

Chapter 3

STUDY AREA

3. STUDY AREA

Darjeeling is a town in the state of West Bengal of India. It is a part of Eastern Himalaya which has an elevation of 2042 meter and stretches between 27° 2' 9.6253" N and 88° 15' 6192" E. It experiences a temperate climatic condition with wet summers caused by cool moisture laden monsoon rains. Cool and humid climatic condition of this place makes it a perfect habitat for bryophytic growth. Maximum diversity of Indian Bryofolra is seen in Eastern Himalaya. In the present study, Darjeeling is taken as the study area for collection of liverworts. Places surveyed for the collecting liverwort species are presented in figure 3.2 and the details of their location is given in table 3.1.

3.1 RAINFALL

The rainfall in Darjeeling occurs under the influence of Southwest Monsoon. The average annual precipitation is 309.2 (cm). This area experiences an average of 126 days of rain per year. Rainy season prevails from late May to early October. Maximum rainfall occurs in July. December is the driest month of the year with minimum rainfall. March receives maximum amount of winter rain.

3.2 TEMPERATURE

The annual average maximum temperature of Darjeeling is 14.9°C while annual average minimum temperature is 8.9°C. During the coldest months of December and January the mean maximum temperature remains 10.5°C and minimum mean temperature remains 2.5°C. Rapid rise in temperature occurs from March to May and remains almost constant till September resulting in maximum mean temperature of 18.2°C and minimum mean temperature of 11.8°C during this time of the year.

3.3 RAINFALL DAYS

Maximum number of rainy days is observed in the months of May, June, July, August and September. November and December are the driest months of the year with almost no rainfall. Months of January February and March sometimes receives few winter rain.

