm long, 0.6-0.8 mm wide, ovate, oblong, apex short acuminate, serrate, arching slightly beyond the farther edge of the stem; ventral lobe ovate, oblong, ligulate, 2-3 mm long, 2-2.3 mm wide, apex short acuminate, margin dentate, basal part entire, teeth usually 1-3 cells long, 1-2 cells broad at base; cells thin walled, trigones minute, tri-radiate; apical cells thin walled, quadrate, rectangular, 10-16.5 µm long, 7-13.2 µm wide; middle cells thin walled, quadrate to sub-quadrate, rectangular, 10-18.4 µm long, 8-15.1 µm wide; basal cells rectangulate, quadrate, polygonal, thin walled, 13.6-32.4 µm long, 8.4-16.1 µm wide. Oil bodies 2-4 per cells, circular, round, elliptical, 3.3 x 6.5 µm in diameter. Gemmae borne at the apex of the main stem, gemma oval like, 1-2 cells, 13.2-22.0 µm long, 8-10.0 µm wide. Androecia and gynoecia not seen.

Ecology

The plants grows in association with liverworts like *Jungermannia* sp, *Calypogeia* sp. and Mosses at 7000-8000 feet a.s.l. Khuzama, KE 10176, 16.11.2009.

Range Of Distribution India (Endemic).

Scapania ferruginea (Lehm. et Lindenb.) Gott., Lindenb. et Nees. Syn. Hepat. 72. 1844.

Plant large, light yellowish green, deep green, 70-95 mm long, 3.5-7 mm wide including leaves, overlapping, saxicolous, branched, branching intercalary, terminal. Rhizoids hyaline, numerous on the ventral surface. Stem oval, 0.45 x 0.7 mm in diameter, cells differentiated into thick cortical cells and thin medullary cells; cortical cells 3-4 layers, 12.3-25.8 µm long, 8.5-13.4 µm wide; medullary cells 19.8-28.6 µm long, 11.6-25.2 µm wide. Leaves closely imbricate, dorsal lobes are cordate to reniform, broadly crossing the farther edge of the stem, long decurrent below the level of the base of the keel, ciliate-dentate throughout the margin, keel short and circularly curved. Ventral lobes are widely spreading, convex, ovate, oblong, densely ciliate-dentate throughout the entire margin of the leaves, ciliate-dentate cells 1-5 cells long, 1-2 cells broad at base; apical cells hexagonal to quadrate, rectangular, slightly trigonous, trigones minute, 16.5-27.5 µm long, 11.2-19.8 µm wide; middle cells rectangulate to sub-quadrate, hexagonal, thin walled, tri-radiate trigones, 20-42.4 µm long, 16.5-27.5 µm wide; basal cells rectangulate, sub-quadrate, tri-radiate trigones, 21.2-54.6 µm long, 15.3-31.2 µm wide. Oil bodies 3-6 per cell, circular, spherical, 6.3 x 13.7 µm in diameter, finely segmented.

Ecology

The plants grows in association with liverworts like *Plagiochila* sp, *Lejeunea* sp. *Trocholejeunea* sp and Mosses at 6500-7000 feet a.s.l. Khuzama, KE 10157, 16.11.2009.

Range Of Distribution : India, Formosa, Java

Scapania griffithii Schiffn. Oest. Bot. Zeit. 4: 204. 1899.

