

Additions to the Bryophyte flora of Tawang, Arunachal Pradesh, India

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ABSTRACT

We here report, a total of thirty bryophyte (sixteen liverworts and fourteen mosses) taxa from the Tawang District, Arunachal Pradesh, India. Of these, *Heterophyllum affine* (Hook.) M. Fleisch. is reported here as new to India while the eight liverworts [*Anastrophyllum minutum* (Schreb.) R.M. Schust., *Frullania retusa* Mitt., *F. tagawana* (S. Hatt. & Thaith.) S. Hatt., *Gongylanthus himalayensis* Grolle, *Plagiochila recurvata* (W.E. Nicholson) Grolle, *Scapania nimbosea* Taylor ex Lehm., *Schistochilopsis incisa* (Schrad.) Konstant. and *S. setosa* (Mitt.) Konstant.] and eleven mosses [*Brachymerium capitulum* (Mitt.) Par., *Dicranum himalayanum* Mitt., *Macrocoma tenue* (Hook. and Grev.) Vitt. ssp. *sullivantii* (C. Muell.) Vitt., *Orontobryum hookeri* (Mitt.) M. Fleisch., *Plagiothecium denticulatum* (Hedw.) B. S. G., *Pleurozium schreberi* (Brit.) Mitt., *Pohlia gedeana* (Bosch. & Sande Lac.) Gangulee, *P. ludwigii* (Spreng. ex Schwägr.) Broth., *Rhynchostegium planiusculum* (Mitt.) A. Jaeger., *Symblepharis vaginata* (Hook.) Wijk. & Marg. and *Thuidium assimile* (Mitt.) A. Jaeger.] have been found as new to the bryoflora of Arunachal Pradesh. The present additional record of bryophytes certainly reflects the rich bryofloral diversity of the Tawang District, Arunachal Pradesh, India.

Key words: Bryophyta, Hepaticae, Liverworts, Marchantiophyta, Mosses.

INTRODUCTION

The Tawang District in Arunachal Pradesh, India, is located in the extreme western corner of the state between 27°25' & 27°45' N latitudes and 91°42' & 92°39' E longitudes. The Tawang District covers an area of about 2,172 km² and shares its borders with Tibet in the North, Bhutan in the southwest and the West Kameng District, Arunachal Pradesh (India) in the east. The bryofloristic information of the region was unknown until, Vohra & Kar (1996) published presence of eighty two species of mosses from Arunachal Pradesh, that included twelve species from the Tawang District, Arunachal Pradesh. Later, Rawat & Verma (2014) recorded the first account of twenty three liverworts in the Tawang region. Ellis et al. (2016a,

2016b) reported two mosses viz., *Splachnum sphaericum* Hedw. and *Polytrichastrum alpinum* (Hedw.) G. L. Sm. from the Tawang District. Very recently, Rawat et al. (2017) published an account of thirty bryophytes from the Tawang District, Arunachal Pradesh. In the present investigation, we record an additional occurrence of thirty bryophyte taxa in the Tawang region. Till date, a total of ninety seven bryophyte taxa (including the ones reported herein) are known from the region. This certainly is a reflection of a presence of rich bryophyte diversity in the Tawang District, Arunachal Pradesh, India.

MATERIAL AND METHODS

The plant samples were collected from various localities within Tawang District, Arunachal Pradesh

(Text-Figure 1) during a survey of the area in June 2015. The collected plant specimens are housed in the CSIR-National Botanical Research Institute's Bryophyte Herbarium (LWG). The taxonomic identifications were carried out with the help of available literature. The actual locations of the collected plant specimens were taken using an in-field GPS, and these marked locations can be viewed on the image (False colour composite image of LISS IV sensor data of Resourcesat 2 satellite) of the study area provided in Text-figure 1.

ENUMERATION OF TAXA

Liverworts (Marchantiophyta)

Anastrophyllum minutum (Schreb.) R. M. Schust., Amer. Midl. Nat. 42: 576, 1949.

Specimen examined: 15.06.2015, K. K. Rawat, 300181C (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m.