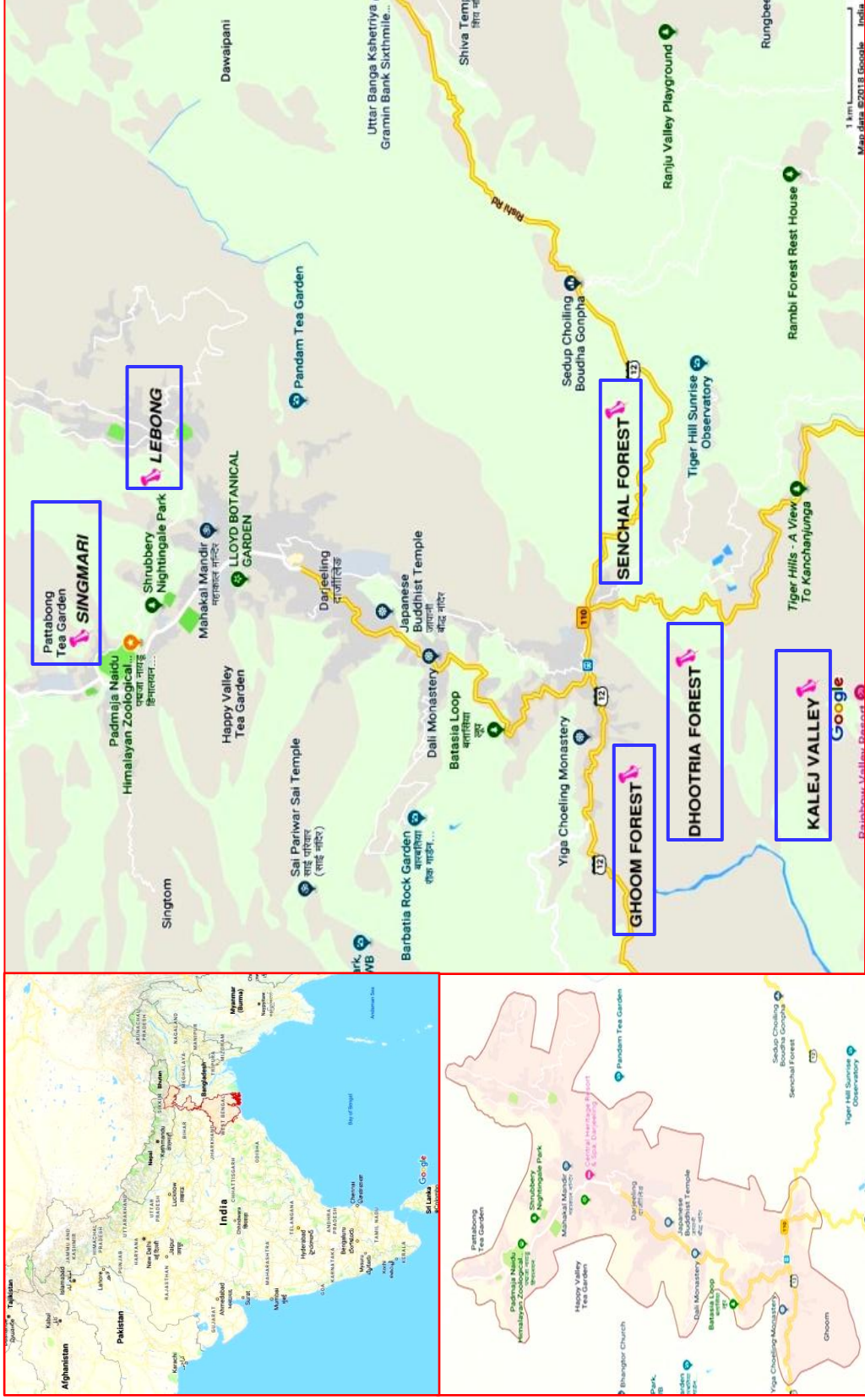


Fig 3.2: Map of surveyed areas of Darjeeling for liverwort sample collection (Sanchal forest, Ghoom forest, Dhootria forest, Kalej valley, Singmari, Lebond)

