

BRYOPHYTES FLORA OF SHERINGAL VALLEY DIR UPPER KHYBER PAKHTUNKHWA PAKISTAN

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ABSTRACT

The study was conducted in the Sheringal Valley, District Dir Upper, Khyber Pakhtunkhwa Pakistan to investigate the occurrence of bryophytes species in the study area. It is the first attempt to document the bryophytes species in the selected area. A total of 27 moss species (20 genera, 14 families), 16 liverwort species comprising 13 genera and 8 families were recorded. Whereas, hornworts were represented by only two species from the target area. Sheringal valley has a more typical tropical bryoflora, fewer thallose liverworts and moss taxa were also found. A richer habitat variety including dry and wet habitats, as well as its bigger area, seem to account for the higher diversity of the bryophyte species in Sheringal valley. Most bryophytes in Sheringal valley are corticolous (40%) followed by epiphyllous (30%), saxicolous (20%), and terrestrial (10%). Further studies are suggested to further confirm our findings.

Keywords: Bryophytes, Dir Kohistan, ecology, hornworts, liverworts, mosses.

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INTRODUCTION

The selected area Sheringal, has been derived from two Kohistanai words, Sherine and Gole meaning charming stream, and the other word's meaning is flattened or a smooth fertile land. This valley is the largest among the gorgeous valleys of Dir Kohistan. Its natural gorgeousness with a diversity of phytoecological and the agroclimatic combinations support the existence of a variety of wild and domesticated plants and animal wealth. Phytogeographically the valley comes under the umbrella of the Sino-japanese region (Ali and Qaiser, 1986) with monsoon rains concentrated mostly in summer season. Sheringal Valley is located between 35° -28 ' North latitude and 72° 20' East longitudes in Dir Upper while height ranges from 1800-2000m above the sea level. This is a small valley and situated on the northern side of an upper Dir district. Bajaur Agency and Jandool Subdivision are located towards the west, while it is surrounded by Districts Swat and Malakand in the East and South, respectively. The total area covered by this valley is 7994 ha. The northern belt is generally covered with lush green forests. The River Panjkora flows from north to south. Panjkora is a pushto word which means five streams or five tributaries of this river viz., Azgologh, Jandrai, Shandoor, Gwaldai and Doagdara streams.. The climate is too cold in winter and warm in the summer (Hazrat *et al.*, 2011).

Land plants inhabiting the amphibious zone are mosses, liverworts, and hornworts, which collectively constitute a non-vascular group of plants called Bryophyta (Crandall-Stotler,1980). The Plant body is gametophyte which is relatively small, ranging from 2cm to 20cm long. Bryophytes play an important, though the inconspicuous role in the cycles of nature. Some of them provide food for the herbivorous mammals, birds and other animals. Water-inhabiting mosses contribute to the filling of ponds and lakes and thus contribute to the building of soil. Due to the dense growth

of the mosses forms mats which absorb the force of falling rain and a large amount of moisture, thus decreasing or preventing soil erosion.

Generally speaking, all the hepatics prefer the moist, shady condition and can be found in a variety of habitats. Their distribution is also diverse, some of them can be recorded from various zones of different altitude, but their basic requirement is shade and moisture remains the same even in different geographical and ecological zones. Even at the same geographic level morphology and behavior of the plant can be changed with the changes in its basic requirements. Though the systematic studies of these plants have been very frequent in Europe and United States of America (Pande and Srivastava, 1952) and various books are written on bryological research, morphology, ecology, taxonomy, methods of collection and preservation (Flowers, 1973; Conard and Redfearn, 1979; Richardson, 1981; Smith, 1980; Schuster,1983-84; Raven *et al.*, 1986; Nishimura and Higuchi, 1993, 1994). However, their study is still neglected in the third world.

However, some scientist tried to find out links among various vegetation like Mamath (1981) and Bartram (1955) published papers on 101 species of mosses sent by R.R.Stewart which he collected from Kashmir, N.W. Himalayas and Mussoorie hills.

Sheringal valley is an unexplored mountainous terrain located on the North boundary of Chitral and Afghanistan. It was virgin for scientific exploration. It has wide biodiversity, both of the Himalaya and the Hindu Kush ranges. So the main focus of this study as on the bryophyte flora of Sheringal valley.

