International Research Journal of Biological Sciences _____ ISSN 2278-3202
Vol. **8(5),** 21-28, May **(2019)** *Int. Res. J. Biological Sci.*

Bryophyte diversity of Jammu and Kashmir State, India

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Available online at: www.isca.in, www.isca.me
Received 20th January 2019, revised 6th April 2019, accepted 5th May 2019

Abstract

Bryophytes are unique group of land plants which exhibit maximum gametophytic diversity among the entire plant kingdom. They are cosmopolitan in distribution but their luxuriance is determined by a number of environmental factors like light, humidity, Temperature, ph, altitude etc. Himalayas which provide humid and shady conditions are suitable habitats for bryophyte growth. Jammu and Kashmir is situated in the extreme north of Indian union which lies between the coordinates 32°17` to 37°20`north latitude and 73°25 to 80° 30 east longitude. Several tribal communities from different corners of world use different species of bryophyte against several disorders and same is the case of tribal peoples of Jammu and Kashmir.

Keywords: Bryophyte, Jammu and Kashmir, review, liverworts, mosses, hornworts.

Introduction

About 20,000 species of bryophyta which belongs to 960 genera are found in world. During 19th and 20th century several scientists works on distribution, taxonomy and other aspects of bryophytes. India is very rich in bryophyte diversity. About 850 species which belongs to 52 families and 140 genera's of liverworts are reported in India[1], Similarly 2000 species which belongs to 54 families and 342 genera's of mosses are present in India[2]. Western coastal regions and Western Ghats of India are home for about 121 and 682 species of liverworts and mosses respectively. In Western Ghats and coastal regions 10 and 190 endemic species of liverworts and mosses are present[3]. Jammu and Kashmir region is a part of north western region and it is very rich in bryophyte diversity[4]. Among photosynthetic land plants. Bryophytes find second position in distribution and diversity . Bryophytes are the oldest land plants on earth and have three lineages, liverworts, hornworts and mosses. They occupy a unique position in the evolutionary status of cryptogams[5]. Jammu and Kashmir which forms the part of the North Western regions of Himalayas, exhibit abundant bryophyte diversity. About 180 Bryophytes are present in three regions of the state[6]. Periodic collections have revealed that bryophyte diversity has been found to increase with increase in altitude. Maximum number of bryophytes are found at altitudes higher than 1000m. At lower altitudes, most common species that are found are *Plagiochasma appendiculatum*, *Asterella multiflora, A. wallichiana, Marchantia paleacea, M. papillata, Pellia endivaefolia* etc. whereas liverworts like *Conocephalum conicum, Dumortiera hirsuta, Preissia quadrata* are found at higher altitudes. A total of 18500 species of Bryophytes belongs to nearly 1050 genera are present all over the world[7].The credit of identifying hepatics of Kashmir first time goes to Stephani (1900-1924) followed by Gola (1914), who reported eleven species of liverworts from Kashmir valley[8]. Kashyap recorded 22 and 9 species hepatic taxa from Kashmir valley Ladakh region respectively[9]. The first checklist of the bryophytic elements of Kashmir Valley was given by Robinson and he reported 56 moss and 4 liverwort species[9]. Kaul and Dhar reported a total of 35 species of bryophytes from the Kashmir valley[10]. Kachroo (1970) Iqbal et al. (2011) Sharma et al. (2011) and Bhagat et al. (2012) studied some important aspects of the Bryoflora of Jammu region including exploration and enumerations[11-13]. 60 % of bryophyta shows world wide resemblance which suggests that this group of green plants has a high phylogenetic age[14].

Following is the list of Sub groups found in three regions of Jammu and Kashmir[15].

Table-1: Distribution of Bryophyte in Jammu and Kashmir

Subgroup	Jammu	Kashmir	Ladakh
Liverworts	66	48	9
Hornworts	4	-	-
Mosses	13	162	--

Materials and methods

Information about bryophytes found in Jammu and Kashmir were collected from the available literature. Species given under each genus is based on literature review. The present study shows that state of Jammu and Kashmir is natural abode for several bryophyte species. The detailed explanation about the presence of bryophyte in Jammu and Kashmir is shown in the Table-1. For the literature survey several data base like

PubMed, Science direct, Research gate, web of science, Google scholar are used. The related papers were downloading by using the free access portal of Jiwaji University Gwalior. The most used key words for the literature survey were as: i. Bryophytes found in Jammu and Kashmir, ii. Bryophytes of Kashmir, iii. Bryophytes in Jammu, iv. Bryophytes present in all regions of State of Jammu and Kashmir.