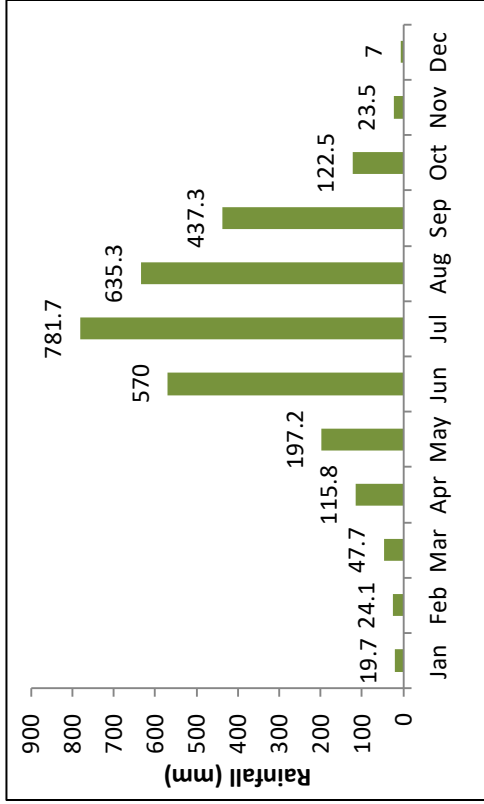


Fig 3.3: Average rainfall of Darjeeling throughout the year

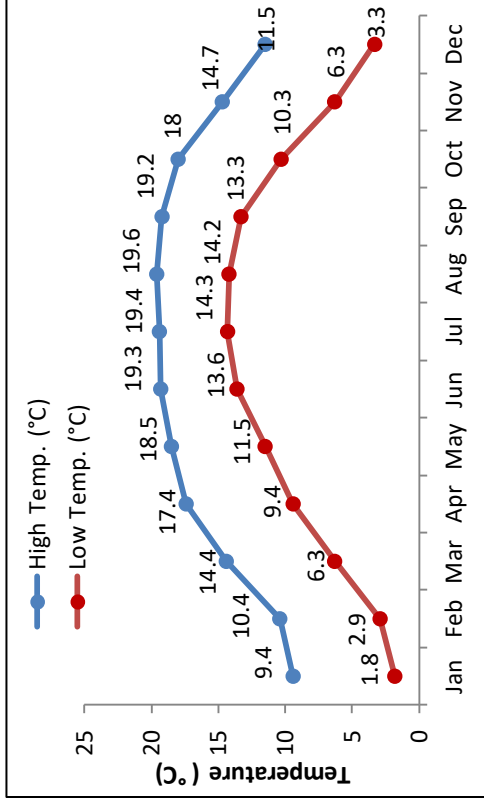


Fig 3.4: Average temperature of Darjeeling throughout the year

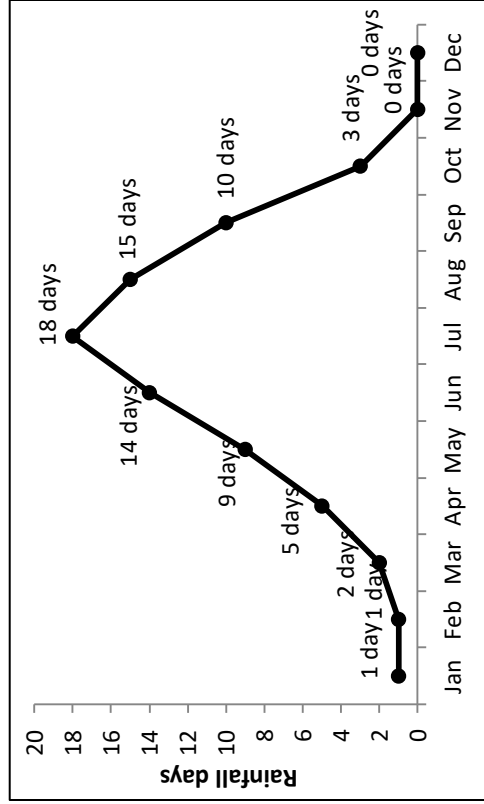


Fig 3.5: Average rainfall of Darjeeling throughout the year

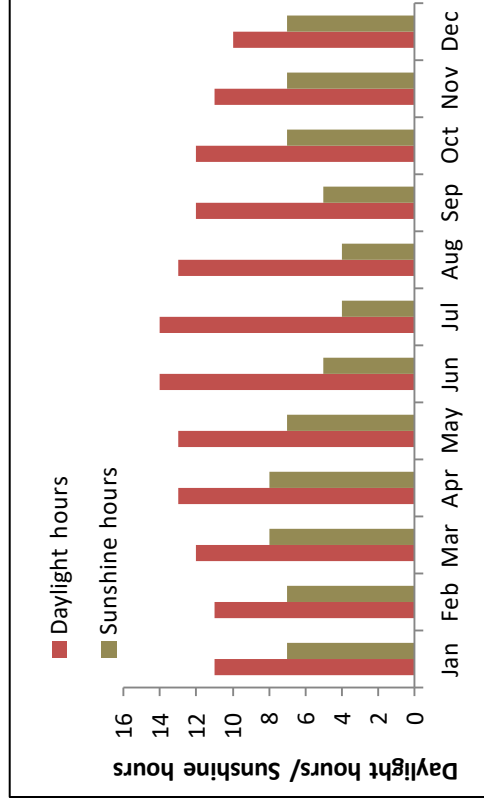


Fig 3.6: Average sunshine hours of Darjeeling throughout the year

3.4 SUNSHINE HOURS

Average daylight hours are shorter during the months of November, December, January, February and March but the average sunshine hours in these months is higher than rest of the months of a year. From April daylight light hours increases, reach the highest during the month of June and July and gradually start to decrease from the month of August. However the average sunlight hours starts decreasing from the month of April and reaches minimum in July and August. Average sunshine starts increasing again from the month of October.

Table 3.1: Altitudinal details of the sites of collection of studied eleven liverwort species

<i>Locality</i>	<i>Altitude</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Species</i>	<i>Abundance at the site of collection</i>
Senchal Forest, Darjeeling	2471 m	27.0072° N	88.2826°E	<i>Pellia epiphylla</i> (L.) Corda	+++
Ghoom, Darjeeling	2196 m	27.0008° N,	88.2437° E	<i>Conocephalum japonicum</i> (Thunb.) Grolle	++
Singmari, Darjeeling	2137 m	27.0606° N	88.2565° E	<i>Lunularia cruciata</i> (L.) Dumort. Ex Lindb	+
Kalej Valley, Daejeeling	1698 m	26.9816°N	88.2524° E	<i>Dumortiera hirsute</i> (Sw.) Nees	+++
Dhootria, Darjeeling	1789 m	26.9953 °N	88.2525° E	<i>Marchantia emarginata</i> Reinw., Blume & Nees subsp. <i>emarginata</i>	++
Dhootria, Darjeeling	1789 m	26.9954 °N	88.2542° E	<i>Marchantia subintegra</i> Mitt.	+
Singmari, Darjeeling	2133 m	27.0594 °N	88.2491° E	<i>Marchantia polymorpha</i> L. subsp. <i>ruderalis</i> Bischl. & Boisselier- Dubayle	++
Dhootria, Darjeeling	1824 m	26.9953 °N	88.2525° E	<i>Plagiochasma cordatum</i> Lehm. & Lindenb	++
Lebong, Darjeeling	1257 m	27.0528 °N	88.2745° E	<i>Asterella wallichiana</i> (Lehm.) Grolle	++
Kalej Valley, Darjeeling	1745 m	26.9812 °N	88.2535° E	<i>Plagiochila nepalensis</i> Lindenb.	+
Singmari, Darjeeling	2135 m	27.0593 °N	88.2485° E	<i>Marchantia paleacea</i> Bertol.	+++

