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# Checklist of Lithophytic Mosses of Kaghan Valley, Mansehra-Pakistan

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## Abstract

The present work is a preliminary compilation mostly based on the available literature and extensive recent field trips. Overall 46 lithophytic moss species have been reported in Kaghan valley, Mansehra-Pakistan. These species are distributed under 16 families and 28 genera. This study is very much significant regarding the diversity of mosses in the study area that proof the considerable, potential of the ambient environment for the luxurious growth of bryophytes.

## Keywords

Bryophyta; Kaghan Valley; Lithophytes; Moss; Pakistan; Western Himalayas

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## Introduction

The Kaghan Valley, a northeast-southwest running gorge in the Western Himalayas which is located in the Mansehra District, Khyber Pakhtunkhwa (Pakistan), between 34° 30' to 35° 15' latitude and 73° 18' to 74° 05' longitude. It extends over about 160 km rising from an elevation of 506 meters to 4150 meters up to the Babusar Pass, its highest point. The valley exists between many high peaks of the Himalaya in the north which represents temperate and alpine zones. Deciduous and coniferous woodland occur up to the timberline at roughly 3600 metres, above *Juniperus* trees, scrub and alpine meadows occur (Hussain and Ilahi, 1991). Bedrocks belong to Kohistan Arc (amphibolites, metadiorites, peridotites,

serpentinites and pyroxene granulites), Higher Himalayan Crystalline napes (calcschist-rich cover with marble and amphibolith, metaphyllith-rich cover, granitic basement, granitic mylonites), and Lesser Himalaya (metapelites and marbles) (Greco and Spencer, 1993).

Mutually within the manifold types of rocks the valley shows a broad variation of climatic and altitudinal gradients, these conditions induced a range of ecological habitats that contribute to the unique biodiversity of mosses. Lithophytic (saxicolous or rock inhabiting) mosses grow on a variety of substrates and range from aquatic to dry stones. In most cases, moss species are stenoecious and, therefore, restricted to a particular substrate and ecological niche.

**Table 1. List of mosses found in Kaghan valley**

Scientific Name	Family	Habitat	Altitude	Distribution
<i>Fissidens bryoides</i> var. <i>schmidii</i> (Müll.Hal.) R.S. Chopra & S.S. Kumar	Fissidentaceae	On boulders & cliffs along the streams.	830-2740 m	Pakistan, India, Sri Lanka, Nepal, Java, Philippines and Japan.
<i>F. curvato-involutus</i> Dix.	Fissidentaceae	On soil covered boulders in or along the streams	630-830 m	Pakistan, India, Nepal, Burma, Thailand and Vietnam.
<i>F. dubius</i> Beauv.	Fissidentaceae	On wet cliffs along the streams.	1600-2280m	Pakistan, India, Sri Lanka, Nepal, Java, Philippines, Japan, Burma, Thailand and Vietnam.
<i>F. grandifrons</i> Brid.	Fissidentaceae	On wet or submerged cliffs in or along streams.	840-2350 m	Pakistan, India, Kashmir, Europe, China, Taiwan, Korea, Japan and North America.
<i>F. strictulus</i> Muell.	Fissidentaceae	On soil-covered boulders also in rock crevices.	630-2400 m	Pakistan, Nepal, India China and Japan.
<i>F. taxifolius</i> Hedw.	Fissidentaceae	On boulders along the roads.	670-2400 m	Widely distributed in the world.
<i>Distichium capillaceum</i> Hedw.	Ditrichaceae	On moist cliffs.	2020-4300m	Pakistan, Nepal, North & central Asia, Japan, New Guinea, Australia, New Zealand, North & South America.
<i>Hyophila involuta</i> Hook.	Pottiaceae	On soil-covered boulders also in rock crevices.	630-1530 m	Pakistan, India, Japan, Central Asia, China, Samoa, Hawaii, Europe, North & South America.
<i>Molendoa sendtneriana</i> Limper.	Pottiaceae	On boulders or dry cliff.	680-2740 m	Pakistan, Europe, Himalayas, China, Taiwan & Japan.
<i>Timmiella anomala</i> Limpr.	Pottiaceae	On cliffs or boulders.	1100-2400 m	Widely distributed in North Hemisphere.
<i>Grimmia ovalis</i> Hedw.	Grimmiaceae	On sunny dry boulders.	1300-1530 m	Pakistan, Europe, West & Central Asia, North America, Hawaii, Australia & Green Land.
<i>G. alpestris</i> (F. Weber & D. Mohr) Schleich.	Grimmiaceae	On moist cliffs along stream sides.	630-2400m	Pakistan, Europe, Croatia, Kashmir, Tatra, North America & Green Land.
<i>G. montana</i> Bruch & Schimp.	Grimmiaceae	On dry boulders.	630-2400m	Pakistan, North America, Europe, N. Africa, Central Asia, Greenland & Iceland.
<i>G. pulvinata</i> (Hedw.) Sm.	Grimmiaceae	Sunny boulders.	670-1600 m	Pakistan, Europe, Africa, West Asia, Australia, New Zealand, Hawaii, North America & Green Land.

