

Occurrence of *Tetralophozia filiformis* (Steph.) Urmí in Uttarakhand, India

A. K. Asthana* and Vinay Sahu

CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001, India
E-mail: drakasthana@rediffmail.com*; sahuvinay28@rediffmail.com

*Corresponding author

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ABSTRACT

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The Govind Wild Life Sanctuary (GWLS), established in 1955, is situated in Uttarkashi district of Uttarakhand. The whole area of the Sanctuary is covered with light to heavy snow and is very rich in biodiversity. During the course of extensive bryological exploration of this area, specimens of *Tetralophozia filiformis* (Steph.) Urmí have been collected from Taluka area of GWLS. Remarkably, this species is rediscovered from India after a gap of 53 years. Earlier, this species was reported from eastern Himalaya but it is being reported here, for the first time, from western Himalaya. The species is considered as rare in Iberian Peninsula in "Red List of Bryophytes of the Iberian Peninsula" and it is also rare in Indian region.

Key-words: *Tetralophozia filiformis* (Steph.) Urmí, Lophoziaceae, Marchantiophyta, western Himalaya, India

INTRODUCTION

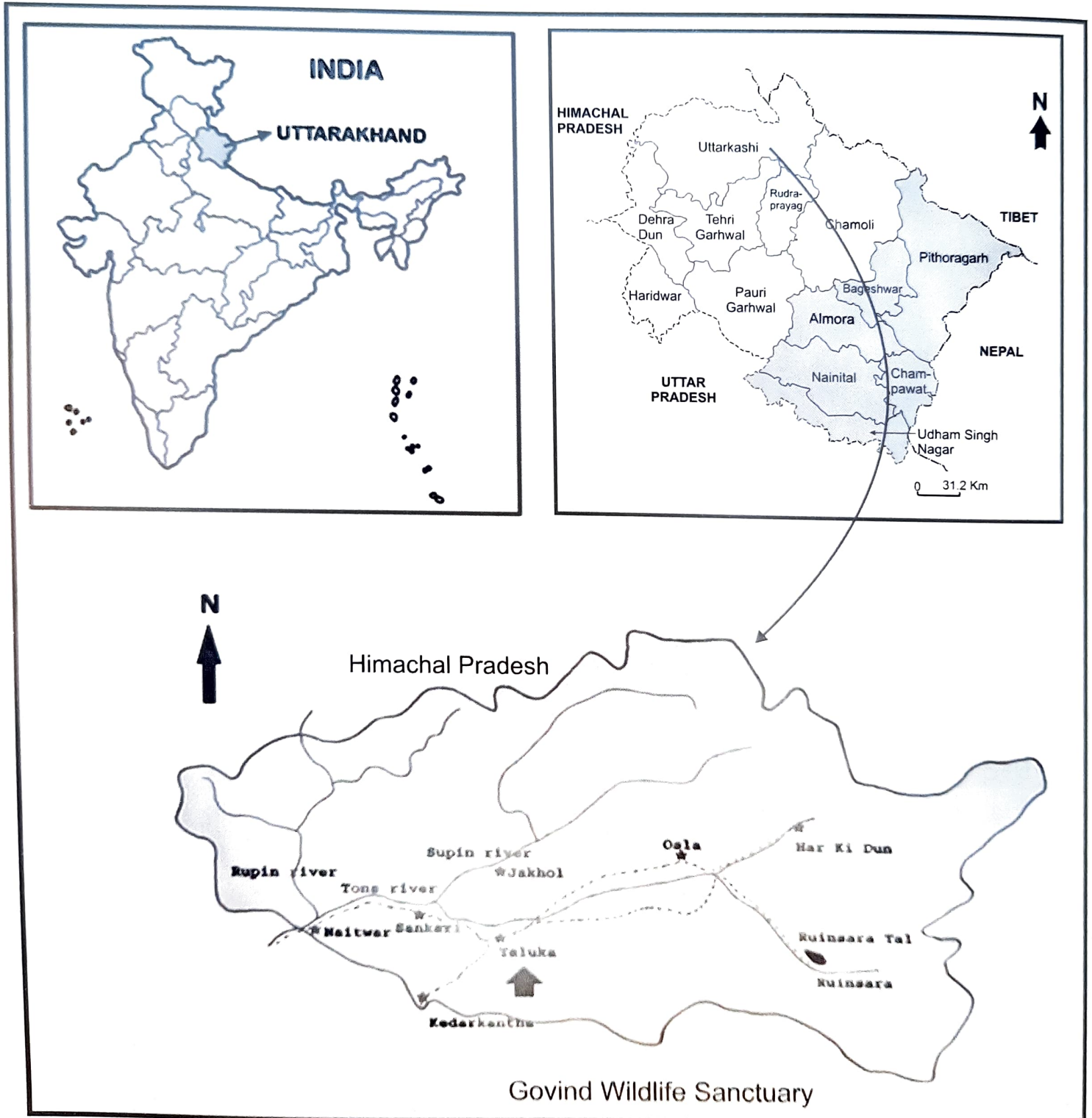
Schuster (1960) divided the genus *Chandonanthus* into two subgenera, *Chandonanthus* and *Tetralophozia*. However, Kitagawa (1965) opined that *Chandonanthus* and *Tetralophozia* were so different from each other that they should be considered as two separate genera. Urmí (1983) designated these two subgenera as two distinct and independent genera and synonymized *C. pusillus* Steph. into *Tetralophozia filiformis* (Steph.) Urmí. Schuster (2002) revised *Chandonanthoideae* and divided *Chandonanthus* into three elements - *Tetralophozia* (Schust.) Schljakov., *Chandonanthus* s. str. and *Plicanthus* Schust. *Chandonanthus* and *Tetralophozia* can be differentiated on the basis of symmetrical leaves and branching. In the case of *Tetralophozia*, leaves are symmetrically arranged (usually 4 lobed leaves) and