MATERIALS AND METHODS

Bryophytes investigation was carried out in the target area. The study area includes six villages of Samang, Shahoor, Ganshal, Gujarcus, Chenaran and Sia Sheringal. A total of 27 species of bryophytes were collected and identified. All the species of bryophyte were noted

time and again in the areas which were visited to observe when the target flora are in bloom. For the morphological study, different species were examined time and again in order to see if there was any variation occurred or not? The specimens were collected at the flowering stage and the herbarium specimens were prepared as voucher specimens. In this practice, a standard method was followed. To compare their characters and photographs were taken in blooming seasons. All the collected specimens were kept in the laboratory and herbarium of the Department of Botany Shaheed Benazir Bhutto University Wari campus. The collected specimens were identified with the help of relevant literature. (Gruber & Peer, 2012). Bryophyte diversity was observed in different localities in the valley, probably due to different substrates including soil rocks, hummus and tree trunks. These species were observed in 18 villages of the valley are Samang, Doki, Goryal, Proper Sheringal, Cham, Jetkot, Gomadan, Upper Tangisar, Lower Tangisar, Markhano ksas, Ghojoro kass, Soldem, Doro, Sia Sheringal, Upper and Lower Deon, Dramdala and Ganshal. Field Visits From April to September of 2016, bryophytes were collected in the valley in a variety of substrates. Every day the newspapers and tissue papers were changed and this process was continuous for 20 days. The dried specimens were then packed in transparent small plastic bags, and these bags are then pressed on Herbarium Sheath. The samples were deposited in the Herbarium of the SBB University Wari Campus. For the biogeographical analysis, the area is distributed for each species was determined by using floras, checklists, and monographs. For many of the liverworts, data on geographical

ranges were obtained from the Qhola khawar; western side of Sheringal valley. Similarities between the areas were established through the analysis of the bryophyte vegetation. The Pictures were taken at the time of collection on a digital microphone, camera 6 Mega pixel HP.

RESULTS

Sheringal valley has favorable conditions for the growth of bryophytes. Bryophyta comprising mosses and liverworts, is the largest and most widely dispersed group of plants with a luxuriant growth of individuals, sometimes dominate the terrains to the exclusion of other plants over large areas. Hornworts are present in fewer number in the area. Twenty-seven moss species, belonging to 20 genera and 14 families were recorded (Table-1). A number of moss species were found in exposed places and some form extensive masses on dry exposed rocks, others were found on barks, cracks and crevices of rocks and muddy shady places (Table-1).

The liverworts were also found in the same habitat. Some species like *Phlegiochasma*, *Robulia*, *Grimaldia*, and *Fimbraria* are diverse in its distribution, found throughout the valley. These were found abundantly in plains, low lying mountains and even observed at high altitudes. *Marchantia polymorpha*, *Preissia* and *Conocephalum* were recorded from the high altitudes with high moisture level. *Pellia*, *Porella*, *Lunularia* and *Anthoceros* were observed at marshy damp steeps. Sixteen liverworts species were collected belonging to 13 genera and 8 families (Table-2). Two species of Hornets belonging to 2 genera and 2 families in the valley were also collected from the target area (Table-3).

Table-1. Species diversity of mosses in the Study Area.