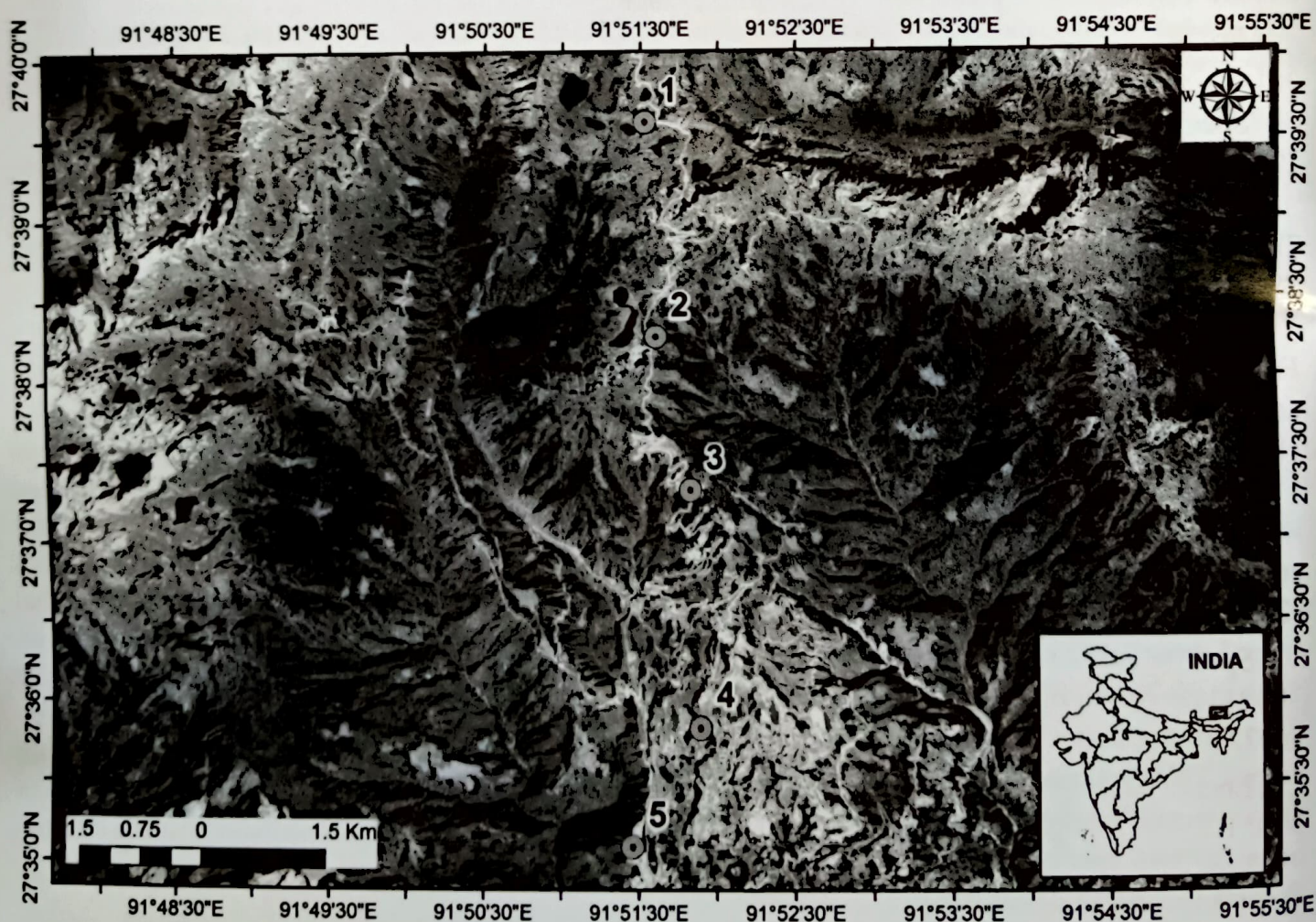
Distribution in India: Sikkim (Schill and Long, 2003), New to Arunachal Pradesh.

Frullania duthiana Steph., Sp. Hepat. 4: 351, 1910. *Frullania duthiana* Steph. var. *appendiculata* S. Hatt. in Hara, Fl. E. Himal. 2: 234, 1971.

Specimen examined: 15.06.2015, K. K. Rawat, 300223B, 300230A (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m.

Distribution in India: Arunachal Pradesh: West Siang (Singh & Singh Deo 2014), Tawang (present study), Meghalaya (Hattori & Thaithong 1978), Sikkim



Text-Figure 1: Map of the study area showing various sampling sites. 1. Near Nagula lake; 2. Near P.T. Tso lake; 3. Near Manglem Gompa; 4. On the way to Tawang monastery; 5. Near Tawang Monastery. The background false colour composite (FCC) image has been prepared using LISS-IV sensor data of Resourcesat-2 satellite (date of satellite pass: 24 Nov 2013).