branching is lateral intercalary, while in *Chandonanthus* leaves are asymmetric and branching is postical intercalary. *Tetralophozia filiformis* was reported, for the first time, from India as *C. filiformis* Steph. from Sikkim by Herzog (1939). Hattori (1966) reported this species from Sikkim (Dzongri) and West Bengal (Darjeeling, Phalut). Parihar (1961-62), Kachroo (1966) and Kitagawa (1975) listed this species from eastern Himalaya. Srivastava et al. (2013) also described this species from eastern Himalaya, India. Their study was based on the specimens collected by Hara and his associates in 1960 which are stored in the herbarium of the Hattori Botanical Laboratory, Japan (NICH). However, there is no report of *Tetralophozia filiformis* from Indian region so far. Interestingly, during the present study this species has been identified in Taluka area of GWLS. Earlier this taxon was known

from eastern Himalaya, but it is being reported here, for the first time, from western Himalaya and has been rediscovered from India after a gap of 53 years. This taxon is also important from the point of view of its distribution pattern as it is a subarctic element and has disjunct distribution in Canada (British Columbia), Norway, Sweden and Spain apart from Asian region.

MATERIAL AND METHODS

Plant specimens were collected from on way to Taluka, Govind Wild Life Sanctuary in Uttarkashi district of Uttarakhand, western Himalaya (Text-figure 1). Plants were air dried and transferred to brown packets. For morphological and anatomical study, plant samples were soaked and washed in tap water and



Text-figure 1. Map showing collection sites at Govind Wild Life Sanctuary (GWLS), Uttarakhand.

