

On a collection of liverworts from Tawang, Arunachal Pradesh, India with *Frullania rhystocolea* Herzog new to India

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Abstract: Rawat, K.K.; Verma, P.K. (2014): On a collection of liverworts from Tawang, Arunachal Pradesh, India. *Frahmia* 8:1-7.

During a small trip in 2002, a total of 24 species of liverworts, both terrestrial and epiphytic, were collected from Tawang and are being described here including *Frullania rhystocolea* Herzog as new to India and *Blasia pusilla* L. as new to Arunachal Pradesh, making the first ever recorded account of liverworts of Tawang, Arunachal Pradesh.

1. Introduction

Arunachal Pradesh is part of Eastern Himalayan biodiversity hotspot and is also among 200 globally important eco regions (Olson and Dinerstein, 1998). The region is mixture of tropical to alpine climate which favours growth of a variety of floral elements in the state comprising nearly 33% of total plant species in India (Mahapatra, 2010). The state harbors northern most tropical rain forests and shows enormous diversity distributed in its various botanically rich areas. One such area, the Tawang district of Arunachal Pradesh, is located in extreme western corner of state between 27°25' & 27°45' N and 91°42' & 92°39' E covering an area of 2,172 km² between 2000-3000 m. The district Tawang is bordered with Tibet (China) to North, Bhutan to south-west and West Kameng district towards east. The area receives average annual rainfall about 250 cm while the mean maximum average temperature is 21.4° and minimum of 2.4°C. The state is also known for its cultural heritage, primarily Buddhist culture marked by the presence of largest and second oldest Monastery and other small monasteries.

The rich floral diversity was earlier worked by Hooker (1886), Kanjilal et al. (1934-40) and Mahapatra (2010), however, remain focused on higher groups of plants. Any account of bryophytes in particular is lacking till now. During a small trip in 2002, a total of 24 species of

liverworts, both terrestrial and epiphytic, were collected from Tawang and are being described here, making the first ever recorded account of liverworts of Tawang, Arunachal Pradesh.

2. Enumeration of liverwort taxa:

Blasiaceae

1. *Blasia pusilla* L., Sp. Pl. 1138. 1753.

Specimen examined: Arunachal Pradesh, Tawang, Near Monastery, ca. 2950 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15722, 15723, 15724, 15725, 15726 (LWU).

Conocephalaceae

2. *Conocephalum conicum* (L.) Underw., Bot. Gaz. 20: 67. 1895

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15584, 15585 (LWU).

Marchantiaceae

3. *Marchantia polymorpha* L., Sp. Pl. 1137. 1753.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15611, 15612, 15613, 15614 (LWU).

Geocalycaceae

4. *Lophocolea minor* Nees, Naturgesch Eur. Lerberm. 2: 330. 1836.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15672 (LWU).

Plagiochilaceae

5. *Plagiochila devexa* Stephani, Bull. Herb. Boissier, ser. 2,3: 340; Sp. Hep. 2: 324. 1903.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, 24.04.02, ca. 2900 m., K.K. Rawat and M.S. Azeem, 15708 (LWU).

6. *Plagiochila detetcta* So & Grolle, Nova Hedwigia 71: 391. 2000.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, ca. 2900 m., 27.4.2002, K.K. Rawat and M.S. Azeem, 15702 (LWU).

7. *Plagiochila subtropica* Stephani, Bull. Soc. Roy. Bot. Belgique 38:46. 1900.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, 27.04.2002, ca. 2900 m., K.K. Rawat and M.S. Azeem, 15556, 15573, 15708 (LWU)

Cephaloziaceae

8. *Odontoschisma denudatum* (Nees ex Mart.) Dumort. Recueil. Observ. Jungerm. 19: 1835.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15662 (LWU).

Lepidoziaceae

9. *Bazzania sikkimensis* (Stephani) Herzog, Ann. Bryol. 12: 78. 1939. ≡ *Mastigobryum sikkimense* Stephani Sp. Hep. 3:434 1908.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15662, 15749 (LWU).

Calyptogiaceae

10. *Metacalypogeia alternifolia* (Nees) Grolle, Oesterr. Bot. Z. 111: 185. 1964.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K. K. Rawat and M.S. Azeem, 15670 (LWU).

Lophoziaceae

11. *Tritomaria exsecta* (Schmidel ex Schrad.) Schiffner ex Loeske, Hedwigia 49: 13. 1909

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, 2900 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15657, 15670, 15681, 15682 (LWU).

12. *Isopaches decolorans* (Limpr.) H. Buch., Memoranda Soc. Fauna Fl. Fenn. 8: 288. 1932.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15598, 15607 (LWU).