NB: += moderate, ++= high, +++= very high



Fig 3.7.1: Photograph of *Lunularia cruciata*



Fig 3.7.2: Photograph of *Dumortiera hirsuta*



Fig 3.7.3: Photograph of *Pellia epiphylla*



Fig 3.7.4: Photograph of *Marchantia paleacea*



Fig 3.7.5: Photograph of *Marchantia polymorpha*



Fig 3.7.6: Photograph of *Conocephalum japonicum*



Fig 3.7.7: Photograph of *Marchantia subintegra*



Fig 3.7.8: Photograph of *Plagiochasma cordatum*



Fig 3.7.9: Photograph of *Asterella wallichiana*



Fig 3.7.10: Photograph of *Marchantia emarginata*



Fig 3.7.11: Photograph of *Plagiochila nepalensis*

3.5 ENUMERATION OF TAXA

1. *Marchantia paleacea* Bertol. subsp. *paleacea*

Family: Marchantiaceae

Marchantia paleacea Bertol., Opusc. Sci. 1: 242. 1817; Bischl., Bryophyt. Biblioth. 38: 93. 1989. D.Singh & D.K.Singh, Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci. 83(1): 23. 2013. *Marchantia nepalensis* Lehm. & Lindenb. in Lehm., Nov. Strip. pug. 4: 10. 1832; V.B. Singh, Natl. Bot. Gard. Bull. 125: 15. 1966. *Marchantia nitida* Lehm. & Lindenb. in Lehm., Nov. Strip. pug. 4: 11. 1832; Mitt., J. Proc. Linn. Soc., Bot. 5: 125. 1861. subsp. *paleacea*

Voucher specimens: India, Eastern Himalaya, Darjeeling, Singmari, 2133 m, 15/6/2012, *Sumira Mukhia* 51876/C (CAL)

2. *Pellia epiphylla* (L.) Corda.

Family: Pelliaceae

Pellia epiphylla (L.) Corda in Opiz (ed.) Beitr. Zur Naturg. 12 (1829) 654; R.S. Chopra in J. Indian Bot. Soc. 22 (1943) 241. *Jungermannia epiphylla* L., Sp. pl. 2 (1753) 1135.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Senchal, 2471 m, 06.03.2013, *Sumira Mukhia* 51871/6 (CAL)

3. *Dumortiera hirsuta* (Sw.) Nees

Family: Dumortieraceae

Dumortiera hirsuta (Sw.) Nees, Fl. Bras. Enum. Pl. 1: 307. 1833 subsp. *hirsuta*; Kashyap, Liverw. W.Himal. 1: 42. 1929; Sushil K.Singh & D.K.Singh, Hepat. Anthoc. Gr. Him. Nat. Park 377. 2009.. *Marchantia hirsuta* Sw., Prodr. 145. 1788.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Kalej Valley, 1698 m, 09.08.2015, *Sumira Mukhia* 51892/16 (CAL)

4. *Marchantia polymorpha* L. subsp. *polymorpha*

Family: Marchantiaceae

Marchantia polymorpha L., Sp. Pl. 1137. 1753; Mitt., J. Proc. Linn. Soc., Bot. 5: 125. 1861; V.B. Singh, Natl. Bot. Gard. Bull. 125: 20. 1966; Bischl., Bryophyt. Biblioth. 38: 74. 1989; D.Singh & D.K.Singh, Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci. 83(1): 24. 2013. subsp. *polymorpha*