Research Article

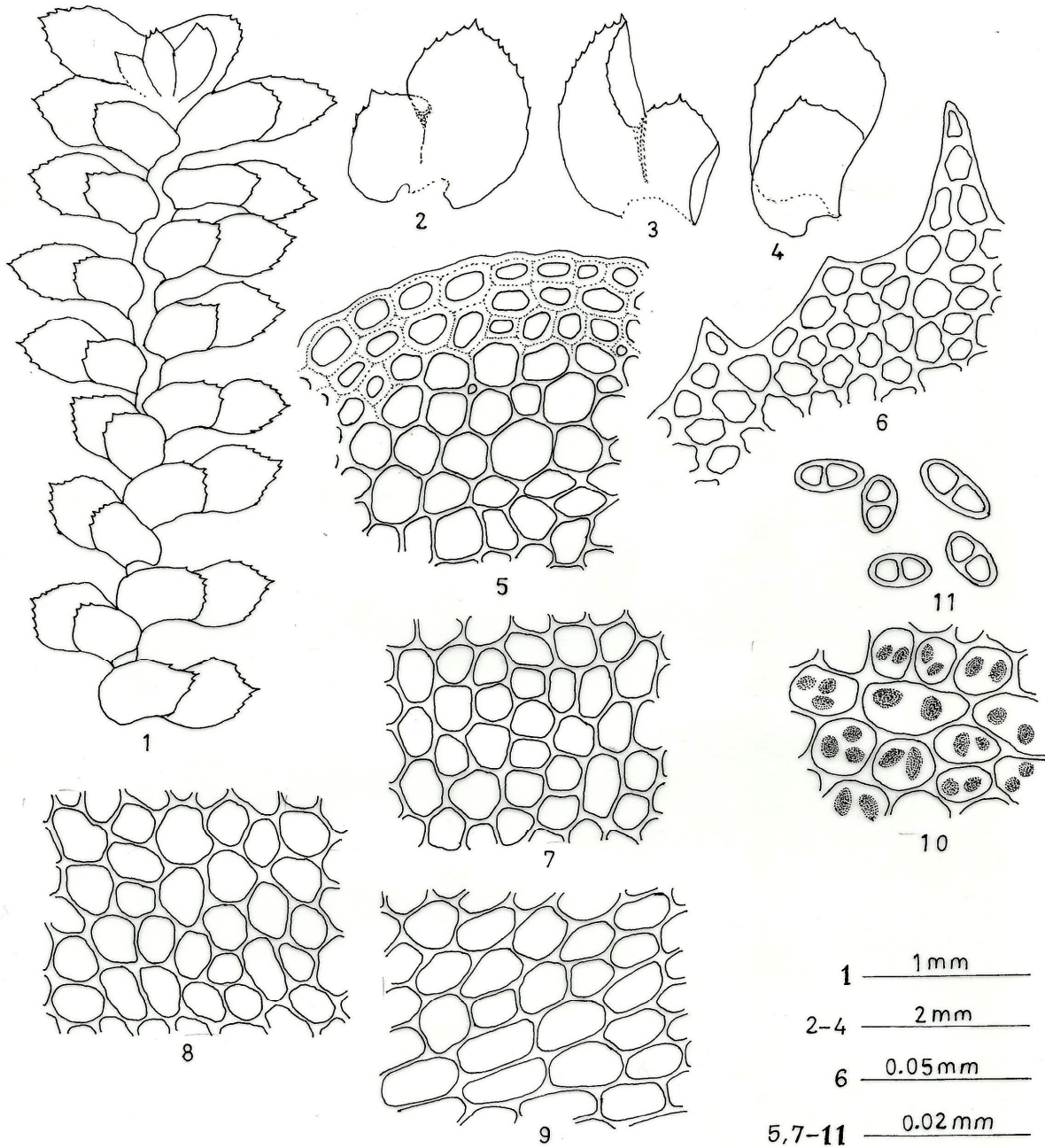


Figure A: Scapania ligulata Steph., Figures 1-11.

Figure 1: A portion of plant body in dorsal view; 2-4. Leaves; 5. Cross section of stem; 6. Leaf apical cells; 7-8. Leaf median cells; 9. Leaf basal cells; 10. Leaf oil bodies; 11. Gemmae.

Scapania ligulata Steph. *Hedwigia* 44: 14. 1904.

Research Article

Plant small to medium, 10-15 mm long, 1.5-2 mm wide including leaves, branching intercalary or rarely branched. Rhizoids hyaline and confined at the basal part of the stem. Stem dark brown, oval to spherical, 0.1 x 0.15 mm in diameter, 8-9 cells across, cells differentiated into thick cortical cells and thin medullary cells; cortical cells 2-3 layer, 8-16.3 μm long, 6-10.3 μm wide; medullary cells 14.5-22.0 μm long, 9.1-14.8 μm wide, polygonal, quadrate. Leaves distant to contiguous, slightly imbricate, ovate, acute, denticulate, bilobed, lobes divide into two unequal lobed, keel $\frac{1}{2}$ the length of the ventral lobe, rhomboid, dorsal lobe transversely inserted on the stem, 0.48-0.55 mm long, 0.35-0.42 mm wide; apex acute or acuminate to pointed, margin denticulate, dentition extend even upto the base of the ventral lobe; ventral lobe obovate, oblong, 0.9-1 mm long, 0.5-0.6 mm wide, apex acute, pointed, teeth one cell or sometime more than one cells; apical cells triangulate, sub-quadrate, thin walled, trigones minute, 10.2-15.2 μm long, 6.9-11.0 μm wide; middle cells rectangulate, quadrate, polygonal, thin walled, tri-radiate trigones, trigone minute or indistinct, 12.2-25.8 μm long, 6.9-13.4 μm wide; marginal cells quadrate, rectangulate, thin walled, 8.9-18.9 μm long, 8.2-11.3 μm wide; basal cells larger, rectangulate, polygonal, quadrate, thin walled, reddish, 22-35.2 μm long, 9-16.2 μm wide. Gemmae present at shoot apex, bi-celled.