(Hattori 1966), Uttarakhand (Kashyap & Chopra 1932, Hattori 1966), West Bengal (Hattori 1966).

Frullania nepalensis (Spreng.) Lehm. & Lindenb., in Lehm., Nov. Strip. Pug. 4: 19. 1832. *Frullania grevilleana* Taylor in Gottsche & al., Syn. Hepat. 421. 1845. *Frullania grevilleana* var. *densa* Schiffn. ex Verd., Ned. Kruidk. Arch. 42: 487. 1932.

Specimen examined: 16.06.2015, K. K. Rawat, 300240B, 300241A (LWG); 16.06.2015, K. K. Rawat, 300242A (LWG).

Localities: India, Arunachal Pradesh, Tawang: On way to Tawang monastery, N 27°35'49.8" E 91°51'53.7", 2999 m; Tawang Monastery, N 27°35'6.5" E 91°51'27.7", 2966 m.

Distribution in India: Arunachal Pradesh (without specific locality); Himachal Pradesh, Meghalaya, Manipur, Sikkim, Uttarakhand, West Bengal (Singh et al. 2016 and literature therein).

Frullania retusa Mitt., J. Proc. Linn. Soc., Bot. 5: 121. 1861 var. *retusa*

Specimen examined: 16.06.2015, K. K. Rawat, 300245A (LWG).

Locality: India, Arunachal Pradesh, Tawang: Tawang monastery, N 27°35'6.5" E 91°51'27.7", 2966 m.

Distribution in India: Widely distributed in Himachal Pradesh, Uttarakhand and Darjeeling area and also known from Meghalaya (Singh et al. 2016). New to Arunachal Pradesh.

Frullania tagawana (S. Hatt. & Thaith.) S. Hatt., J. Hattori Bot. Lab. 59: 160. 1985. *Frullania evoluta* Mitt. var. *tagawana* S. Hatt. & Thaith., J. Hattori Bot. Lab. 43: 441. 1977.

Specimen examined: 15.06.2015, K. K. Rawat, 300211A (LWG); 15.06.2015, K. K. Rawat, 300223C, 300230C (LWG).

Localities: India, Arunachal Pradesh, Tawang: Near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m; Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m.

Distribution in India: Earlier known from Meghalaya and West Bengal as *Frullania evoluta* var.

tagawana (Hattori & Thaithong 1978). New to Arunachal Pradesh.

Gongylanthus himalayensis Grolle, Khumbu Himal 1(4): 285, f.7, 1966.

Specimen examined: 16.06.2015, K. K. Rawat, 300238A (LWG).

Locality: India, Arunachal Pradesh, Tawang: on way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Tamil Nadu (Srivastava & Verma 2005 as *Gongylanthus indicus* Srivastava & Verma), Karnataka (Frahm 2013 as *G. indicus*), Sikkim; Upper Assam (Robinson 1968, Bapna & Kachroo 2000b as *G. gollanii*). New to Arunachal Pradesh.

Herbertus dicranus (Taylor) Trevis, Mem. Reale Ist. Lombardo Sci., Ser. 3, Cl. Sci. Mat. 4: 397. 1877.

Specimen examined: 15.06.2015, K.K. Rawat 300229C (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, alt. N27°37'46.2" E91°51'49.3", 3656m.

Distribution in India: Widely distributed in Eastern Himalayas, North-eastern hilly regions and Western Ghats (Singh et al. 2016).

Herbertus ramosus (Steph.) H.A. Mill. J. Hattori Bot. Lab. 28: 314. 1965.

Specimen examined: 15.06.2015, K.K. Rawat 300178A (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, alt. N27°39'37.0" E91°51'31.6", 4137m.

Distribution in India: Arunachal Pradesh: West Siang (Singh Deo & Singh 2016), Tawang, Arunachal Pradesh (present study)

Lepidozia stahlii Steph., Sp. Hepat. 3: 616. 1909.

Specimen examined: 15.06.2015, K. K. Rawat, 300167H (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, N 27°39'37.0" E 91°51'31.6", 4137 m.

Distribution in India: Arunachal Pradesh: West Siang (Singh Deo & Singh 2016), Tawang, Arunachal Pradesh (present study) Sikkim (Herzog 1939; Sharma & Srivastava 1993), Uttarakhand (Nath et al. 2010), West Bengal (Sharma & Srivastava 1993).

