

EPIPHYTIC BRYOPHYTES ON *THUJA ORIENTALIS* IN NAGALAND, NORTH-EASTERN INDIA

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Abstract

A survey of bryophyte diversity in district Mokokchung (Nagaland) has brought to light an unexpectedly rich bryophyte flora, including several interesting species to Nagaland. The tree species *Thuja orientalis* Linn. growing in Nagaland, luxuriantly covered by epiphytic bryophytes with wide range of diversity. The samplings were made from tree base up to canopy as well as abaxial and adaxial side of the tree. Investigation has revealed twelve species of mosses represented to eight families belonging to the genus *Brachymenium* Schwaegr., *Plagiothecium* B.S.G., *Entodontopsis* Broth., *Entodon* C. Muell., *Erythrodonium* Hamp., *Fabronia* Raddi, *Regmatodon* Brid., *Floribundaria* Fleisch. and *Hyophila* Brid., four species of hepatics belonging to two families and two genera *Frullania* Raddi and *Lejeunea* Libert compose the corticolous bryophyte vegetation of *Thuja orientalis* in some of the localities of Nagaland, North-east region of India. The richness and diversity of bryophytes on *Thuja* tree bark have been assessed for the first time.

Introduction

Thuja orientalis Linn. is a distinct species of densely branched evergreen coniferous tree in the cypress family Cupressaceae and is widely distributed in China, Korea, Japan, Iran and India. The trees are conical shaped, slow growing, 5-8 m tall and 3 m wide. *Thuja orientalis* is widely used as an ornamental tree in homeland, where it is associated with long life and vitality, as well as elsewhere in temperate climates. Although this coniferous tree has been subjected to different kinds of researches, no critical study of their epiphytic bryophytes has been carried out till date. In addition, study of the epiphytic bryophytes may provide interesting information about the environments of the study area because these are often valuable environmental indicators as well (Barkman, 1958; Smith, 1982; Bates *et al.*, 2004; Medina *et al.*, 2010). The vegetation of Nagaland has been summarized by various workers (Robinson, 1841; Masters, 1848; Clarke, 1889; Kanjilal *et al.*, 1934-40; Bor, 1942; Panigrahi, 1960; Hynniewta, 1986; Jamir and Rao, 1988; Singh and Sinha, 1994). It varies according to altitudinal gradient and ranges from tropical-evergreen to temperate-evergreen to coniferous. Exploration of bryophytes in Nagaland was started by Gangulee (1969-1980), who worked on the mosses of Eastern India and adjacent regions and reported 77 species of mosses belonging to 55 genera from different parts of Naga Hills, though the exact localities of these taxa are not yet confirmed. Later Udar and Asthana (1985)

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studied hornworts and reported a new species *Anthoceros pandei* - a hornwort from Mao area of Nagaland, but no attention was paid towards the hepatic flora of this state. Three species of hepatic genus *Frullania* viz. *F. wallichiana* Mitt., *F. ericoides* Nees. and *F. muscicola* Steph. (Nath *et al.*, 2010) and three species of moss genus *Brachymenium* viz. *B. bryoides* Hook. ex Schwaegr., *B. capitulatum* (Mitt.) Kindb. and *B. longicolle* Ther. (Bansal *et al.*, 2010) were reported for the first time from Mokokchung and Kohima districts of Nagaland. The tree species *Thuja orientalis* growing in Nagaland, ornamentally in a number of residential campuses covered with epiphytic bryophytes. Recently, an attempt has been made to study bryophytes growing epiphytically in Nagaland.

Materials and Methods

Field survey of bryophytes growing epiphytically on tree trunk and branches of *Thuja orientalis* in Mokokchung district of Nagaland was carried out in the month of August 2008. The samplings were made from tree base up to canopy as well as abaxial and adaxial side of the tree for study.

Results and Discussion

Thirty two specimens belonging to sixteen species and out of these twelve species of mosses belonging to the genera *Brachymenium* Schwaegr., *Plagiothecium* B.S.G., *Entodontopsis* Broth., *Entodon* C. Muell., *Erythrodontium* Hamp., *Fabronia* Raddi, *Regmatodon* Brid., *Floribundaria* Fleisch. and *Hyophila* Brid. (assignable to 8 families) and four species of liverworts belonging to the genera *Frullania* Raddi and *Lejeunea* Libert (assignable to 2 families) constitute the corticolous bryophyte vegetation of *Thuja orientalis* in Mokokchung district of Nagaland, North-eastern India provide first hand information of epiphytic bryophytes on *Thuja* tree.