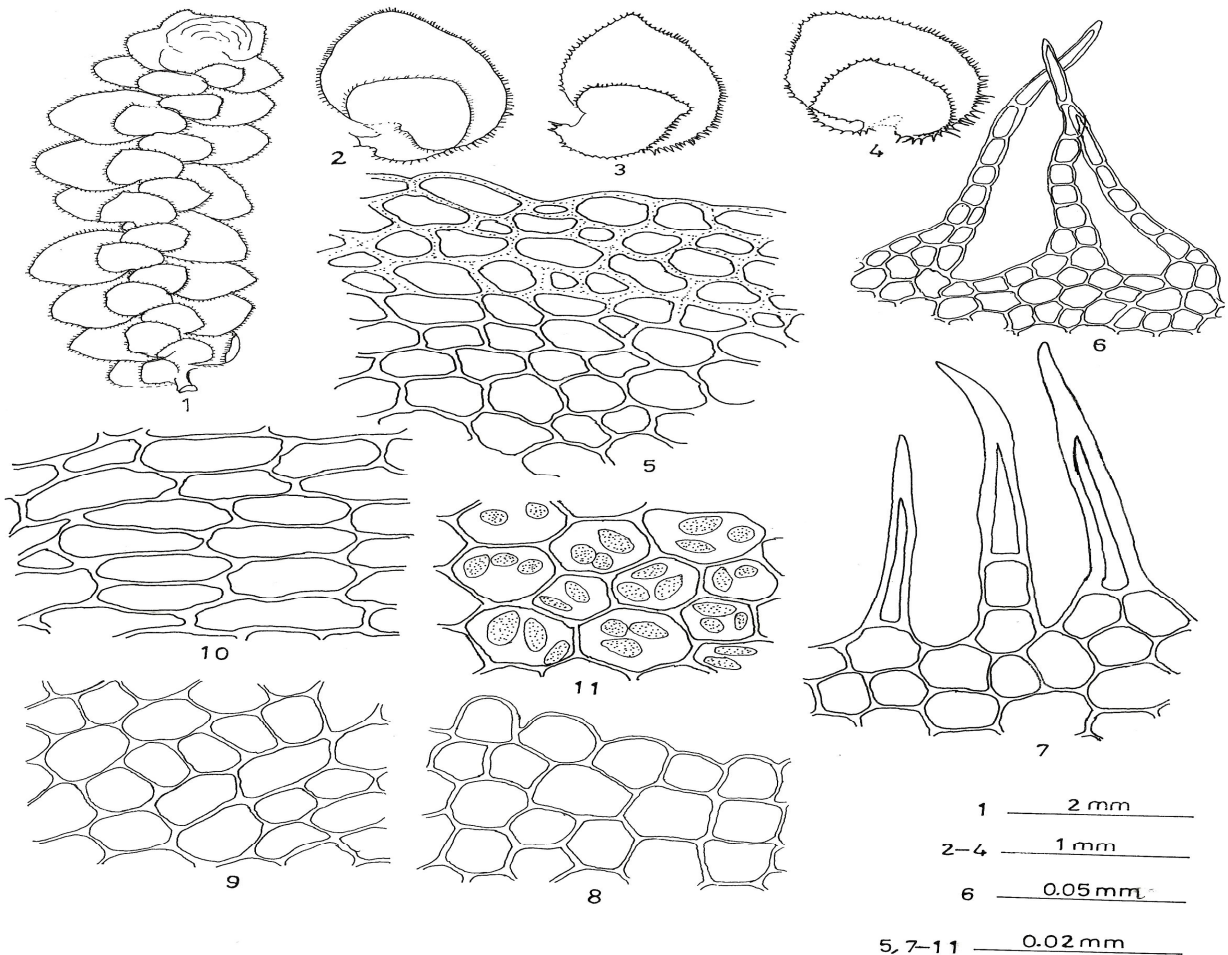


Figure B: Scapania ferruginea (Lehm. et Lindenb.) Gott., Lindenb. et Nees, Figures 1-11.