Scapaniaceae

13. *Diplophyllum nanum* Herzog, Memoranda Soc. Fauna Fl. Fenn. 26: 48. 1950.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15592, 15598, 15601, 15602, 15603, 15606, 15620A (LWU).

Jubulaceae

14. *Frullania neurota* Taylor, London J. Bot. 5: 400. 1846.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, ca. 2900 m., 27.04.2002, K. K. Rawat and S. Azeem, 15582A (LWU).

15. *Frullania rhystocolea* Herzog, Symb. Sin. 5: 39 1930.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, 27.04.2002, ca. 2900 m., K.K. Rawat and M.S. Azeem, 15679, 15582A (LWU). Fig. 1: 1-7 (New to India).

The species earlier known from only some pockets of Bhutan and China, shows extension of distributional range to India. The species is easily separable to other species of *Frullania* in having exserted, obovoid, densely plicate perianth, plicae 12-14, irregularly inflated, vermiculate and crooked with short-tubular mouth.

Lejeuneaceae

16. *Ptychanthus striatus* (Lehm. & Lindenb.) Nees, Naturgesch. Eur. Leberm. 3: 212. 1838

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, ca. 2900 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15575 (LWU).

17. *Spruceanthus semirepandus* (Nees) Verd., Ann. Bryo., Suppl. 4: 153. 1934. = *Marchesinia gigantea* Steph. Sp. Hepat. 5: 154, 1912 (Gradstein, 2012).

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, ca. 2900 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15568, 15572 (LWU).

18. *Drepanolejeunea angustifolia* (Mitt.) Grolle, J. Jap. Bot. 40: 206. 1965. ≡ *Lejeunea angustifolia* Mitt. J. Proc. Linn. Soc. Bot. 5: 116. 1861 "1860" (Grolle, 1965). = *Drepanolejeunea longifolia* Ajit P. Singh et V. Nath, Hepat. Khasi Jaintia Hills E. Himal.: 248. 2007; Bryologist 111: 477. 2008 (He and Zhu, 2014)

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15658 (LWU)

19. *Lejeunea flava* (Sw.) Nees, Naturgesch. Eur. Leberm. 3: 277. 1838.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15679A (LWU).

20. *Lejeunea bidentula* Herzog, Symb. Sin. 5: 51. 1930.

Specimen examined: Arunachal Pradesh, Tawang, on way from Tawang to Bomdir village, ca. 2900 m., 27.04.2002, K.K. Rawat and M.S. Azeem, 15582A (LWU).

21. *Microlejeunea punctiformis* (Taylor) Spruce in Steph. Sp. Hep. 5: 832. 1915.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15583 (LWU).

22. *Microlejeunea ulicina* (Taylor) Steph. in Hedwigia 29: 88. 1890.

Specimen examined: Arunachal Pradesh, Tawang, Tawang town, 2950 m., 27.04.2002; K.K. Rawat and M.S. Azeem, 15657 (LWU).

23. *Cololejeunea bhutanica* Grolle & Mizut., J. Bryol. 15: 281. 1988.

Specimen examined: Arunachal Pradesh, Tawang, on way to Bomdir village from Tawang, ca. 2900 m., 27.04.2002; K.K. Rawat and M.S. Azeem 15657, 15670, 15671, 15682 (LWU).