In Nagaland epiphytic bryophyte communities of mosses appear more frequently and more dominant than liverworts (Plate 1). *Entodontopsis leucostega* (Brid.) Buck & Ireland (Stereophyllaceae), *Fabronia secunda* Mont., *F. schensiana* C. Muell. (Fabroniaceae), *Brachymenium capitulatum* (Mitt.) Kindb., *B. longicolle* Ther. (Bryaceae) are very common epiphytic bryophytes in Nagaland, whereas *Hyophila nymaniana* (Fleisch.) Menzel (Pottiaceae), *Plagiothecium cavifolium* (Brid.) Iwats. (Plagiotheciaceae) in the upper trunk, *Regmatodon orthostegius* Mont. (Regmatodontaceae), *Frullania ericoides* Nees. and *F. wallichiana* Mitt. (Frullaniaceae) in the lower trunk, *Erythrodontium julaceum* (Schwaegr.) Par. (Entodontaceae) in the middle trunk and *Plagiothecium neckeroideum* var. *sikkimense* Ren. et Card. (Plagiotheciaceae), *Floribundaria floribunda* (Doz. et Molk.) Fleisch. (Meteoriaceae) in the basal zone, are less confined and show less abundance in comparison to genera belonging to family Stereophyllaceae, Fabroniaceae and Bryaceae (Table 1). In case of liverworts both the species of genus *Frullania* viz. *F. ericoides* Nees. and *F. wallichiana* Mitt. (Frullaniaceae) are confined to lower trunk only and the plants of *Lejeunea curviloba* Steph. (Lejeuneaceae) are present as epiphytes on the branches only, on the other hand, plants of *Lejeunea cavifolia* (Ehrh.) Lindb. are present on the middle as well as basal zone of trunk.



Plate 1

Figs 1-16. 1: *Entodon scariosus* Ren. et Card., 2: *Entodontopsis leucostega* (Brid.) Buck & Ireland., 3: *Lejeunea cavifolia* (Ehrh.) Lindb., 4: *Fabronia secunda* Mont., 5: *Erythrodontium julaceum* (Schwaegr.) Par., 6: *Plagiothecium neckeroideum* var. *sikkimense* Ren. et Card., 7: *Lejeunea curviloba* Steph., 8: *Frullania wallichiana* Mitt., 9: *F. ericoides* Nees., 10: *Brachymenium capitulatum* (Mitt.) Kindb., 11: *B. longicolle* Ther., 12: *Plagiothecium cavifolium* (Brid.) Iwats., 13: *Fabronia schensiana* C. Muell., 14: *Regmatodon orthostegius* Mont., 15: *Floribundaria floribunda* (Doz. et Mol.) Fleisch., 16: *Hyophila nymaniana* (Fleisch.) Menzel.

Table 1. Diversity of epiphytic bryophytes on different parts of *Thuja orientalis* Linn.

S. N.	Name of taxa	Family	Ecology					Associated taxa	
			Trunk			Near bifurcation	Branch system		
			Base	Lower	Middle				Upper
			MOSES						
1	<i>Brachymenium capitulatum</i>	Bryaceae		+	+		+		<i>En. leucostega</i> , <i>F. schensiana</i> , <i>Fu. hygrometrica</i> , <i>H. nymmaniana</i>
2	<i>B. longicolle</i>	Bryaceae		+			+		<i>P. cavifolium</i> , <i>R. orthostegius</i> , <i>Fr. wallichiana</i>
3	<i>Entodon scariosus</i>	Entodontaceae	+					+	
4	<i>Entodontopsis leucostega</i>	Stereophyllaceae		+	+			+	<i>B. capitulatum</i> , <i>F. schensiana</i> , <i>F. secunda</i> , <i>L. cavifolia</i>
5	<i>Erythrodontium julaceum</i>	Entodontaceae			+			+	<i>B. capitulatum</i> , <i>En. leucostega</i> , <i>Fl. floribunda</i>
6	<i>Fabronia schensiana</i>	Fabroniaceae	+		+			+	<i>En. leucostega</i> , <i>Er. julaceum</i> , <i>L. cavifolia</i>
7	<i>F. secunda</i>	Fabroniaceae			+			+	<i>F. schensiana</i>
8	<i>Floribundaria floribunda</i>	Meteoriaceae	+						<i>B. capitulatum</i> , <i>Fu. Hygrometrica</i>
9	<i>Hyophila nymmaniana</i>	Pottiaceae					+		<i>B. longicolle</i>
10	<i>Plagiothecium cavifolium</i>	Plagiotheciaceae					+		<i>L. cavifolia</i>
11	<i>P. neckeroides</i> var. <i>sikkimensis</i>	Plagiotheciaceae	+						<i>B. longicolle</i> , <i>Fr. wallichiana</i>
12	<i>Regmatodon orthostegius</i>	Regmatodontaceae					+		<i>F. schensiana</i>
13	<i>Frullania ericoides</i>	Frullaniaceae							<i>B. longicolle</i> , <i>R. orthostegius</i>
14	<i>F. wallichiana</i>	Frullaniaceae					+		<i>En. leucostega</i> , <i>F. schensiana</i> , <i>P. neckeroides</i> var. <i>sikkimensis</i>
15	<i>Lejeunea cavifolia</i>	Lejeuneaceae	+				+		
16	<i>L. curviloba</i>	Lejeuneaceae	+				+		