Figure 1. A portion of plant in dorsal view; 2-4. Leaves; 5. Cross section of the stem; 6. Leaf apical cells; 8. Leaf marginal cells; 9. Leaf median cells; 10 Leaf basal cells; 11. Leaf oil bodies

1

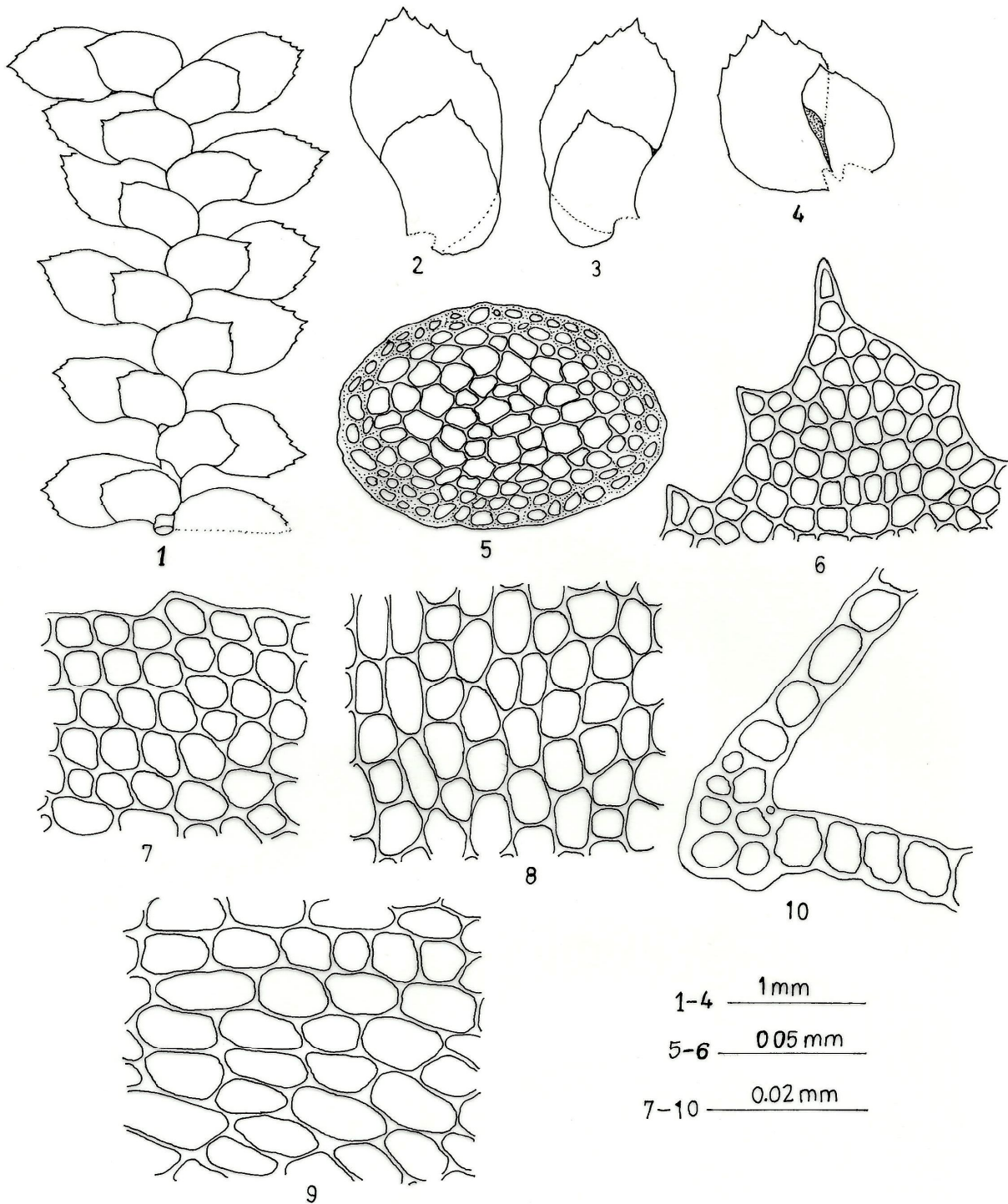


Figure C: Scapania griffithii Schiffn., Figures 1-10. Figure 1. A portion of plant in dorsal view; 2-4. Leaves; 5. Cross section of the stem; 6. Leaf apical cells; 7. Leaf marginal cells; 8. Leaf median cells; 9. Leaf basal cells; 10. Cross section of leaf keel

Research Article

Ecology: The plants grows in association with liverworts like *Jungermannia* sp, *Calypogeia* sp. *Metzgeria* sp and Mosses at 7000-8000 feet a.s.l. Khuzama, KE 10174, 16.11.2009.