**Table 1 Contd: List of mosses found in Kaghan valley**

<i>Shistidium apocarpum</i> Hedw.	Grimmiaceae	On dry boulders or on dry cliffs.	1600-2020 m	Pakistan, Europe, Africa, Siberia, Central Asia, Tibet, Himalayas, Australia, Tasmania, North & South America & Green land.
<i>Anomobryum filiforme</i> Dicks.	Bryaceae	On cliffs & dry boulders along streams.	630-2400m	Cosmopolitan
<i>Bryum argentums</i> Hedw.	Bryaceae	On boulders & rock crevices along road side.	1070-2710m	Cosmopolitan
<i>B. coronatum</i> Schwaegr	Bryaceae	On boulders along road side.	1070-2710m	Pakistan. & Pan tropical.
<i>B. pseudotriquetrum</i> Hedw.	Bryaceae	On wet rocks along streams.	830-2250m	Widely distributed in temperate to Arctic regions in North & south Hemisphere.
<i>Pohlia wahlenbergii</i> Andrews	Melichoferiaceae	On wet cliffs along streams.	1780-2150m	Pakistan, Asia, Europe, New Zealand, North & South America.
<i>Mnium marginatum</i> Breauve.	Mniaceae	On shady rocks.	3230-3500m	Pakistan, North & Central Europe, Afghanistan, North west Himalayas, Mongolia & China.
<i>M. stellare</i> Hedw.	Mniaceae	On soil covered boulders.	1780-2250m	Europe, Pakistan, Siberia, Northwest Himalayas, China, Korea, Japan, & eastern America.
<i>M. laevinerve</i> Card.	Mniaceae	On moist cliffs.	2740-3500m	Pakistan, Northern Himalayas, Sikkim, Bhutan, China, Korea, Japan, Siberia & Philippines.
<i>Plagiomnium rostratum</i> (Schar.) Kop.	Mniaceae	On wet boulders or cliffs.	1600-2300m	Pakistan & Temperate range in North Hemisphere.
<i>Bartramia ityphylla</i> Brid.	Bartramaceae	On rocks in <i>Pinus wallichiana</i> forests.	300-3500m	Pakistan, Europe, Siberia, North West Himalayas, China, Taiwan Japan & North America.
<i>Philonotus falcata</i> Hook.	Bartramaceae	On wet rocks in streams.	2100-2400m	Pakistan, South Africa, North to East Himalayas, China, Philippine & Hawaii.
<i>Drummondia thomsonii</i> Mitt.	Orthotrichaceae	On dry boulders.	1300-1500m	Pakistan, Himalayan Mountains, India, Afghanistan, Kashmir & Tibet.
<i>Orthotrichum anomalum</i> Hedw.	Orthotrichaceae	On dry boulders.	1940-2020m	Pakistan & widespread in north west Hemisphere.