Metzgeria consanguinea Schiffn., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 60: 271. 1893. *Metzgeria darjeelingensis* Kuwah., J. Hattori Bot. Lab. 39: 365. 1975.

Specimen examined: 15.06.2015, K. K. Rawat, 300223D (LWG); 16.06.2015, K. K. Rawat, 300240D (LWG).

Localities: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m; On way to Tawang monastery, N 27°35'49.8" E 91°51'53.7.", 2999 m.

Distribution in India: Widely distributed in Eastern Himalayan territory including Arunachal Pradesh, also known from Himachal Pradesh in Western Himalayan region and Tamil Nadu in South India (Singh et al. 2016).

Plagiochila recurvata (W. E. Nicholson) Grolle, Trans. Brit. Bryol. Soc. 4: 654. 1964.

Specimen examined: 15.06.2015, K.K. Rawat, 300170A, 300178C (LWG).

Locality: India, Arunachal Pradesh: Tawang- near Nagula lake, N 27°39'36.0" E 91°51'31.6", 4137 m.

Distribution in India: Sikkim, West Bengal (Rawat & Srivastava 2007). New to Arunachal Pradesh.

Scapania davidii Potemkin, Ann. Bot. Fenn. 38: 83. 2001.

Specimen examined: 15.06.2015, K.K. Rawat, 30016G (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, N 27°39'37.0" E 91°51'31.6", 4137 m.

Distribution in India: Sikkim (Potemkin 2001, Majumdar et. al. 2016). Arunachal Pradesh: on way from Hotspring to Jachhup (Majumdar et. al. 2016), Tawang, Arunachal Pradesh (present study).

Scapania nimbose Taylor ex Lehm., Nov. Strip. Pug. 8: 6. 1844.

Specimen examined: 15.06.2015, K. K. Rawat, 300178B (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, N 27°39'37.0" E 91°51'31.6", 4137 m.

Distribution in India: West Bengal: Phalut (Amakawa 1964, Hattori 1966). New to Arunachal Pradesh.

Scapania ornithopoides (With.) Waddell, Moss Exch. Club Cat. Hepat. 4: 1897.

Specimen examined: 15.06.2015, K. K. Rawat, 300167A (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, alt. N 27°39'37.0" E 91°51'31.6", 4137 m.

Distribution in India: Widely distributed in eastern Himalayan region (Singh et al. 2016).

Schistochilopsis incisa (Schrad.) Konstant., Arctoa 3: 125, 1994. *Lophozia incisa* (Schrad.) Dumort. Recueil Observ. Jungerm. 17. 1835.

Specimen examined: 15.06.2015, K. K. Rawat, 300216B (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near P. T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Himachal Pradesh; Jammu & Kashmir (Kashyap & Chopra 1932 as *L. incisa*); West Bengal (Hattori 1966 as *L. incisa*); Sikkim (Long & Grolle 1990 as *L. incisa*); Uttarakhand (Srivastava et al. 2013). New to Arunachal Pradesh.

Schistochilopsis setosa (Mitt.) Konstant., Arctoa 3: 125. 1994. *Jungermannia pluridentata* Mitt., J. Proc. Linn. Soc., Bot. 5:92. 1861. *Jungermannia setosa* Mitt., J. Proc. Linn. Soc., Bot. 5: 92. 1861. *Lophozia setosa* (Mitt.) Steph., Bull. Herb. Boissier, ser. 2, 2: 159. 1902. *Lophozia pluridentata* (Mitt.) Steph., Sp. Hepat. 6: 113. 1917.

Specimen examined: 15.06.2015, K. K. Rawat, 300216A (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Sikkim (Mitten 1861 as *J. pluridentata* and *J. setosa*; Herzog 1939, Hattori

1966 as *L. setosa*). West Bengal (Hattori 1966 as *L. setosa*). New to Arunachal Pradesh.

Bryophyta (Mosses)

Brachymenium capitulatum (Mitt.) Par., J. Hattori Bot. Lab. No. 79: 181 (1996). *Brachymenium ochianum* Gangulee, Mosses E. India: 934, 1977.

Specimen examined: 16.06.2015, K. K. Rawat, 300245B (LWG).

Locality: India, Arunachal Pradesh, Tawang: Tawang Monastery, N 27°35'6.5" E 91°51'27.7", 2966 m.