Results and discussion

Jammu and Kashmir is very rich in bryophyte diversity. A total 241species of bryophyte are present in the State of Jammu and Kashmir. The detailed information about the bryophytes of Jammu and Kashmir State is explained in Table-1.

Table-2: List of bryophytes found in Jammu and Kashmir.

Order	Family	Genus	Species
Polytrichales	Polytrichaceae	*Atrichum*	*A.aculeatum*
-	-	*Polytrichum*	*P.piliferum*
Diphysciales	Diphysciaceae	*Theriotia*	*T. kashmirensis*
-	-	-	*T. lorifolia*
Timmiales	Timmiaceae	*Timmia*	*T. austriaca*
-	-	-	*T.bavarica*
-	-	-	*T.megapolitana*
Encayptales	Encalyptaceae	*Encalypta*	*E. alpine*
-	-	-	*E. ciliate*
-	-	-	*E.rhabdocarpa*
-	-	-	*E.streptocarpa*
-	-	-	*E.tibetiana*
Funariialis	Funariaceae	*Funaria*	*F.capillipes*
-	-	-	*F.koelzii*
-	-	-	*F.orthocarpa*
-	-	-	*F.pilifera*
-	-	-	*F.wizkii*
Grimmiales	Grimmiaceae	*Cosinodon*	*C.cribrosus*
-	-	*Griminia*	*G.laevigata*
-	-	-	*G.poecilostoma*
-	-	-	*G.unicolour*
-	-	*Schistidium*	*S.alpicola*
-	Ptychomitriaceae	*Indusiella*	*I.thianschanica*
Dicranales	Fissidentaceae	*Fissidens*	*F.grandiforms*
-	Ditrichaceae	*Distichium*	*D.carillaceum*
-	-	-	*D.inclinatum*
-	-	*Saelania*	S.*glaucescens*
-	Rhabdoweisiaceae	*Dicranowweisia*	*D.cirrata*
-	-	*Oncophorous*	*O.gracillimus*
-	-	-	*O.virens*
-	-	-	*O.wahlenbergi*
-	-	*Oreas*	*O.martiana*
-	-	*Oreoweisia*	*O.laxifolia*
-	Dicranaceae	*Dicranum*	*D.kashmirense*
-	-	-	*D.lorifolium*
-	-	-	*D.lorifolium*
-	-	*Orthodicranum*	*O.montanum*
-	-	*Compylopodiella*	*C.fragilis*
-	-	-	*C.sedgwickii*
Pottiales	Pottiaceae	*Barbula*	*B.canaliculata*
-	-	-	*B.fallax*
-	-	-	*B.microstoma*
-	-	-	*B.stewartii*
-	-	*Bryoerythrophyllum*	*B.alpigenum*
-	-	-	*B.recurvirostre*
-	-	-	*B.recurvirostrum*
-	-	*Cinclidotus*	*C.acutifolius*
-	-	*Didymodon*	*D.vinealis*
-	-	*Hydrogonium*	*H.amplexifolium*
-	-	-	*H.pseudoehrenbergii*
-	-	*Hymenostomum*	*H.microstomum*
-	-	*Pottia*	*P.starkeana*
-	-	*Stegonia*	*S.latifolia*