**Table 1 Contd: List of mosses found in Kaghan valley**

<i>O. pumilum</i> Sw.	Orthotrichaceae	On dry cliffs.	1500-3230m	Pakistan Europe, North Africa & North America.
<i>Amphidium lapponicum</i> (Hedw.) Schimp.	Orthotrichaceae	On stones in <i>Pinus wallichiana</i> forests.	3200m	Widespread in northern hemisphere.
<i>Timmia megapolitana</i> Hedw.	Timmiaceae	On dry cliffs.	2740m	Pakistan & Northern Hemisphere mountains.
<i>Cryptoptodon pluvinii</i> (Brid.) Broth.	Neckeraceae	On moist cliffs.	1800-2400m	Pakistan, Himalayas & Africa.
<i>Homalia trichomanodides</i> Hedw.	Neckeraceae	On rock cliffs.	2020-2740m	Pakistan, India, China, Korea, Japan, Far East Europe & North America.
<i>Thamnobryum alopeculum</i> (Hedw.) Nieuwl.	Neckeraceae	On shaded cliffs.	2740m	Pakistan, India, China, Korea, Japan, Far East Europe & North America.
<i>T. suberratum</i> (Hook.) Nog.	Neckeraceae	On dry cliffs.	2020-2400m	Pakistan, India, Sri Lanka & Indochina to Philippines.
<i>Hypopterygium tibetanum</i> Mitt.	Hypopterygiaceae	On shaded soil covered boulders.	2000-2450m.	Pakistan, India & Tibet.
<i>Anomodon minor</i> Hedw.	Thuidiaceae	On soil covered boulders near the roots of pines.	2400-2700m	Pakistan, China, Japan, Korea, Himalayas, Burma & East Siberia.
<i>A.giraldii</i> Muell.	Thuidiaceae	On dry cliffs.	1900-2020m	Pakistan, China, Japan & Korea.
<i>Thuidium vestitissimum</i> Besch.	Thuidiaceae	On cliffs.	2500-2700m	Pakistan, China, Japan, Taiwan, Himalayas & Siberia.
<i>Cratoneuron filicinum</i> Hedw.	Amblystegiaceae	On wet or submerged boulders in or along streams.	840-2400m	Pakistan, Europe, North Africa, Siberia, Afghanistan, Kashmir, Tibet, Nepal, Bhutan, China, Green Land & North & South America.
<i>Brachythecium buchananii</i> Hook.	Brachytheciaceae	On wet cliffs along streams.	1780-2020m	Pakistan, Nepal, Bhutan, Assam, South India, Burma, China, Korea & Japan.
<i>B.glareosum</i> Sprue.	Brachytheciaceae	Brachytheciaceae On boulders in dry streams.	2200-2500m	Pakistan, Japan, Europe, Siberia & North America.
<i>B.rivulare</i> Bruch.	Brachytheciaceae	On cliffs along streams.	1800-3230m	Pakistan, Europe, Siberia, Turkistan, Taiwan, Himalaya, Japan, N.America.
<i>Plagiothecium nemorale</i> Mitt.	Plagiotheciaceae	On moist cliffs.	2200-2400m	Pakistan, China, Korea, Europe. North Africa, Himalayas & Japan.
<i>Gollania clarescens</i> Mitt.	Hypnaceae	On shaded moist boulders or in crevices.	1900-2020m	Pakistan, North India & Nepal.
<i>Taxiphyllum taxirameum</i> (Mitt.) Fleisch.	Hypnaceae	On shaded moist boulders and cliffs along streams.	1500-1880m	Widely distributed in Asia North & South America.