Range Of Distribution: India (Endemic).

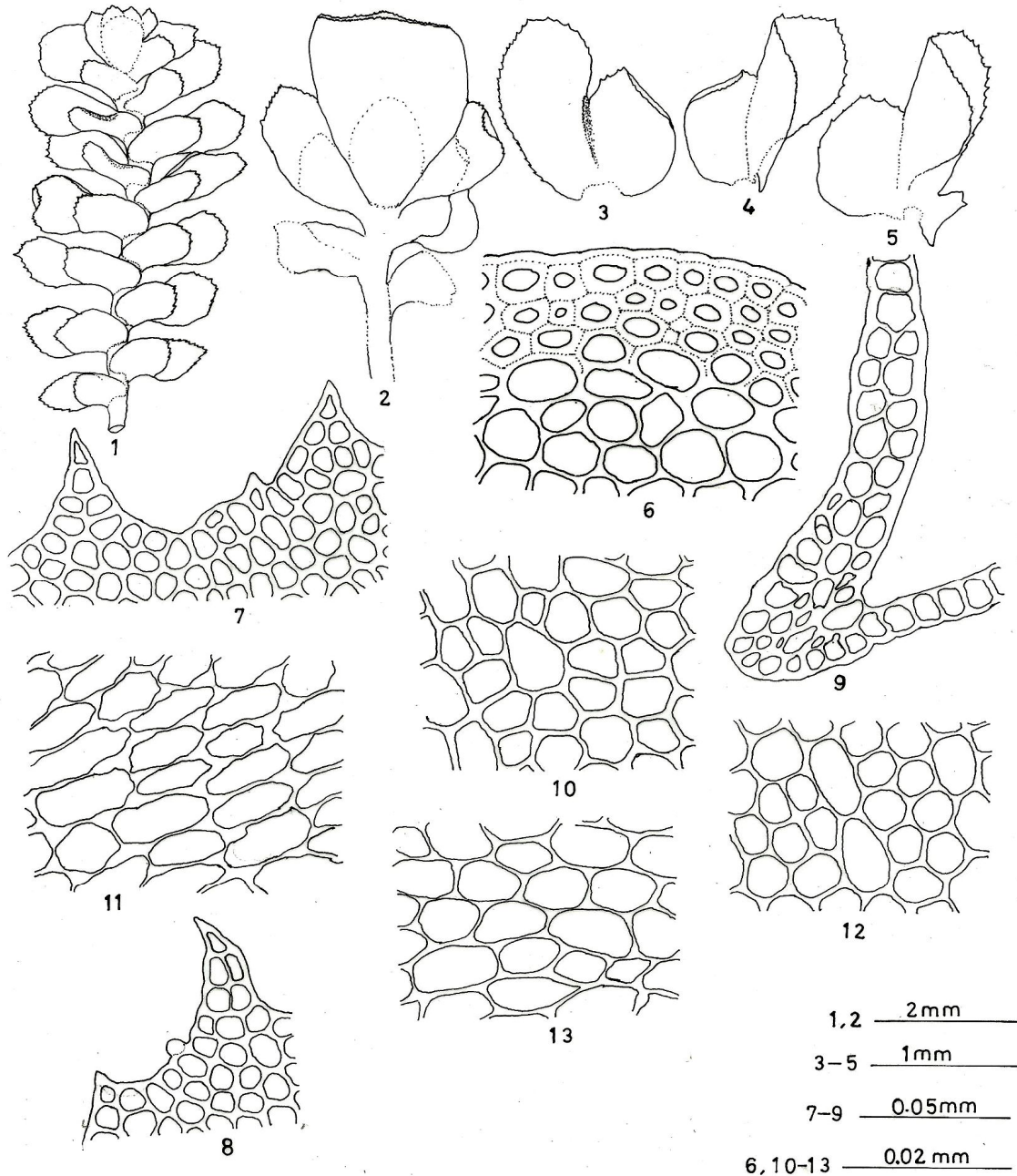


Figure D: *Scapania parva* Steph., Figures 1-13. Fig. 1. A portion of plant in dorsal view; 2. Female plant showing perianth; 3-5. Leaves; 6. Cross section of the stem; 7-8. Leaf apical cells; 9. Cross section of leaf keel; 10 & 12. Leaf median cells; 13. Leaf basal cells; 11. Female bract basal cells