Distribution in India: Darjeeling, Sikkim (Gangulee 1974-77), Uttarakhand (Tewari & Pant 1994, Nath & Srivastava 2010, Sahu & Asthana 2015, 2016) Tamil Nadu (Kumar & Krishnamurthy 2007, Daniels 2010), Kerala (Manju et al. 2008), Nagaland (Bansal et al. 2011). New to Arunachal Pradesh.

Clapodium prinophyllum (C. Muell.) Broth. In Eng. & Prantl. Nat. Pflanzenfam. 1(3): 1009. 1908.

Specimen examined: 15.06.2015, K. K. Rawat, 300230F (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m.

Distribution in India: Arunachal Pradesh, Sikkim, Darjeeling, Meghalaya, Naga Hills, Kerala, Tamil Nadu, Uttarakhand (Gangulee 1978-1980, Vohra 1983, Kumar & Singh 2002, Asthana & Sahu 2013, Sahu & Asthana 2015, Sahu & Asthana 2016).

Dicranum himalayanum Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 14. 1859.

Specimen examined: 15.06.2015, K. K. Rawat, 300169B (LWG); 15.06.2015, K. K. Rawat, 300212 H (LWG).

Localities: India, Arunachal Pradesh, Tawang: Near Nagula lake, N 27°39'37.0" E 91°51'31.6", 4137 m; Near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Eastern Himalaya: Sikkim, Western Himalaya: Garhwal, Kumaon (Gangulee 1969-72). New to Arunachal Pradesh.

Heterophyllum affine (Hook.) M. Fleisch. Musci Buitenzorg 4: 1177. 1923. *Heterophyllum confine* (Mitt.) M. Fleisch, Musci Buitenzorg 4: 1177. 1923.

Specimen examined: 16.06.2015, K. K. Rawat, 300240 I (LWG).

Locality: India, Arunachal Pradesh, Tawang: on way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Earlier known from Bhutan as *H. confine* (Gangulee 1978-1980). New to India (Arunachal Pradesh).

Macrocoma tenue (Hook. and Grev.) Vitt. ssp *sullivantii* (C. Muell.) Vitt., J. Hattori Bot. lab. No. 79: 163-357. 1996. *Macromitrium perrottetii* C. Muell. in Syn., 1: 721, 1849.

Specimen examined: 16.06.2015, K. K. Rawat, 300240H (LWG).

Locality: India, Arunachal Pradesh, Tawang: on way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Sikkim, Nilgiri Hills, Uttarakhand (Gangulee 1974-1977, Sahu & Asthana 2015). New to Arunachal Pradesh.

Orontobryum hookeri (Mitt.) M. Fleisch., Musci Fl. Buitenz., 4: 1475-1478. 1922.

Specimen examined: 15.06.2015, K.K. Rawat 300229A (LWG); 16.06.2015, K. K. Rawat, 300240E (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m; On way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Sikkim (Gangulee 1974-1977, Chopra 1975). New to Arunachal Pradesh.

Pleurozium Schreberi (Brit.) Mitt. J. Linn. Soc. Bot., 12: 537 (1869).

Specimen examined: 15.06.2015, K. K. Rawat, 300228H, 300232D (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m.

Distribution in India: Sikkim (Gangulee 1978-1980, Chopra 1975). New to Arunachal Pradesh.

Pohlia gedeana (Bosch. & Sande Lac.) Gangulee, Mosses E. India 4: 927. 1974.

Specimen examined: 15.06.2015, K. K. Rawat, 300185 (LWG).

Locality: India, Arunachal Pradesh, Tawang: Near Nagula lake, N 27°39'37.0" E 91°51'31.6", 4137 m.

Distribution in India: Madhya Pradesh (Nath et al. 2007, 2008); Manipur (Govindaparyari et al. 2012); Uttarakhand (Kumar & Singh 2002, Sahu & Asthana 2016). New to Arunachal Pradesh.

Pohlia ludwigii (Spreng. ex Schwägr.) Broth. in Acta Societatis Scientiarum Fennicae 19(12): 27. 1892

Specimen examined: 16.06.2015, K.K. Rawat 300237C(LWG).

Locality: India, Arunachal Pradesh, Tawang: on way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Kashmir, Meghalaya (Gangulee 1969-1972) South India (Nath & Bansal 2009) Tamil Nadu (Palani et al. 2017). New to Arunachal Pradesh.

Pyloisadelpha tenuirostris (Bruch. & Schimp. ex Sull.) W.R. Buck. Yushania 1(2): 13. 1984. *Brotherella harveyana* (Mitt.) Dixon, Notes Roy. Bot. Gard. Edinburgh 19: 298. 1938.