Order	Family	Genus	Species
-	-	*Timmiella*	*T.anomala*
-	-	*Tortella*	*T.alpicola*
-	-	*Tortula*	*T.brandisii*
-	-	-	*T.muralis*
-	-	-	*T.pseudoprincep s*
-	-	-	*T.rubripila*
-	-	-	*T.websteri*
-	-	*Trichostomum*	*T.uncifolium*
-	-	*Weissia*	*W.rutilans*
-	-	-	*W.wimmeriana*
-	-	Barbula	*B.asperfolia*
-	-	-	*B.cylindrica*
-	-	-	*B.vinealis*
Splachn ales	Splachnaceae	*Tayloria*	*T.froelichiana*
-	Meesiaceae	*Amblydon*	*A.dealbatus*
-	-	*Leptobryum*	*L.pyriforme*
Bryales	Bryaceae	Anomobryum	*A*.astrorense
-	-	-	*A.kashmirense*
-	-	-	*A.parvifolium*
-	-	-	*A.pellucidm*
-	-	*Bryum*	*B.argentenum*
-	-	-	*B.caespiticium*
-	-	-	*B.capillare*
-	-	-	*B.pseudotriquetr um*
-	-	-	*B.uliginosum*
-	-	*Mielichhobryu m*	*M.himalayanum*
-	-	*Mniobryum*	*M.lufwigii*
-	-	-	*M.wahlenbergii*
-	-	*Rhodobryum*	*R.ontariense*
-	Mniaceae	*Mielichhoferia*	*M.badhwarii*
-	-	-	*M.himalayana*
-	-	*Mnium*	*M.affine*

Order	Family	Genus	Species
-	-	-	*M.cuspidatum*
-	-	*Pohlia*	*P.longicolla*
-	-	-	*P.minor*
-	-	*Plagiomnium*	*P.cuspidatum*
-	-	*Mnium*	*M.rostratum*
-	-	-	*M.confertidens*
-	-	-	*M.integrum*
-	-	-	*M.succlentum*
Bartbra miales	Bartramiaceae	*Bartramia*	*B.halleriana*
-	-	-	*B.ithyphylla*
-	-	*Conostomum*	*C.tetragonium*
-	-	*Philonotis*	*P.seriata*
-	-	*Plagiopus*	*P.oederi*
-	-	*Philonotics*	*P.falcuta*
Orthotri chales	Orthotrichaceae	*Orthotrichum*	*O.offine*
-	-	-	*O.alpestre*
-	-	-	*O.anomalum*
-	-	-	*O.cupulatum*
-	-	-	*O.duthiei*
-	-	-	*O.griffthii*
-	-	-	*O.hispanicum*
-	-	-	*O.macounii*
-	-	-	*O.rupestre*
-	-	-	*O.striatum*
-	-	-	*O.sturmii*
-	-	-	*O.urnigerum*
-	-	-	*O.venustum*
-	-	-	*O.virens*
Hedwigi ales	Hedwigiaceae	*Braunia*	*B.attenuata*
Rhizogo niales	Aulacomniaceae	*Aulacommium*	*A.androgyum*
-	-	-	*A.palustre*
-	-	-	*A.turgidum*

Order	Family	Genus	Species
Hypnales	Amblystegiaceae	*Amblystegium*	*A.serpens*
-	-	-	*A.subdilatatum*
-	-	*Campyliadelphus*	*C.brevisetum*
-	-	*Cratoneuron*	*C.commutatum*
-	-	-	*C.filicinum*
-	-	*Drepanocladus*	*D.exannulatus*
-	-	*Hygrohypnum*	*H.dilatatum*
-	-	-	*H.luridam*
-	-	-	*H.subdilatatum*
-	-	Drepanocladus	*D.aduncus*
-	Leskeaceae	*Haplociadium*	*H.microphyllum*
-	-	*Lescuraea*	*L.incrassate*
-	-	-	*L.incurvata*
-	-	-	*L.laevifolia*
-	-	-	*L.mutabilis*
-	-	-	*L.nervosa*
-	-	*Leskea*	*L.hyaloapiculata*
-	-	*Laskeela*	*L.incrassata*
-	-	-	*L.nervosa*
-	-	*Pseudolaskeella*	*P.catenulata*
-	-	*Lindbergia*	*L.duthiei*
-	Thuidiaceae	*Thuidium*	*T.meyenianum*
-	-	-	*T.glaucinum*
-	-	-	*T.orientole*
-	Brachytheciaceae	*Brachytheciu m*	*B.cirrosum*
-	-	-	*B.kamounense*
-	-	-	*B.procumbens*
-	-	-	*B.rirulare*
-	-	-	*B.ratabulum*
-	-	*Eurhynchium*	*E.pulchellum*
-	-	*Homalotheciu m*	*H.sericeum*
-	-	*Brachytheciu m*	*B.brachytheciu m*