Research Article

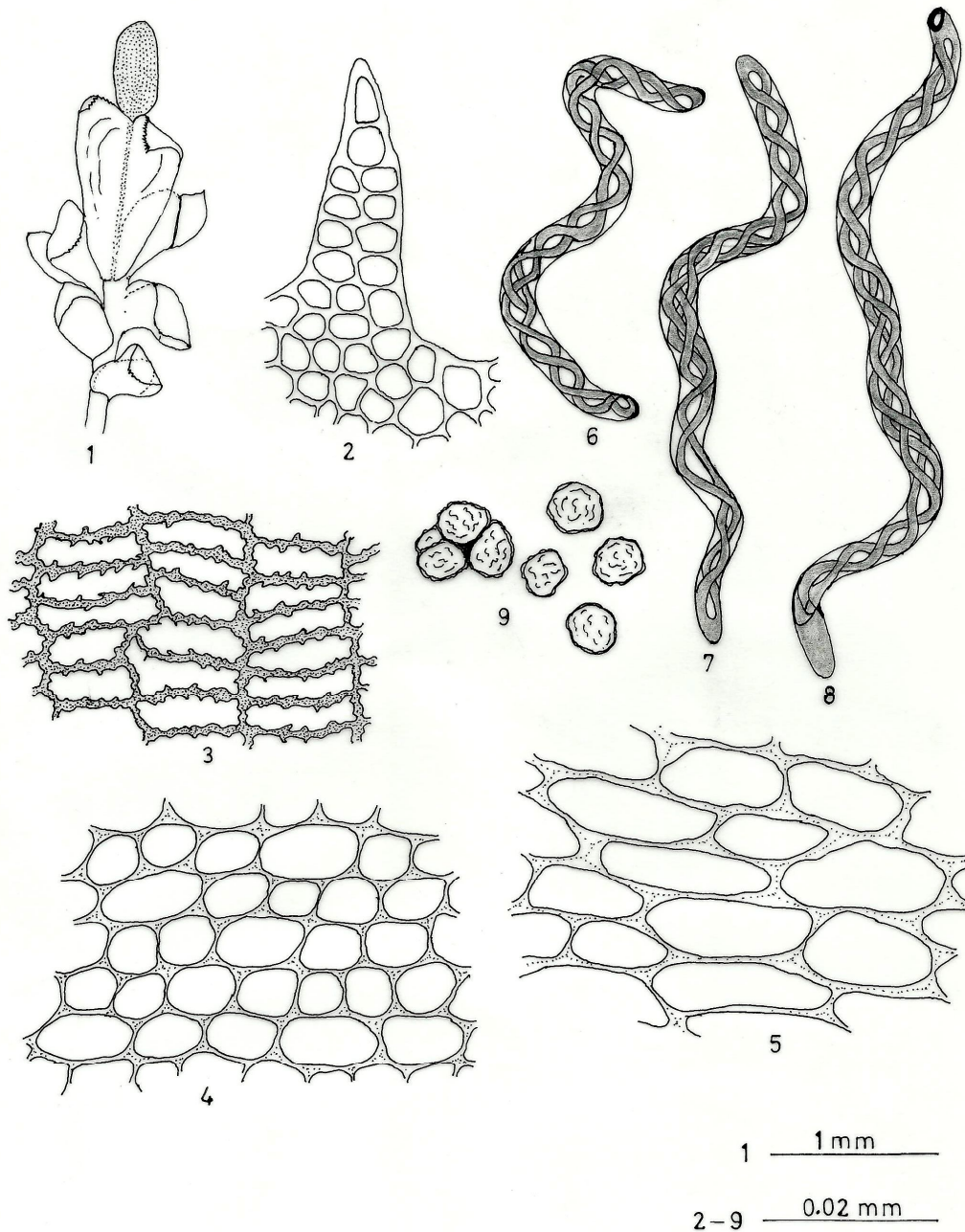


Figure E : scapania parva steph., figures 1-9.