Specimen examined: 16.06.2015, K. K. Rawat, 300245C (LWG).

Locality: India, Arunachal Pradesh, Tawang: Tawang Monastery, N 27°35'6.5" E 91°51'27.7", 2966 m.

Distribution in India: Meghalaya (Ellis et al. 2016b as *B. harveyana*), Uttarakhand (Sahu & Asthana 2016 as *B. harveyana*), Tamil Nadu (Ellis et al. 2016a as *B. harveyana*). New to Arunachal Pradesh.

Rhynchostegium planiusculum (Mitt.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 18676-77: 364. 1878.

Specimen examined: 16.06.2015, K. K. Rawat, 300237B (LWG).

Locality: India, Arunachal Pradesh, Tawang: on way to Tawang Monastery, N 27°35'49.8" E 91°51'53.7", 2999 m.

Distribution in India: Sikkim, Uttarakhand (Vohra 1983, Sahu & Asthana 2016). New to Arunachal Pradesh.

Rozea pterogonioides (Harv.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876-77: 274. 1878.

Specimen examined: 15.06.2015, K.K. Rawat 300215G (LWG).

Locality: India, Arunachal Pradesh: Tawang- near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Sikkim, Darjeeling, Khasi hills, Uttarakhand (Gangulee, 1978-1980). New to Arunachal Pradesh.

Symblepharis vaginata (Hook.) Wijk. & Marg., Taxon 8(2): 75. 1959.

Specimen examined: 15.06.2015, K. K. Rawat 300224B (LWG); 15.06.2015, K. K. Rawat, 300212 G (LWG).

Localities: India, Arunachal Pradesh, Tawang: Near Manglem Gompa, N 27°37'46.2" E 91°51'49.3", 3656 m; Near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Assam, Sikkim, South India, Kashmir, (Gangulee 1969-1972, Chopra 1975), Uttarakhand (Sahu & Asthana 2016), Kerala (Manju et al. 2009). New to Arunachal Pradesh.

Thuidium assimile (Mitt.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876-77: 260 (Gen. Sp. Musc. 2: 326), 1878.

Specimen examined: 15.06.2015, K. K. Rawat, 300203C (LWG).

Locality: India, Arunachal Pradesh: Tawang- near P.T. Tso lake, N 27°38'14.3" E 91°51'35.6", 3982 m.

Distribution in India: Darjeeling, Uttarakhand, Himachal Pradesh (Gangulee 1978-1980, Sahu & Asthana 2015, 2016, Asthana & Sahu 2013, Nath et al. 2010). New to Arunachal Pradesh.

DISCUSSION

Tawang, a small district of Arunachal Pradesh remains neglected for floristic explorations, particularly bryophytic studies. There are very few recent contributions towards the knowledge of the bryophytic wealth of the district. The present report of 30 bryophytes from Tawang including 19 taxa as new to Arunachal Pradesh not only strengthen the bryophyte diversity database of the area but also highlight the rich bryophytic diversity of Tawang District. Future explorations should further strengthen the potential of the study area in terms of floral biodiversity particularly for bryophytes.

