

Seasonal Fluctuation in the Floristic Diversity of Prashar Alpine Pasture, District Mandi, Himachal Pradesh

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Research Article

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Abstract

Seasonal fluctuation in the plant diversity provide basis for devising suitable strategies for management and conservation of the plant resources. Accordingly, a study was conducted to understand the plant diversity of Prashar alpine pasture, District Mandi, Himachal Pradesh during the year 2017 between 2550–2750 m elevation ranges. The study was carried out on seasonal basis. The study was carried out in summer season in May, rainy season in August and winter season in November. A total of 44 plant species belonging to 24 families and 35 genera were recorded in summer season, a total of 72 plant species belonging to 28 families and 58 genera were recorded in rainy season and a total of 13 plant species belonging to 6 families and 10 genera were recorded in winter season from the study area. Dominant families were Asteraceae, Lamiaceae, Rosaceae, Poaceae and Polygonaceae. A total of 56 medicinal plant species recorded from the pasture, out of which two species viz; *Roscoea alpina* and *Selinum vaginatum* fall in the category of threatened plants.

Introduction

The term “alpine” is derived from the Latin word “albus” which means white (or snow- covered) originally referring to the peaks of Alps (Love, 1970). Alpine refers to those lands lying above climatic limit of upright trees i.e. region of open vegetation, above the timberline where general environment and the vegetation are extensively different from that of lowland. These alpine regions are characterized by low atmospheric pressure, low temperature, and intense insolation, rapid and high ultraviolet radiation along with other correlated effects. The Western Himalayan alpiners are among the most diverse ecological locations having diverse vegetation and provide a wide range of ecosystem services. Himachal Pradesh, a north Indian state, is located in western part of the Himalayan range. The important alpine regions in Himachal Pradesh are the Dhauladhar and Pir Panjal ranges (Santvan, 1993). The alpine plants are generally stunted, spiny, dwarfed and develop a mosaic patch of special plant forms, possessing an early growth initiation with very short vegetative span and life cycle ranging from several days to a few months to develop different plant forms. The alpine pastures are supposed to be the only true grasslands in India and where the grazing intensity is very high. Uncontrolled and unregulated grazing results in a loss pasture degradation. Due to high level of this degradation, the present level of production of these alpine pastures is less than that of their possible potential. The pastures in the alpine zone occupy about 1.52 per cent of the total land area in the country and are chiefly concentrated in the Himalayan states of Arunachal Pradesh, Sikkim, Uttarakhand, Himachal Pradesh and Jammu and Kashmir. The Himalayan land in India is enclosed by alpine pastures usually found at an altitude above 2400 m and where climate is not useful for growth of any trees. In Himachal Pradesh alpine pastures cover around 18.1 per cent of the total geographical area of the state. These alpine pastures are locally known as *Dhar* in Himachal Pradesh. The flora of alpine region represents the total quantity of different types of plants. The floristic study involves periodic observations of the flora of a community for the whole year. Floristic composition is one of the most important components of the community that determines the functioning of an ecosystem. Floristic composition of an area varies from place to place according to habitat heterogeneity

of the area itself. A different community occurs in every changed habitat. Floristic studies therefore, provide basic knowledge about the extent of distribution of plant diversity in the pasture. It also helps to assess the plant wealth and its potentiality of any given pastures. Due to lack of proper management practices, a large number of pastures lands have been converted or are in the process of conversion to degraded lands. The present study was carried out to know the status of plant diversity of Prashar alpine pasture, which may provide key devising strategies and action plan for the management of biodiversity rich alpine pastures through generating baseline data. This baseline data generated on flora can serve as a base for its continuous monitoring for future changes in the pasture.

Materials And Methods

The study was conducted in alpine pasture of Prashar, District Mandi, Himachal Pradesh during the year 2017. The study site lies at 31°44'54.61"N to 31°44'57.72"N latitude and 77°06'32.53" E to 77°06'55.14" E longitude and 2550–2750 m elevation range. The present study was conducted to assess the seasonal fluctuation in the plant diversity and growth form of Prashar alpine pasture. The studies of plant diversity in this alpine pasture were done on seasonal basis. The study was carried out in summer season in May, rainy season in August and winter season in November. The size and number of the quadrat was worked out by species area curve method (Misra, 1968). The Different plant categories viz; grasses, sedges, leguminous and non-leguminous forbs were recognized and then species were assigned to various growth forms i.e. tall forbs (> 30 cm height), short forbs (< 30 cm height) and cushion & spreading forbs following Santvan (1993). The plants of medicinal value along with threatened category were also documented from the site.

Results

During the summer season at Prashar alpine pasture, total number of herb species was 44 belonging to 24 families and 35 genera. Out of which 3 species were grasses, 1 sedges, 2 leguminous and 38 species were non-leguminous forbs. The species present in the alpine pasture were analyzed for four different plant categories viz; grasses, sedges, leguminous and non-leguminous forbs. Tall forbs contributed 20.45% in the present alpine pasture flora. This category comprised of nine species of non-leguminous forbs. Short forbs contributed 63.64% to the present alpine pasture flora and comprised of twenty four species of non-leguminous forbs, one species of sedges and three species of grasses. Grasses comprised in this category were *Poa alpina*, *Poa annua* and *Polypogon monspeliensis*. Cushion and spreading forbs comprised of herbaceous or rosette forming prostrate flora of the alpine pasture. It contributed 15.91% to the total alpine pasture flora. The species comprised of five species of non-leguminous forbs and two species of leguminous forbs. The two species included in the leguminous forbs category were *Parochetus communis* and *Trifolium repens* (Table 1).