Figure 1. A plant showing mature sporophyte; 2. Perianth tooth cells; 4. Perianth median cells; 5. Perianth basal cells; 3. Thickenings on the inner walled of capsule; 6-8. Elaters. 9. Spores
Scapania parva Steph., in Mem. Soc. Sci. Nat. Cherbourg 29: 226. 1894 & Sp. Hepat. 4: 142. 1910.

Plants medium, erect, reddish brown to greenish brown, 10-30 mm long, 2.5-3.5 mm wide including leaves, rarely branched, intercalary; rhizoids confined at the basal part of the stem. Stem oval, brownish dark red, circular, 3-4 thick cortical cells, 5.7-15.4 μm long 4.9-13.2 μm wide; medullary cells thin

Research Article

walled, 16.2-24.3 μm long, 7.7-17.6 μm wide. Leaves distant to contiguous or sometime imbricate at apex part, ovate, oblong, apex acute, 1/2-2/3th bilobed, bilobed into unequal lobed; dorsal lobed obliquely inserted, ovate, oblong, apex acute, denticulate, 1.1-1.3 mm long, 0.7-0.9 mm wide; ventral lobed oblong, ovate, 1.5-1.8 mm long, 1-1.3 mm long, margin dentate throughout, teeth 1-3 cells long; keeled 1/3-1/2 the length of the ventral lobe, keel 3-4 cells long and 2-3 cells wide; apical cells 8-15.6 μm long, 6.10.5 μm wide, quadrate to sub-quadrate, trigones tri-radiate, cells thin walled, median cells 10-22 μm long, 8-15 μm wide, cells rectangular to quadrate, trigones concave one sided, basal cells 18.9-40 μm long, 10-22 μm wide, cells quadrate, trigones tri-radiate, concave one sided. Cuticle slightly or minutely verrucous. Androecia not seen. Perianth terminal, oblong, 4 mm long, 2.6 mm wide, dorso-ventrally compressed, truncate, denticulate at the mouth, decurved, bracts similar to the adjacent cauline leaves; apical cells 10-15 μm long, 8-12 μm wide, median cells 17-34 μm long, 13-17 μm wide, basal cells 36-109 μm long, 15-31 μm wide, cells rectangular. Elaters brownish red, tri-spiral, 125-150 μm long, 6.6-9.8 μm . Spores brownish red, circular, 9.8-10.3 μm in diameter. Inner walled of sporogonium thickening present.

Ecology: The plants grows in association with liverworts like *Lepidozia* sp, *Metacalypogeia* sp. and Mosses at 7000-8000 feet a.s.l. Khonoma, KE 10471, 19.03.2011.

Range Of Distribution: India, China.