Voucher specimens: India, Eastern Himalaya, Darjeeling, Singmari, 1698 m, 12.08.2015, *Sumira Mukhia* 51879/1 (CAL)

5. *Conocephalum japonicum* (Thunb.) Grolle

Family: Conocephalaceae

Conocephalum japonicum (Thunb.) Grolle, J. Hattori Bot. Lab. 68: 423. 1990; D.K.Singh & Sushil K.Singh, Indian J. Forest. 26(4): 442. 2003. *Marchantia japonica* Thunb., Fl. Jap. 344. 1784.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Ghoom, 1698 m, 07.08.2015, *Sumira Mukhia* 51882/4 (CAL)

6. *Asterella wallichiana* (Lehm. & Lindenb.) Pande & al. ex Grolle

Family: Aytoniaceae

Pande et al. ex Grolle, Ergebnisse der Forschungs-Unternehmens Nepal Himalaya 1 (1966) 262; D.G. Long in Bryophyt. Biblioth. 63 (2006) 144. *Fimbriaria wallichiana* Lehm. & Lindenb., Nov. Strip. pug. 4 (1832) 4. *Asterella angusta* (Steph.) Mahab. & Bhate in J. Univ. Bombay 13 (5) (1945) 5; R.S. Chopra in J. Indian Bot. Soc. 22 (1943) 238.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Lebong, 1257 m, 06.08.2015, *Sumira Mukhia* 51881/3 (CAL)

7. *Plagiochila nepalensis* Lindenb.

Family: *Plagiochilaceae*

Plagiochila nepalensis Lindenb., Sp. Hepat. (*Plagiochila* fasc. 2 – 4): 93. 1840; M.L.So, Syst. Bot. Monog. 60: 156. 2001; K.K.Rawat & S.C.Srivast., Genus *Plagiochila* in E. Himal. 176. 2007.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Kalej Valley, 1745 m, 11.08.2015, *Sumira Mukhia* 51889/11 (CAL)

8. *Marchantia subintegra* Mitt.

Family: Marchantiaceae

Marchantia subintegra Mitt., J. Proc. Linn. Soc., Bot. 5: 125. 1861; V.B. Singh, Natl. Bot. Gard. Bull. 125: 23. 1966; Bischl., Bryophyt. Biblioth. 38: 74. 1989; D. Singh & D.K.Singh, Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci. 83: 25. 2013. *Marchantia papulosa* Amakawa in Hara, Fl E. Himal. 535. 1966.

Voucher specimens: India, Eastern Himalaya, Darjeeling, Dhootria, 1745 m, 09.08.2015, *Sumira Mukhia* 51884/6 (CAL)

9. *Lunularia cruciata* (L.) Dumort. ex Lindenb.

Family: Lunulariaceae

Lunularia cruciata (L.) Dumort. ex Lindenb., Not. Sällsk. Fauna Fl. Fenn. Förh. 9: 298. 1868. *Marchantia cruciata* L., Sp. Pl. 1137. 1753. subsp. *cruciata*

Voucher specimens: India, Eastern Himalaya, Darjeeling, Singmari, 1928 m, 09.08.2015,
Sumira Mukhia 51891/17 (CAL)

10. *Marchantia emarginata* Reinw. Blume & Nees

Family: Marchantiaceae

Marchantia emarginata Reinw. Blume & Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 192. 1824; Bischl., Bryophyt. Biblioth. 38: 183. 1989. *Marchantia palmata* Reinw. Blume & Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 193. 1824. subsp. *emarginata*

Voucher specimens: India, Eastern Himalaya, Darjeeling, Dhootria, 1789 m, 09.08.2015,
Sumira Mukhia 51887/9 (CAL)

11. *Plagiochasma cordatum* Lehm. & Lindenb.

Family: Aytoniaceae

Plagiochasma cordatum Lehm. & Lindenb. in Lehm., Nov. Stirp. Pug. 4: 13. 1832; Kashyap, Liverw. W. Himal. Pl. 1: 81. 1929. *Plagiochasma paradoxum* Griff., Not. Pl. Asiat. 2: 330. 1849

Voucher specimens: India, Eastern Himalaya, Darjeeling, Dhootria, 1824 m, 09.08.2015,
Sumira Mukhia 51883/5 (CAL)