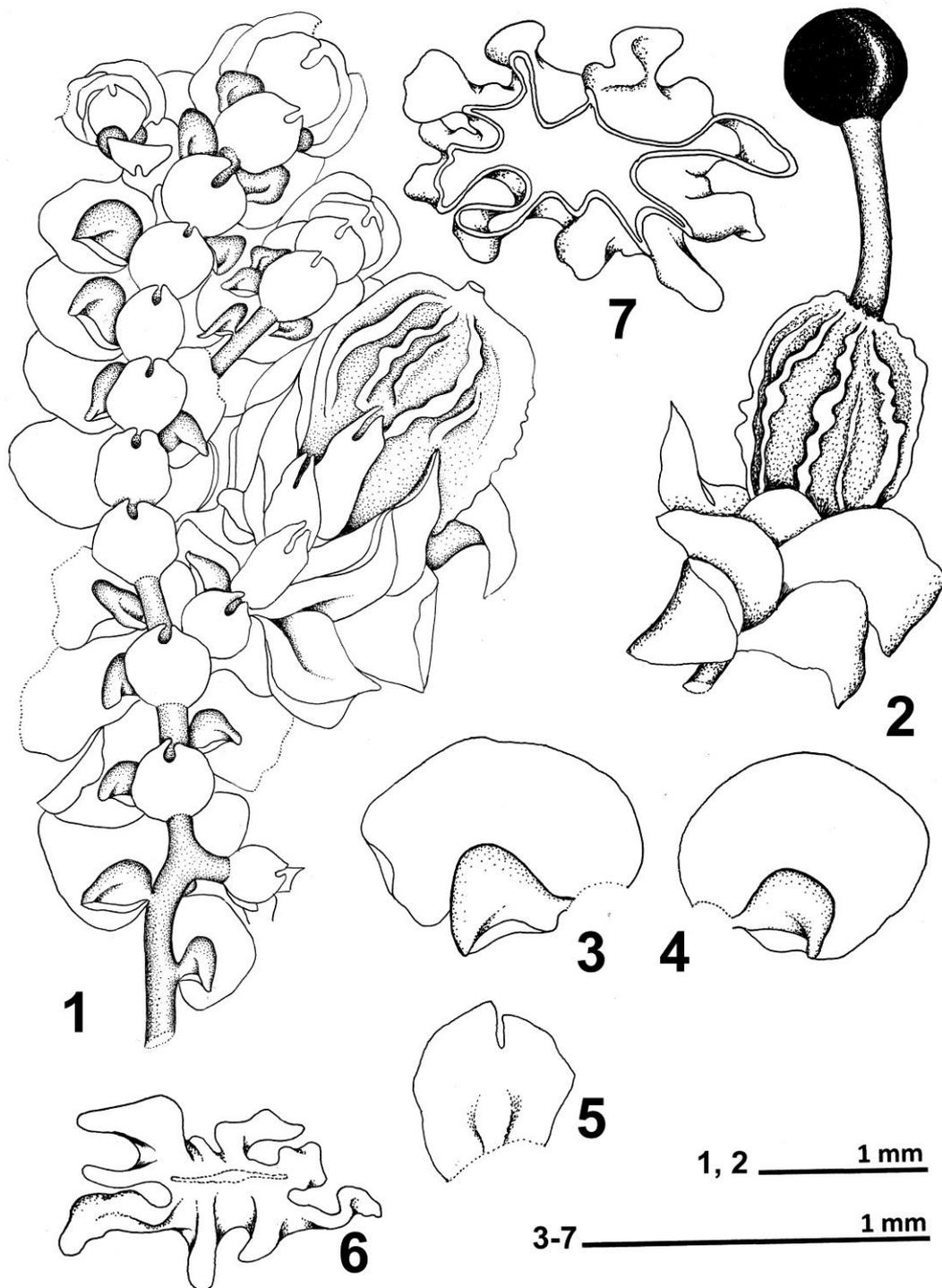
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Bibliography:

- GRADSTEIN, S.R. (2012) An overview of the genus *Marchesinia* (Marchantiophyta: Lejeuneaceae) with special attention of the species described from Asia and Oceania. *Polish Botanical Journal* 57(1): 69-79.
- GROLLE, R. (1965) Miscellanea hepatologica 41-50. *Journal of Hattori Botanical Laboratory* 40: 206-219.
- HE, Q.; ZHU, R.L. (2014) Notes on Early Land Plants Today. 48. *Drepanolejeunea longifolia*, a new synonym of *Drepanolejeunea angustifolia* (Marchantiophyta, Lejeuneaceae). *Phytotaxa* 162(4): 234-235.
- HOOKE, J. D. (1886) *The Flora of British India*. Vol. V. Reeve & Co., London.

- KANJILAL, U. N.; KANJILAL, P.C.; DAS, A. (1934-1940) *Flora of Assam*. Vol. I-V. Government of Assam.
- MAHAPATRA, H.S. (2010) A contribution to the flora of Tawang district, Arunachal Pradesh. *Bulletin of Arunachal Forest Research* 26 (1&2) : 44-51,
- OLSON, D.M.; DINERSTEIN, E. (1998) The global 200: a representative approach to covering Earth's most biologically valuable eco regions. *Conservation Biology* 12: 502-515.
- SINGH, A.P.; NATH, V. (2007) Hepaticae of Khasi and Jaintia Hills: Eastern Himalayas. Bishen Singh Mahendra Pal Singh, Dehradun, 382pp.
- SINGH, A.P., NATH, V., ASTHANA, A.K. (2008) Studies on two noteworthy species of *Drepanolejeunea* (Lejeuneaceae) from Meghalaya (India). *The Bryologist* 111: 476-481.



Figs. 1-7 *Frullania rhystocolea*: 1. Plant, habit with perianth. 2. a portion of plant with perianth and sporophyte. 3,4. Leaves, 5. underleaf, 6. perianth section showing top view, 7. perianth section from middle region. (All from KKR and Azeem 15679 (LWU)).