S.No	Family	Voucher Specimen No.	Species	Habitat
1.	Amblystigiaceae	901	<i>Cratoneuron filicinum</i> (Hedwig) Spruce	DR,WMS,DMS
2.	Batramiaceae	902	<i>Philonotis rigida</i> Brid.	WR, WMS, DMS
3.	Brachytheciaceae	903	<i>Brachythecium rivulare</i> Br.	DR,WR,WSS
4.		904	<i>Brachythecium velutinum</i> (Hedwig) Br.	WR
5.		905	<i>Homalothecium lutescens</i> (Hedwig) Rubins.	WR , WSS
6.		906	<i>Homalothecium sericeum</i> Hedwig.	DSS,TT
7.		907	<i>Isothecium myosuroids</i> Brid.	WR, DSS,TT,WMS
8.	Bryaceae	908	<i>Bryum algovicum</i> Sendtn.ex.C.Mull.	DR, DSS,WSS,DMS
9.		909	<i>Bryum caespiticium</i> Hedwig	DR, DMS
10.		910	<i>Bryum pallens</i> Sw.	WSS, DMS
11.	Dicranaceae	911	<i>Dicranum majus</i> Hedwig	WSS, S, DMS
12.	-do-	912	<i>Dicranella heteromella</i> (Hedwig) Schimp.	DR, DSS, DMS
13.	Funariaceae	913	<i>Funaria hygrometrica</i> Hedwig	DSS
14.	Grimmiaceae	914	<i>Grimmia ovalis</i> (Hedwig) Lindb.	DR, DSS, X
15.		915	<i>Grimmia pulvinata</i> Hedwig	DR, X
16.		916	<i>Grimmia tricophylla</i> Grev.	DR, X, WR
17.		917	<i>Schistidium maritimum</i> Turn.	WR, WSS, WMS
18.	Hedwigiaceae	918	<i>Hedwigia ciliata</i> (Hedwig) Spruce.	WR
19.	Hypnaceae	919	<i>Hypnum cupressiformes</i> Hedwig	DSS, TT, S, WSS
20.	Neckeraceae	920	<i>Homalia trichomanoides</i> (Hedwig) Schimp.	DR,WR, TT
21.	Orthotrichaceae	921	<i>Orthotrichum anomalum</i> Hedwig	WR
22.	Pottiaceae	922	<i>Barbula convoluta</i> Hedwig	DSS
23.		923	<i>Barbula unguiculata</i> Hedwig	DR, DMS
24.		924	<i>Gymnostomum aeruginosum</i> Sm.	WR, WMS
25.		925	<i>Pottia intermedia</i> (Turn).Furnr.	WMS, DMS
26.	Polytrichaceae	926	<i>Polytrichum piliferum</i> Hedwig	DR
27.	Sphagnaceae	927	<i>Sphagnum riparium</i> Angstr.	WR, WMS

Table -2. Species diversity of liverworts in the study area.

S.No	Family	Voucher Specimen No.	Species	Habitat
1.	Aytoniaceae	928	<i>Reboulia hemispherica</i> Raddi.	WR, WMS
2.		929	<i>Fimbraria mussuriensis</i> Kashyap	WMS, TT
3.		930	<i>Grimaldia indica</i> St.	WR
4.		931	<i>Plagiochasma appendiculatum</i> L.et.L.Pug.	WR, DMS
5.	Anthocerotaceae	932	<i>Anthoceros punctatus</i> L.	WMS, WSS
6.	Conocephalaceae	933	<i>Conocephalum conicum</i> (L.) Necker	WMS, S
7.	Lunulariaceae	934	<i>Lunularia cruciata</i> (L.) Dumort. ex. Lindb.	WMS
8.	Marchantiaceae	935	<i>Marchantia polymorpha</i> L.	WMS, WR
9.		936	<i>Marchantia nepalensis</i> L.	WMS, WR, S
10.		937	<i>Marchantia palmata</i> Nees.	WMS, S
11.		938	<i>Preissia quadrata</i> Nees.	WR, WMS
12.		939	<i>Dumartiera hirsuta</i> Reinw.	WR, WMS
13.	Pelliaceae	940	<i>Pellia endivifolia</i> (Dick) Dum.	WMS, DMS
14.		941	<i>Pellia epiphylla</i> (L.) Corda.	WMS, TT
15.	Porellaceae	942	<i>Porella platyphylla</i> (L.) Lindb.	WMS, S
16.	Ricciaceae	943	<i>Riccia beyrichiana</i> Hampe ex Lehm & Lindb.	WR, WSS,S

Table-3. Species diversity of hornworts in the target area.

S.No	Family	Voucher Specimen No.	Species	Habitat
1.	Dendrocerotaceae	944	<i>Dendroceros crispus</i> (Sw.) Nees.	WMS
2.	Notothyladaceae	945	<i>Phaeoceros laevis</i> (L.) Prosk.	WMS, S,

Keys: 1. DR=Dry rock 2. WR=Wet rock 3. DSS=Dry sandy soil 4.WSS= Wet sandy soil
 5. DMS=Dry muddy soil 6. WMS= Wet muddy soils 7. TT= Tree trunks
 8. X= Presence on barren rocks 9. S= Shade