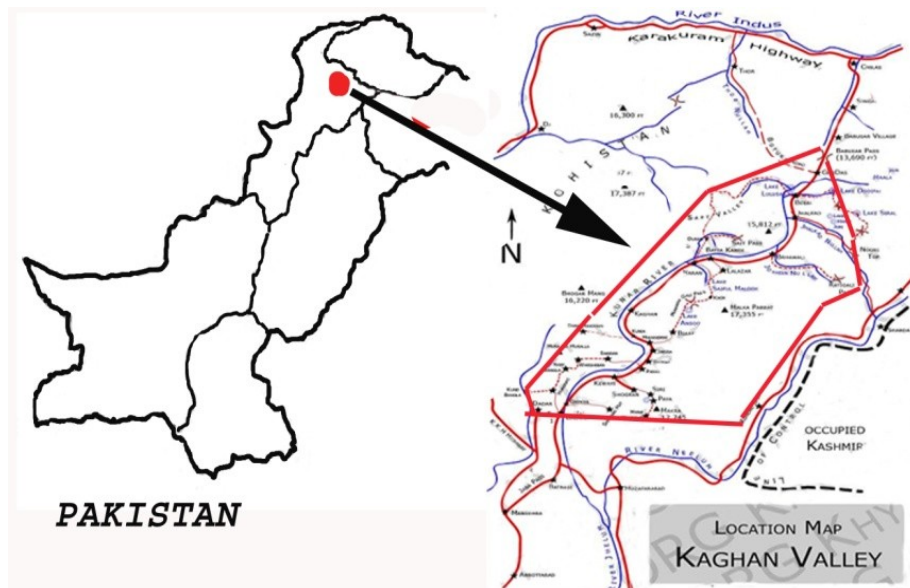


Fig 1. Map of the study area

Unfortunately, very little research work has been done on the mosses of Pakistan in past. Few workers tried and collected mosses in bits and pieces from very few selected localities of the northern part of the country (Brotherus, 1898a, 1898b; Dixon, 1926, 1929; Blatter and Fernandez, 1929; Herzog, 1938; Stoermer, 1954; Bartram, 1955; 1956; Noguchi, 1956, Asghar, 1957; Noguchi, 1959, 1964; Higuchi, 1992; Froehlich, 1964; Nishimura *et al.*, 1993a, 1993b; Townsend, 1993; Gruber and Peer, 2012). Specifically, from Kaghan valley, Townsend (1993) reported 40 taxa among which 9 were as the new records for Pakistan. After compiling all reported taxa the number goes to around 340 taxa. The current checklist of lithophytic mosses of Kaghan valley has been presented on the basis of many recent and on self extensive field surveys and on available literature till date viz. Dixon, 1926; Noguchi, 1964, Higuchi, 1992; Nishimura *et al.*, 1993a, 1993b; Townsend 1993 and Islam *et al.*, 2015.

### Materials and Methods

This study is essentially based on all previous and recent reports regarding moss flora of Kaghan Valley (Pakistan). All moss taxa included in the list were checked with the help of TROPICOS database (2016) concerning systematic and nomenclature. Plant specimens that were collected during recent excursions along with 820 duplicates of herbarium specimens collected by Nishimura (1991-1992) are surveyed and identified using the standard procedure. All the specimens are deposited to Hazara University Herbarium (HUP) and also in Pakistan Museum of Natural History Islamabad (PMNH).

### Results

The checklist of lithophytic mosses from Kaghan valley comprises of 46 species (Table 1) that falls in 28 genera and 16 families, which are 13.5 % of the known Pakistani moss flora. The largest family is the Fissidentaceae (7 species), followed by Bryaceae and Grimmiaceae (5 species each). Four species belong to Mniaceae, Neckeraceae as well as Orthotrichaceae. In the remaining families less than 3 species were recorded. Among these 46 taxa 31 are Acrocarpous and 15 have been reported as Pleurocarpous. This is the first ever checklist of lithophytic mosses from this region of Pakistan. This obvious diversity of mosses proofs the potential of Western Himalayas (Pakistan) in terms of bryodiversity in this case. The taxa, family, habitat altitude and general distribution are given in Table 1.

### Discussion

This amazing diversity of lithophytic mosses in the Kaghan Valley i.e. 42.99% of the total known moss species in the district Mansehra proofs the potential of the Western Himalayas in terms of bryodiversity because of manifold habitats and ecological niches. Although the current status represents a high and diverse value of the lithophytic moss flora in the area, however, some more serious efforts are still required. On the other hand, extensive utilization and deforestation are causing habitat destruction; the woodlands are extremely vulnerable to human influences, so that some mosses in the investigation area may be facing extinction risk.



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