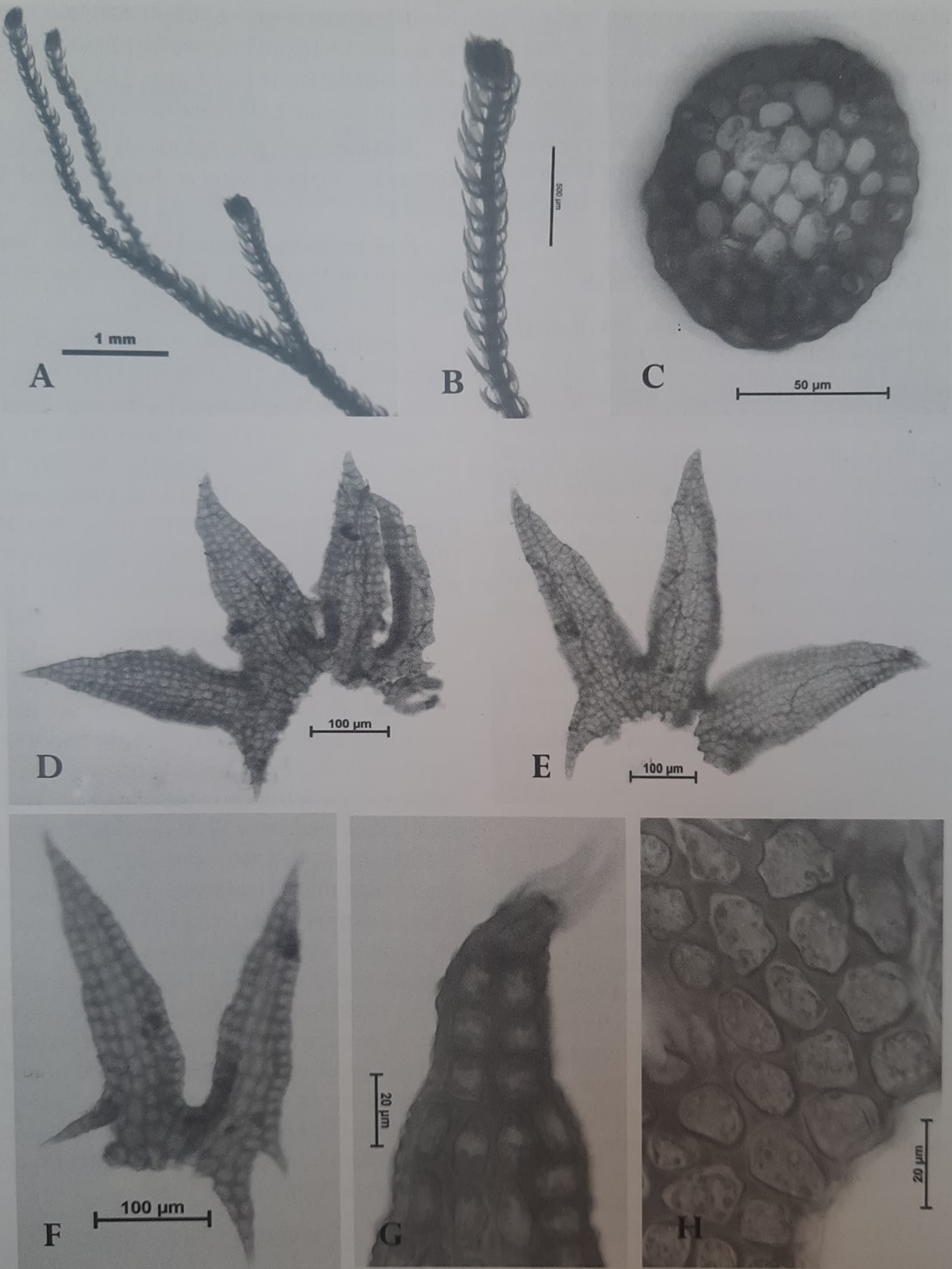


Plate 1

A-H. *Tetralophozia filiformis* (Steph.) Urmi. A-B. Plants (a portion). C. Cross section of stem. D-E Leaves. F. Under-leaf. G. Apical cells of leaf. H. Basal cells of leaf.

were mounted on glass microslide in 30 % glycerine for investigation under microscope. Sections were cut free hand with a razor blade. Observations were made under Olympus compound microscope. The measurements were taken with the help of oculometer. The specimens have been deposited in the Bryophyte Herbarium, CSIR-National Botanical Research Institute, Lucknow (LWG).