Order	Family	Genus	Species
-	-	-	*B.buchananii*
-	-	-	*B.plumosum*
-	-	-	*B.ratabulum*
-	-	*Eurhynchium*	*E.mulleri*
-	-	-	*E.riparioides*
-	-	-	*E.swartzii*
-	-	*Rhynchostegiu m*	*R.herbaceum*
-	Hypnaceae	Campylium	*C.hispidulum*
-	-	*Homomallium*	*H.incurvatum*
-	-	-	*H.shimlaense*
-	-	*Platydictya*	*P.sublits*
-	-	*Pylaisia*	
-	-	*Polyantha*	
-	-	*Cratoneuron*	*C.commutatum*
-	-	*Hypnum*	*H.cupressiforme*
-	Pterigynandraceae	*Orthothecium*	*O.intricatum*
-	Plagiotheciaceae	*Plagiothecium*	*P.denticulatum*
-	-	-	*P.nemorale*
-	-	-	*P.perminutum*
-	-	-	*P.sylvaticum*
-	Pycaisiadelphaceae	*HEterophylliu m*	*H.haldanianum*
-	Leucodontaceae	*Leucodon*	*L.sciuroides*
-	Anomodontaceae	*Anomodon*	*A.viticulosus*
Marchantiales	Marchantiaceae	*Marchantia*	*M.nepalensis*
-	-	-	*M.paleacea*
-	-	-	*M.papillata*
-	-	-	*M.polymorpha*
-	-	*Preissia*	*P.quadrata*
-	-	*Fimbriaria*	*F.parvipora*
-	-	-	*F.reticulata*
-	-	Dumortiera	*D.hirsuta*
-	-	Marchantia	*M.kashyapii*

Order	Family	Genus	Species
-	-	Marchantia	*M.palmata*
	-	-	*M.subintegra*
-	Clevaceae	*Sauteria*	*S.alpina*
	-	*Athalmia*	*A.pusilla*
	-	-	*A.pingus*
-	Conocephalaceae	*Conocephalum*	*C.conicum*
-	Ricciaceae	*Riccia*	*R.frostii*
-	-	*Ricciocarpus*	*R.natans*
	-	*Riccia*	*R.discolour*
	-	-	*R.warnstorfii*
Porellales	Porellaceae	*Porella*	*P.chinensis*
-	-	-	*P.decurrens*
-	-	-	*P.gracillima*
-	-	-	*P.madagascariensis*
-	-	-	*P.obtusata*
-	-	-	*P.acutifolia*
-	-	-	*P.caespitans*
-	-	-	*P.campylophlla*
-	-	-	*P.platyphylla*
-	Pseudolepicoleaceae	*Blepharostoma*	*B.trichophyllum*
-	Lepidoziaceae	*Lepidozia*	*L.reptans*
-	Lophocoleaceae	*Chilossyphus*	*C.campanulatus*
-	-	-	*C.himalayensis*
-	-	*Lephocolea*	*L.minor*
-	Plagiochilaceae	*Plagiochila*	*P.aspleniodes*
-	-	-	*P.cavifolia*
-	-	-	*P.duthiana*
-	-	-	*P.himalayensis*
-	-	-	*P.sciophila*
-	-	-	*P.accendens*
-	-	-	*P.chinensis*
-	-	-	*P.parvifolia*
-	-	-	*P.phalangea*
-	-	-	*P.woronofii*
-	Scapaniaceae	*Lophozia*	*L.piacenzai*
		Scapania	*S.parra*
-	Jungermanniaceae	*Jungermannia*	*J.confertissima*
	-	*Gymnocolea*	*G.inflata*
	-	*Jungermannia*	*J.lanceolata*
-	-	-	*J.duthiana*
	Aytoniaceae	Asterella	*A.angusta*
	-	-	*A.blumeana*
	-	-	*A.reticulata*
	-	Mania	*M.foreai*
	-	Plagiochasma	*P.appendiculatum*
	-	-	*P.articulatum*
	-	-	*P.intermedium*
	-	Reboulia	*R.complanata*
	Jublaceae	Frullania	*F.gaudichadii*
	-	-	*F.muscicola*
	-	-	*F.neurota*
	Lejeuneacea	Lejunea	*L.aloba*
	Pelliaceae	Pellia	*P.endivifolia*
	Phoeocerotaceae	Phoeoceros	*P.laevis*
	Redulaceae	Redula	*R.complanata*
	Aneuraceae	Riccardia	*R.multifida*
	Scapaniaceae	Scapania	*S.verrucosa*
	Targionaceae	Targionia	*T.hypophylla*
	Lejeunceae	Trocholejeunea	*L.sandvicensis*
	-	Tuzibeanthus	*T.chinensis*