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REFERENCES

- Amakawa T. 1964. A short revision of Himalayan *Scapania* (Hepaticae). J. Hattori Bot. Lab. 26: 20-26.
- Asthana A.K. & Sahu V. 2013. Bryophyte diversity in Mukteshwar (Uttarakhand): an overview. Archive for Bryology 154: 1-11.
- Bansal P., Nath V. & Chaturvedi S.K. 2011. Epiphytic bryophytes on *Thuja orientalis* in Nagaland, North-Eastern India. Bangladesh J. Plant Taxon. 18(2): 163-167.
- Bapna K.R. & Kachroo P. 2000. Hepaticology in India-II. Himanshu Publication, Delhi. pp. 490.
- Chopra R.S. 1975. Taxonomy of Indian Mosses (An introduction). New Delhi: Publication and Information Directorate, CSIR.
- Daniels A.E.D. 2010. Checklist of Bryophytes of Tamil Nadu, India. Archive for Bryology 65: 1-117.
- Ellis L. T., Asthana A. K., Srivastava P., Omar I., Rawat K. K., Sahu V., Cano M. J., Costa D. P., Dias E. M., Dias dos Santos N., Silva J. B., Fedosov V. E., Kozhin M. N., Ignatova E. A., Germano S. R., Golovina E. O., Gremmen N. J. M., Ion R., "teĭĭnuĭ S., von Konrat M., Jimenez M. S., Suárez G. M., Kiebacher T., Lebouvier M., Long D. G., Maity D., Ochyra R., Parnikoza I., Plášek V., Fialová L., Skoupá Z., Poponessi S., Aleffi M., Sabovljeviæ M. S., Sabovljeviæ A. D., Saha P., Aziz M. N., Sawicki J., Suleiman M., Sun B.-Y., Váda J., Wójcik T., Yoon Y.-J., ̄arnowiec J. & Larrain J. 2016a. New National and Regional Bryophyte records, 46. Journal of Bryology 38(1): 47-63.
- Ellis L. T., Alata M., Asthana A. K., Rawat K. K., Sahu V., Srivastava A., Bakalin V. A., Batan N., Bednarek-Ochyra H., Bester S. P., Borovichev E. A., De Beer D., Enroth J., Erzberger P., Fedosov V. E., Feuillet-Hurtado C., Gradstein S. R., Gremmen N. J. M., Hedenäs L., Katagiri T., Yamaguchi T., Lebouvier M., Maity D., Mesterházy A., Müller F., Natcheva R., Németh Cs., Opisso J., Özdemir T., Erata H., Parnikoza I., Plášek V., Sabovljeviæ S., Sabovljeviæ A. D., Saha P., Md Nehal Aziz, Schröder W., Váda J., van Rooy J., Wang J., Yoon Y.-J. & Kim J. H. 2016b. New National and Regional Bryophyte records, 47. Journal of Bryology 38(2): 151-167.
- Frahm J.P. 2013. Mosses and liverworts of the Western Ghats, India - a picture book. Archive for Bryology, special volume 14.
- Gangulee H. C. 1969-72. Mosses of Eastern India and adjacent regions. Vol. 1, Calcutta, India.
- Gangulee H.C. 1974-77. Mosses of Eastern India and adjacent regions. Vol. 2, Calcutta, India.
- Gangulee H.C. 1978-80. Mosses of Eastern India and adjacent regions. Vol. 3, Calcutta, India.
- Govindaparyi H., Kumari P., Bahuguna Y.M. & Uniyal P.L. 2012. Evaluation of species richness of Acrocarpous mosses in Imphal district, Manipur, India. Taiwania 57(1): 14-26.
- Hattori S. & Thaitong O. 1978. Indian *Frullania* collection made by Prof. & Mrs. A.J. Sharp and Dr. Z. Iwatsuki. J. Hattori Bot. Lab. 44: 177-193.
- Hattori S. 1966. Bryophyta. In: Hara (ed.), The Flora of Eastern Himalaya. University of Tokyo, Japan, pp. 501-536.
- Herzog T. 1939. Zwei Bryophytensammlungen aus dem Sikkim-Himalaya. Ann. Bryol. 12: 71-97.
- Kashyap S.R. & Chopra R.S. 1932. Liverworts of Western Himalayas and the Panjab plain. II. Lahore. pp. 137.
- Kumar G.V. & Krishnamurthy K.V. 2007. Moss flora of Shervaroy hills of Eastern Ghats. IN: Nath V and Asthana A.K. (eds.) Current Trends in Bryology. Bishen Singh Mahendra Pal Singh, Dehradun, India: 37-45.
- Kumar S & Singh D.K. 2002. Contribution to the mosses of Gobind National Park, Uttaranchal, India. Bull. Bot. Surv. India 44(1-2): 119-134.
- Long D.G. & Grolle R. 1990. Hepaticae of Bhutan II. J. Hattori Bot. Lab. 68: 381-440.
- Majumdar S., Singh S.K., Potemkin A.D. & Singh D. 2016. Female plants and range extensions in *Scapania davidii* Potemkin (Scapaniaceae, Marchantiophyta). Journal of Bryology 38(2): 103-109.
- Manju C.N., Rajesh K.P. & Madhusoodanan P.V. 2008. Checklist of the bryophytes of Kerala, India. Tropical Brology Research Reports 7: 1-24.
- Manju C.N., Rajesh K.P. & Madhusoodanan P.V. 2009. Contribution to the Bryophyte flora of India: Agasthyamalai Biosphere Reserve in Western Ghats. Taiwania 54(1): 57-68.
- Mitten W. 1861. Hepaticae Indiae Orientalis, an enumeration of the Hepaticae of East Indies. J. Proc. Linn. Soc., Bot. 5: 89-128.
- Nath V. & Bansal P. 2009. *Pohlia ludwigii* (Schwaegr.) Broth. - an addition to bryoflora of South India. Geobios 36(4): 245-248.
- Nath V. & Srivastava B. 2010. *Brachymenium capitulatum* (Mitt.) Kindb.-new to Garhwal hills, Western Himalaya. Geophytology 38(1-2): 93-95.
- Nath V., Asthana A.K. & Kapoor R. 2007. Enumeration of the mosses in Amarkantak (Madhya Pradesh), India -I. Taiwania 52(2): 168-176.