TAXONOMIC DESCRIPTION

Tetralophozia (Schust.) Schiljak., Novit. Syst. Plant. non Vasc.13: 227, 1976.

Description: Plants erect to sub-erect, rigid, yellowish to brown, branched or simple. Stem in cross section with 2-3 rows of thick walled cortical cells. Leaves contiguous to imbricate, symmetrically 3-4 lobed, lobes ovate triangulate to lanceolate, margin reflexed, at the base few marginal teeth present, leaf cells thick walled. Underleaves 2 lobed with deep sinus, at the base of the underleaves few cilia or teeth present.

Tetralophozia filiformis (Steph.) Urmi

J. Bryol. 12: 393-401, 1983 [= *Chandonanthus filiformis* Steph. Species Hepaticarum 3: 644 (1909); *Chandonanthus pusillus* Steph. Species Hepaticarum 3: 645 (1909)].

Plate 1, figures A-H

Description: Plants yellowish green above, brownish below, filiform, branched, 14-30 mm long and 0.32 mm wide including leaves, growing in dense mats. Stems in cross section rounded to elliptical, 120 μ m long and 100 μ m wide. Cortical cells slightly thicker than medullary cells, 10-11 cells across and 8 cells high, cortical cells 4-8 μ m wide, medullary cells 8-14 μ m long and 8-10 μ m wide. Leaves contiguous to imbricate, erect, (3-) 4 lobed, lobes triangulate, ovate-lanceolate, incurved, convex towards axis, acute to acuminate, obliquely inserted, subquadrate to subreniform 0.40-0.48 mm long and 0.32-0.48 mm wide, at the base of the leaf lobes few marginal teeth present, teeth 2-8 cells long and 2-5 cells wide at the base. Underleaves large, 2 lobed with deep sinus, oblong-obovate, lobes lanceolate, subacute to acute, 0.32-0.40 mm long and 0.20-0.24 mm wide, at the base of the leaves marginal teeth present, up to 6 cells long and 2-3 cells wide at

base. Leaf cells at apex 12-16 μ m long and 8 μ m wide, at middle 12-16 μ m long and 8-12 μ m wide, at base 12-20 μ m long and 8-12 μ m wide, thick walled, trigones large but indistinct. Gemmae not seen.

Habitat: Plants grow luxuriantly on wet rocks under constantly dripping water at shady place, altitude ca 1976m.

Specimens examined: India, western Himalaya, Uttarakhand, Uttarkashi, on way to Taluka, 6.10.2013, leg. Vinay Sahu, 254814A (LWG).

Distribution Range: Spain, Canada (British Columbia), Bhutan, Malaysia, India (Sikkim-Dzongri, Tsomgo Lake, West Bengal-Darjeeling: Sandakphu Bungalow, Phalut, Uttarakhand-GWLS), Japan, Korea, Taiwan, China, Norway, Sweden, Nepal, Russia (Hattori 1966, 1971, Grolle 1966, Laine 1970, Kitagawa 1973, Mizutani 1979, Urmi 1983, Fuertes 1987, Long and Grolle 1990, Konstantinova 2002, Bakalin et al. 2009, Srivastava et al. 2013).

DISCUSSION

Schuster (1960) differentiated *C. pusillus* from *C. setiformis*. In *C. pusillus*, leaf lobes are narrowly lanceolate, leaf cell walls strongly and unevenly thickened, cuticle distinctly verrucose while in *C. setiformis*, leaf lobes are ovate triangular, their walls evenly thickened and cuticle smooth. *T. filiformis* is distinguished with *T. setiformis* (Ehrh.) Schiljak by its smaller size and the leaf lobes are always more than twice as long as wide (Urmi 1983). As compared to the plants of eastern Himalaya (Sikkim and West Bengal), plants of GWLS (western Himalaya) are slightly larger in size, leaf lobes are more longer than wide, while underleaves are little smaller in size. These morphological variations may be due to different ecological conditions at two different climate zones. Sérgio et al. (1994) considered *T. filiformis* as rare in Iberian Peninsula in their paper "Red List of Bryophytes of the Iberian Peninsula".

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