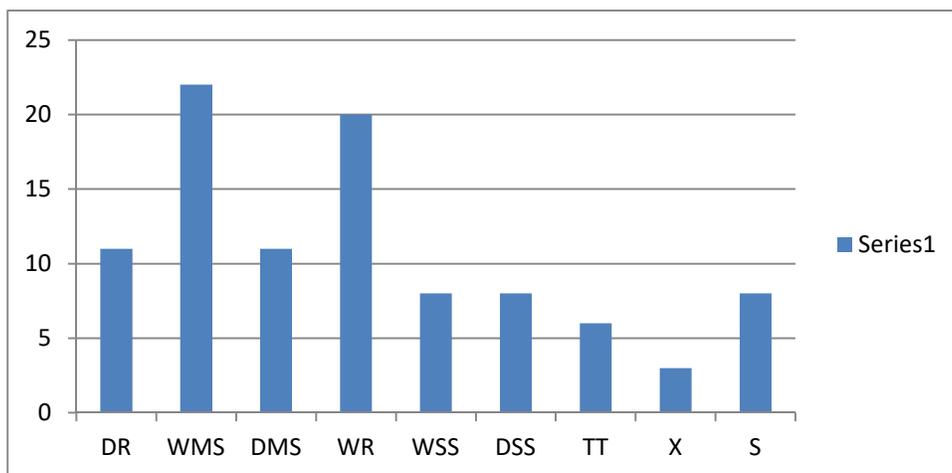


Figure-1. Diversity of Bryophytes on the basis of Habitat (refer to above keys),

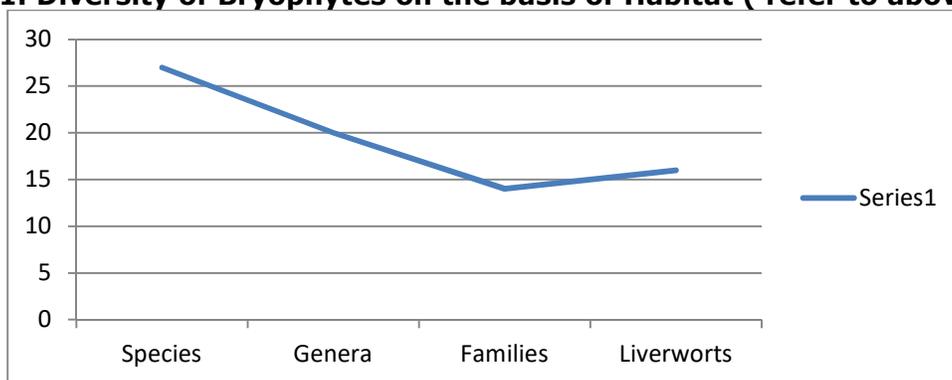


Figure-2. No. of Bryophytes families, genera and species.

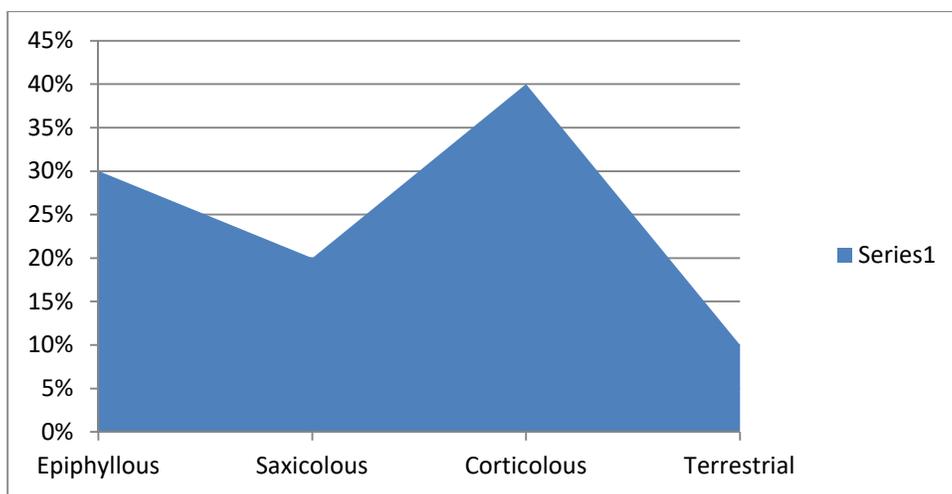


Figure-3, Percentage wise habitats of bryophytes.

Key: 1. Epiphyllous: Species attached to another plant 2. Saxicolous: Species on rocks
3. Corticolous: Species grow on tree bark. 4. Terrestrial: Species on land.

DISCUSSION

The growth and development of masses are accelerated by humidity and temperature. Mosses grow in moist, shady places where transpiration and evaporation rate is low. Schäfer-Verwimp and Gruber (2002) reported 8 species of genus *Orthotrichum* from Pakistan, while the species *O. obtusifolium* was reported for the first time from Pakistan. The places under water permanently or periodically is the favourite site for mosses, such as species of Amblystegiaceae and Bryaceae. On the other side some grow in dry places such as species of *Grimmia* and *Orthotrichum*. However moderate light intensity is the liked habitat of most mosses.