- Nath V., Asthana A.K. & Kapoor R. 2008. *Pohlia gedeana* (Bosch & Lac.) Gangulee – A new record from India. *Journal of Indian Botanical Society* 87: 49-52.
- Nath V., Asthana A.K. & Sahu V. 2010. Enumeration of liverworts and mosses of Valley of Flowers, Garhwal hills, Uttarakhand, India. *Geophytology* 39: 49-63.
- Palani R., Sahaya Sathish S., Thamizharasi T. & Vijayakanth P. 2017. Checklist of mosses (Bryophyta) of Bodamalai hills in Eastern Ghats, Tamil Nadu. *Plant Science Today* 4(1): 49-54.
- Potemkin A.D. 2001. Three new species of *Scapania* (hepaticae) from India and China. *Ann. Bot. Fenn.* 38: 83-89.
- Rawat K.K. & Srivastava S.C. 2007. Genus *Plagiochila* in Eastern Himalaya (India). Bishen Singh Mahendra Pal Singh, Dehradun, pp. 258.
- Rawat K.K. & Verma P.K. 2014. On a collection of liverworts from Tawang, Arunachal Pradesh, India with *Frullania rhytocola* Herzog new to India. *Frahmia* 8: 1-7.
- Rawat K.K., Sahu V., Singh C.P. & Verma P.V. 2017. Additions to the Bryophyte flora of Tawang, Arunachal Pradesh, India. *Frahmia* 14: 1-17.
- Robinson H. 1968. Notes on Bryophytes from the Himalayas and Assam. *Bryologist* 71: 82-97.
- Sahu V. & Asthana A.K. 2015. Diversity in Mosses of Pithoragarh and Its Neighbouring Areas, Western Himalaya, India. *Indian Forester* 141(11): 1183-1193.
- Sahu V. & Asthana A.K. 2016. Mosses of Govind Wild Life Sanctuary, Uttarakhand, Western Himalaya, India *Geophytology* 46(2): 147-155
- Schill D. & Long D.G. 2003. A revision of *Anastrophyllum* (Spruce) Steph. (Jungermanniales, Lophoziaceae) in the Himalayan region and western China. *J. Hattori Bot. Lab.* 94: 115-157.
- Sharma D. & Srivastava S.C. 1993. Indian Lepidoziineae- (A taxonomic revision). *Bryophyt. Biblioth.* 47: 1-353.
- Singh Deo S. & Singh D.K. 2016. *Herbertus ramosus* (Herbertaceae, Marchantiophyta) – an addition to Indian bryoflora from Arunachal Pradesh with a note on *H. sendtneri*. *Lindbergia* 39: 1-6.
- Singh D.K. & Singh Deo S. 2014. Notes on scarcely collected Indian liverworts I. *Horikawayella subacuta* and *Pleurozia purpurea* (Marchantiophyta). *Indian J. Forest.* 37(4): 465-472.
- Singh D.K., Singh S.K. & Singh D. 2016. Liverworts and Hornworts of India. An annotated checklist. *Botanical Survey of India, Kolkata.* 439 pp.
- Srivastava S., Srivastava S.C. & Rawat K.K. 2013. Status of family Lophoziaceae (Hepaticae) in India. *Nelumbo* 55: 113-152.
- Srivastava S.C. & Verma P.K. 2005. *Gongylanthus indicus* sp. nov. (Hepaticae) an interesting new addition from India (Nilgiri hills). *Indian J. Forest.* 28:200-205.
- Tewari S.D. & Pant G. 1994. Bryophytes of Kumaon Himalaya, Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Vohra J.N. 1983. Hypnobryales, suborder Leskineae (Musci) of the Himalayas. *Rec. Bot. Surv. India* 23: 1-336.
- Vohra J.N. & Kar B.D. 1996. On a collection of mosses from Arunachal Pradesh. *Bulletin of Botanical Survey of India* 38(1-4): 301-310.