Medicinal importance of some important bryophytes found in Jammu and Kashmir: Like higher plants bryophytes are of great medicinal importance. They are the medicine for several diseases. Medicinal importance of some important bryophytes which are present in Jammu And Kashmir State listed in Table-2.

Table-3: Medical importance of some important Bryophytes.

Name	Family	Medicinal use	References
Barbula canaliculata	Pottiaceae	Used to cure rheumatism, reduce fever, and body aches	5
Barbula microstoma	Pottiaceae	For curing menstrual pain leaf extract of this plant is consumed two times in a day. Liquid extract of leaf shows properties against fever.	4
Bryum argentenum	Bryaceae	Used as antidote, antipyretic, antifungal	16
Conocephalum conicum	Conocephalaceae	Mixture of powdered leaf material and vegetable oil is used to cure wounds, snake bites and burns	17
Cratoneuron filicinum	Amblystegiaceae	Used for the treatment of Malum cordis	17
Fissidens grandiforms	Fissidentaceae	It shows diuretic properties and used to cure hair loss	17
Funaria koelzii	Funariaceae	The drug prepared from the plant is used to treat Dermatophytosis, pulmonary tuberculosis and many other disease	13
Haplociadium microphyllum	Thuidiaceae	It is Used to cure cystisis, fever , pneumonia bronchitis,	24
Marchantia paleacea	Marchantiaceae	It is Used to cure gastric intolerance, fever and hepatitis.	20
Marchantia polymorpha	Marchantiaceae	The Paste which is prepared from the thallus of plant are used to cure inflammation, liver ailments and snake bites.	18
Mnium affine	Mniaceae	The powdered plant material is used for the treatment of wounds and burn injuries.	5
Mnium cuspidatum	Mniaceae	It is used to cure Hemostatis and nose bleeding.	5
Philonotis seriata	Bartramiaceae	It is used to cure heal burns and shows antidotal and antipyretic properties.	4
Plagiochila cavifolia	Plagiochilaceae	Used for wound healing	17
Plagiopus oederi	Bartramiaceae	Epilepsy, apoplexy, cardiopathy	26
Plagomnium cuspidatum	Mniaceae	It is used against swellings and infections.	5
Polytrichum piliferum	Polytrichaceae	It shows medicinal properties against prostate, skin diseases and urinary difficulties.	16
Rhodobryum ontariense	Bryaceae	Powdered plant material is applied to cure broken bones.	26
Riccia frostii	Ricciaceae	Paste of Riccia, honey and fat are used Cuts, burns, and wounds. Decoction is used to treat ringworms in children.	19
Weissia wimmeriana	Pottiaceae	Used as Antipyretic and antidotal	26

Discussion: There are 241 species of bryophytes found in the state of Jammu and Kashmir. There are some families which show higher number of species and some families which show the presence of only one species. Following is the graph which explains the distribution of species in particular[1-34].

Conclusion

A total number of 241 species of bryophytes are present in the state which belongs to 123 Genus, 51 families and 17 orders. The families which are dominant are Potiaceace followed by Brachytheciae, Orthotrichaceae and Bryaceace.

Acknowledgement

The author is highly thankful to head of department school of studies in botany for providing all kind of support. Author is very thankful to senior Research Scholars of School of Studies in Botany, Jiwaji University Gwalior for their valuable suggestions and their support.

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