A total of 27 species belonging to 14 families and 20 genera have been reported from Sheringal valley. Pottiaceae leads the list with 3 genera and 4 species. Brachytheciaceae with 3 genera and 5 species. Grimmiaceae have 2 genera and 4 species. Dicranaceae contains 2 genera and 2 species each. Bryaceae contain 1 genera and 3 species. Amblystegiaceae, Batramiaceae, Funariaceae, Hypnaceae, Hedwigiaceae, Neckeraceae, Orthotrichaceae, Polytrichaceae, Sphagnaceae are represented by as a single genus and single species each (Table-1)

Mosses grow on varying diverse habitats (Table-1) viz., *Brachythecium*, *Barbula*, *Dicranum*, *Dicranella*, *Funaria* and *Homalothecium* species mostly grow in ordinary moist soil. Whereas, *Hypnum cupressiforme* and *Isothecium myosuroids* grow on the tree trunks and some grow on rocks such as *Grimmia* etc.

The species of *Grimmia* and *Barbula* spp. are adapted to dry condition with less developed gametophyte and mostly erects (Smith, 1980). They mostly grow on barren rocks with little supply of water. The leaves are modified with thick and re-curved margins being narrow, cylindrical, twisted and mostly dentate hairy points. *Homalothecium lutescens*, *Bryum algovicum*, *Dicranella hetromella*, etc. grow on sandy soil and forming small

cushions in dry habitat and thick cushions in good habitat. Mostly these species are regular or irregularly branched and the leaves have ovate lamina with broad nerve only up to mid of leaf. These characters are well adapted to the sandy soil as also reported by (Asghar, 1957).

Funaria, *Dicranum*, *Pottia* and *Bryum* are small-sized, erect gametophytic species adopted to muddy type of soil. According to Richardson (1981) the muddy type of soil is suitable for their growth due to good water holding capacity and rich in nutrients.

Brachythecium rivular, *Orthotrichum*, *Gymnostomum aeruginosum*, *Philonotis rigida* etc flourish well along the banks of streams and below water-fall. They prefer abundance of water and nutrients in their surroundings, therefore, they form thick mat with broad and single celled-thick leaves with plane and entire margins. (Flower, 1973)

Hypnum cupressiformes, *Brachythecium veluntinum*, *Dicranum majus*, *Homalothecium sericeum*, *Isothecium myosuroids*, form loose tufts on the surface of tree trunks or on the wet type of soil are branched and do not have crowded leaves as reported by Smith (1980).

In Europe and America the systematic studies of these plants are very frequent (Pande and Srivastava, 1952) and various books are written on bryological research, morphology, ecology, taxonomy, methods of collection and preservation (Flowers, 1973; Conard and Redfearn, 1979; Richardson, 1981; Smith, 1982; Schuster, 1983-84; Raven *et al.*, 1986) their study is still neglected in the third world and especially in Pakistan. Some standard reports are there as Stewart collection of 101 species of mosses from Kashmir, N.W. The Himalayas and Mussoorie hills were published by Bartran, (1955). Chitral and allied areas are thoroughly explored for bryophytes, some 89 species with some subspecies from Tirch Mir were reported by Stromer (1954). Highuchi, 1992, compiled a paper on Mosses of Pakistan. A list of 67 genera and 131 species of

Mosses of West Pakistan is published by Asghar (1957). Some 22 genera and 40 species of mosses are reported from the Dir Malakand Division by Afridi (1996), while Sirajuddin (1992) reported 18 species of thallose liverworts from Malakand Division.

The Bryophytes of Sheringal valley have special importance and could be studied for their genetic diversity. The liverworts collected are 16 species belonging to 13 genera and 8 families. *Reboulia*, *Grimaldia*, *Fimbraria*, *Preissia*, *Conocephallum*, *Dumartiera*, *Porella*, *Riccia*, *Plagiochasma*, *Anthoceros*, *Lunularia* is represented by single species each. Two species of *Pellia* and three species of *Marchantia* were recorded (Table-2). A survey of the liverworts shows that *Reboulia hemispherical*, and *Plagiochasma appendiculatum* flora is fairly rich and common in the gorges and

sides of the streams, where there is enough shade and moisture. *Pressia*, *Conocephallum*, *Dumartiera*, *Pellia* and *Porella* prefer those places where water is percolating or the splashes of water fall on them with a dense shade. *The merchant* and *Anthoceros* are commonly found in muddy areas, either in shade or exposed places. *Grenada* and *Fimbraria* colonizing the exposed and sandy loam types of soil. The ratio of hornworts species in Sheringal valley is lesser as compared to mosses and liverworts. Only two species *Dendroceros crispus* and *Phaeoceros laevis* of families Dendrocerotaceae and Notothyladaceae respectively found in the valley. The first one grows in shady places and on tree trunk, and the second species is found in wet muddy soil, shady and on wet rocks.