B = *Brachymenium*, E = *Entodon*, En = *Entodontopsis*, Er = *Erythrodontium*, F = *Fabronia*, Fl = *Floribundaria*, Fr = *Frullania*, H = *Hyophila*, L = *Lejeunea*, P = *Plagiothecium*, R = *Regmatodon*

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References

- Barkman, J.J. 1958. Phytosociology and ecology of cryptogamic epiphytes. Van Gorcum, Assen, Netherlands, pp. 628.
- Bansal, P., Nath, V. and Chaturvedi, S.K. 2010. Morphotaxonomic study on the genus *Brachymenium* Schwaegr. from Nagaland (North-eastern Hills), India. *Phytomorphology* **60**(3&4): 150-155.
- Bates, J.W., Roy, D.B. and Preston, C.D. 2004. Occurrence of epiphytic bryophytes in a 'tetrad' transect across southern Britain. 2. Analysis and modelling of epiphyte-environment relationships. *J. Bryol.* **26**: 181-197.
- Bor, N.L. 1942. Some remarks on the Geology and Flora of the Naga and Khasi hills. 150th Anniversary Volume of Royal Botanical Garden, Calcutta. pp. 129-195.
- Clarke, C.B. 1889. Some new plants of Kohima and Munneypore. *J. Linn. Soc. Lond. Bot.* **25**: 1-105.
- Gangulee, H.C. 1969-1980. Mosses of Eastern India and Adjacent Regions, Vol. I-III. Books and Allied (P) Ltd., Kolkata, India.
- Hynniewta, T.M. 1986. Orchidaceae of Nagaland (A detailed knowledge of the Orchid flora). Ph.D. Thesis. Gauhati University, Gauhati, India.
- Jamir, N.S. and Rao, R.R. 1988. The ferns of Nagaland. Bishen Singh Mahendra Pal Singh, Dehradun, India. pp. 23-27.
- Kanjilal, U.N., Kanjilal, P.C., Das, A., De, R.N. and Bor, N.L. 1934-1940. Flora of Assam. Vols. 1-4, Government Press, Shillong.
- Masters, J.W. 1848. Extract from a memoir of some natural productions of the Angami Naga hills and other parts of Upper Assam. *J. Asiat. Soc. Bengal* **17**(1): 57-59.
- Medina, R., Lara, F., Albertos, B., Draper, I., Garilleti, R. and Mazimpaka, V. 2010. Epiphytic bryophytes in harsh environments: the *Juniperus thurifera* forests. *J. Bryol.* **32**: 23-31.
- Nath V., Chaturvedi, S.K. and Bansal, P. 2010. Studies on the genus *Frullania* Raddi of Nagaland. *In*: Gupta, R.C. (ed.), Nagaland University Research Communication, Cambridge University Press India Pvt. Ltd., New Delhi. pp. 171-178.
- Panigrahi, G. 1960. Pteridophytes of Eastern India - I. Enumeration of the species collected and their nomenclature. *Bull. Bot. Surv. Ind.* **2**: 309-314.
- Robinson, W. 1841. A descriptive account of Assam. London.
- Singh, K.P. and Sinha, G.P. 1994. Lichen flora of Nagaland. Bishen Singh Mahendra Pal Singh, Dehradun, India. pp. 10-23.
- Smith, A.J.E. 1982. Epiphytes and epiliths. *In*: Bryophyte ecology. London, Chapman and Hall, pp. 191-227.
- Udar, R. and Asthana, A.K. 1985. A new *Anthoceros* from Nagaland. *J. Ind. Bot. Soc.* **64**: 303-305.

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