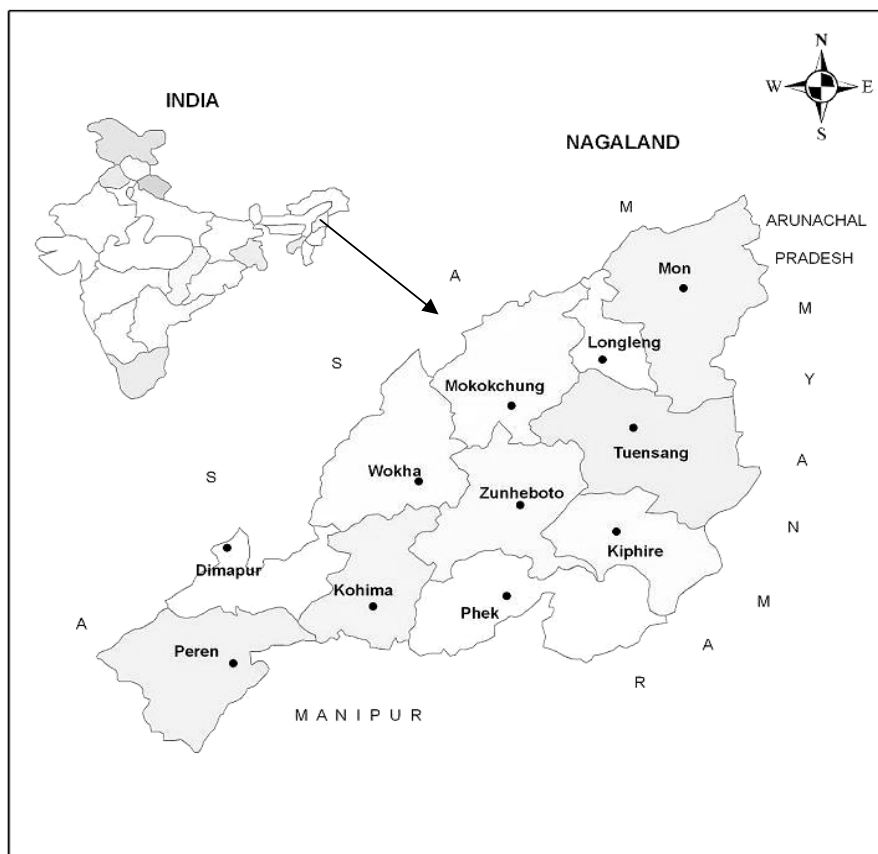


Figure 1: Showing Nagaland state

DISCUSSION

Out of the four species described from the present study areas two species viz., *S. ligulata* and *S. griffithii* are endemic to India but the other two species viz., *S. ferruginea* and *S. parva* shows wide range of distribution (India, China, Formosa, Java).

Research Article

ACKNOWLEDGEMENTS

Authors are thankful to the University Grants Commission, Government of India, New Delhi for the financial help to the Department under SAP (DRS-II) and Rajiv Gandhi National Fellowship (RGNF) for ST/SC, UGC, for appointing JRF to one of the authors (K.E). Thanks are due to Dr. S.K. Singh, BSI, Shillong, Dr. D. Singh, Mr. M. Shuvadeep, CNH Howrah and Mr. Soyhunlo Sebu for their generous help.

REFERENCES

- Amakawa T (1964).** A short revision of Himalayan *Scapania* (Hepaticae). *Journal of the Hattori Botany Laboratory* **27** 1-19.
- Chopra RS (1938).** Notes on Indian hepatics II. Sikkim Himalayas and Bengal. *Proceedings of Indian Academy of Sciences Series B.* **8** 427-439.
- Hattori S (1966).** Anthocerotae and Hepaticae. In: *The Flora of Eastern Himalayas*, edited by **Hara H (University of Tokyo, Japan)** **1** 501-536.
- Hattori S (1971).** Hepaticae. In: *The Flora of Eastern Himalayas*, edited by Hara H (University of Tokyo, Japan) **2** 222-240.
- Hattori S (1975).** Anthocerotae and Hepaticae. In: *The Flora of Eastern Himalayas*, edited by Hara H (University of Tokyo, Japan) **3** 206-242.
- Herzog T (1936).** Zwei Bryophytensammlungen aus dem Sikkim-Himalaya. *Annales Bryologici* **12** 71-97.
- Kachroo P (1969).** Hepaticae of India. A taxonomic survey and census I. Floristic and taxonomic consideration. *Kashmir journal of science* **6 (1-2)** 39-55.
- Kashyap SR (1932).** *Liverworts of the Western Himalayas and the Panjab Plains.* II. The University of Panjab, Lahore 47-50.
- Long DG (1979).** Hepaticae from Bhutan, East Himalayas. *Lindbergia* **5** 54-62.
- Potemkin AD (1998).** On the origin, evolution and classification of the genus *Scapania* (Dum.) Dum. (Scapaniaceae, Hepaticae). *Journal of the Hattori Botany Laboratory* **85** 33-61.
- Potemkin AD (1999).** Circumscription of the family Scapaniaceae, with segregation of the new family Diplophyllaceae (Hepaticae). *Annales Botanici Fennici* **36** 271-283.
- Potemkin AD (2001).** Three new species of *Scapania* (Hepaticae) from India and China. *Annales Botanici Fennici* **38** 83-89.
- Singh AP and Nath V (2007).** *Hepaticae of Khasi and Jaintia Hills: Eastern Himalayas.* Bishen Singh Mahendra Pal Singh, Dehra Dun 154-161.
- Singh SK and Singh DK (2009).** *Hepaticae and Anthocerotae of Great Himalayan National Park and its environs (HP), India.* Botanical Survey of India, Kolkata 76-86.
- Srivastava SC and Srivastava A (1994).** Two species of *Scapania* (Dum.) Dum. from eastern Himalaya with sporophytes. *Lindbergia* **19** 40-48.