REFERENCES CITED

- Afridi, H.R. 1996. Moss Flora of District Dir, Malakand Division. KPK. The University of Peshawar.
- Asghar, A. 1957. A list of Mosses of West Pakistan. *Biologia Lahore*, 3:44-52.
- Ali, S.I and M. Qaiser, 1986. A phytogeographic Analysis of the Phanerogams of Pakistan and Kashmir. *Proc. The Royal Society of Edinburgh*. pp. 89 -101.
- Bartran, E.B. 1955. North West Himalayan Mosses. *Bull. Torrey, Bot. Club.* 82(1):165- 229.
- Conard, H.S. and P.O. Redfearn. 1979. How to know the Mosses and liverworts. 2nd ed., William C. Brown Co. Dubuque, Iowa.
- Crandall- Stoler, B. 1980. Morphogenetic designs and a theory of bryophyte organs and divergence *Biol. Sci.*, 30:580-85.
- Flowers, S. 1973. Mosses. Utah and the West, Brigham Young. UN. Press. Prov. Utah.
- Hazrat, A, S.Ahmad, J.Shah and M.Nisar. 2011. Ethnobotanical Study of some Elite Plants belonging to Dir, Kohistan valley, KPK, Pakistan. *Pak. J. Bot.*, 43(2): 787-795.
- Gruber J.P. and T. A. Peer 2012. Contribution to the knowledge of the bryoflora of the mountains of North Pakistan (Autonomous Region of Gilgit –Baltistan). *Herzogia* 25: 271-285.
- Highuchi, M. 1992. Mosses from Pakistan collected by the Botanical expedition of a Natural Science museum, Tokyo. *Cryptogamic Flora of Pakistan* 1:245-259.
- Mamath Kulov, U.K. 1981. Bryoflora in Tadzhik SSR. U. S.S.R. (ins. Bot. Acad. Sci. Taadzh. SSR. Dushanbe, U.S.S. R.) *Izv. Allad, Nauk. Tadzh SSR. Otd. Biol. Nauk* O (2): 22- 27.
- Nishimura, N. and M. Higuchi. 1993. Checklist of Mosses of Pakistan. – *Cryptogamic Flora of Pakistan*, Vol. 2:275-299. *Nat.Sci.Museum, Tokyo*.
- Nishimura, N. and M. Higuchi. 1994. Additions to the checklist of Mosses of Pakistan. *Proc:Bryological Society of Japan*, 6 (5): 98-99.
- Pande, S.K., and K.P. Srivastava. 1952. The Hepatic vegetation of Pachmari (Madhya Pradesh). A preliminary survey. *J. Ind. Bot. Soc.*, 31(4): 342-51.
- Raven, P. H., R.F. Evert and S.E. Eichhorn. 1986. *Biology of Plants*, 4th ed. Worth Publisher, Inc.
- Schäfer-Verwimp, A. and J. P. Gruber. 2002. *Orthotrichum* in Pakistan. *Trop. Bryol.*, 21:1-9.
- Smith, A.J.E 1982. *Bryophyte Ecology*. Champan and Hall, New York.
- Richardson, D.H.S. 1981. *The Biology of Mosses*. John Wiley & Sons. Inc. New York.
- Schuster, R.M. 1984. *New Manual of Bryology*. Hattori. Bot. Lab. Nichinan Miyazak, Japan. 1x 2.
- Stromer, P. 1954. Mosses from Trich Mir. *Nytt. Mag. Bot.*, 3:213-226.
- Sirajuddin. 1992. *Thallose Liverworts of Malakand Division*. M. Phil. Thesis, Dept. of Bot., Univ. of Peshawar.
- Smith, A.J.E. 1980. *The Moss flora of Britian and Ireland*. 1st ed. London. Camb. Univ. Press. Cambridge.