Table 1

Presence and absence of the species recorded at the Prashar alpine pasture during the study period from Summer Season, 2017 to Winter Season, 2017

S.No.	Species	2017			Growth Form
		SS, 2017	RS, 2017	WS, 2017	
Grasses:					
1	<i>Agrostis munroana</i> Aitch. & Hemsl.	-	+	-	SF
2	<i>Phleum alpinum</i> L.	-	+	-	SF
3	<i>Poa alpina</i> L.	+	+	+	SF
4	<i>Poa annua</i> L.	+	+	+	SF
5	<i>Polypogon monspeliensis</i> (L.) Desf.	+	+	-	SF
6	<i>Trisetum spicatum</i> (L.) K.Richt.	-	+	-	SF
Sedges:					
1	<i>Carex nubigena</i> D.Don ex Tilloch & Taylor	+	+	-	SF
2	<i>Cyperus squarrosus</i> L.	-	+	-	SF
Leguminous Forb:					
1	<i>Lotus corniculatus</i> L.	-	+	-	CS
2	<i>Parochetus communis</i> D.Don	+	+	+	CS
3	<i>Trifolium pratense</i> L.	-	+	-	CS
4	<i>Trifolium repens</i> L.	+	+	+	CS
Non-Leguminous Forb:					
1	<i>Achillea millefolium</i> L.	-	+	-	SF
2	<i>Adiantum edgeworthii</i> Hook.	+	+	-	SF
3	<i>Ainsliaea latifolia</i> (D.Don) Sch.Bip.	+	+	-	SF
4	<i>Ajuga bracteosa</i> Wall. ex Benth.	+	+	-	SF
5	<i>Anaphalis contorta</i> (D.Don) Hook.f.	-	+	-	SF
6	<i>Anaphalis margaritacea</i> (L.) Benth. & Hook.f.	+	+	+	SF

Note: + = Presence, - = Absence, TF = Tall Forbs, SF = Short Forbs, CS = Cushion and Spreading Forbs, SS = Summer Season, RS = Rainy Season, WS = Winter Season

S.No.	Species	2017			Growth Form
		SS, 2017	RS, 2017	WS, 2017	
Grasses:					
7	<i>Anaphalis triplinervis</i> (Sims) Sims ex C.B.Clarke	+	+	+	SF
8	<i>Anemone obtusiloba</i> D.Don	+	+	-	SF
9	<i>Arisaema jacquemontii</i> Blume	+	+	-	SF
10	<i>Aster himalaicus</i> C.B.Clarke	-	+	-	SF
11	<i>Bergenia ciliata</i> (Haw.) Sternb.	+	+	-	SF
12	<i>Chenopodium album</i> L.	+	+	-	SF
13	<i>Cirsium falconeri</i> (Hook.f.) Petr.	+	+	+	TF
14	<i>Cirsium wallichii</i> DC	+	+	+	SF
15	<i>Clinopodium umbrosum</i> (M.Bieb.) Kuntze	-	+	-	SF
16	<i>Cynoglossum wallichii</i> G.Don	+	+	-	TF
17	<i>Cynoglossum zeylanicum</i> (Vahl) Brand	+	+	-	TF
18	<i>Delphinium vestitum</i> Wall. ex Royle	-	+	+	TF
19	<i>Diplazium esculentum</i> (Retz.) Sw.	-	+	-	SF
20	<i>Fragaria vesca</i> L.	+	+	+	CS
21	<i>Gentiana argentea</i> (Royle ex D.Don) Royle ex D.Don	+	+	-	CS
22	<i>Gentiana ornata</i> (D.Don) Wall. ex Griseb.	+	+	-	CS
23	<i>Geranium wallichianum</i> D.Don ex Sweet	+	+	-	SF
24	<i>Gypsophila cerastoides</i> D.Don	+	+	-	SF
25	<i>Hackelia uncinata</i> (Benth.) C.E.C.Fisch.	-	+	-	SF
26	<i>Impatiens scabrida</i> DC.	-	+	-	TF
27	<i>Impatiens sulcata</i> Wall.	-	+	-	TF
28	<i>Lactuca macrorhiza</i> (Royle) Hook.f.	-	+	-	SF
29	<i>Mazus surculosus</i> D. Don	+	+	-	CS
Note: + = Presence, - = Absence, TF = Tall Forbs, SF = Short Forbs, CS = Cushion and Spreading Forbs, SS = Summer Season, RS = Rainy Season, WS = Winter Season					

S.No.	Species	2017			Growth Form
		SS, 2017	RS, 2017	WS, 2017	
Grasses:					
30	<i>Mentha spicata</i> L.	-	+	-	SF
31	<i>Myriactis nepalensis</i> Less	-	+	-	SF
32	<i>Nepeta elliptica</i> Royle ex Benth.	-	+	-	TF
33	<i>Origanum vulgare</i> L.	-	+	-	SF
34	<i>Parnassia nubicola</i> Wall. ex Royle	+	+	-	SF
35	<i>Pedicularis hoffmeisteri</i> Klotzsch	-	+	-	TF
36	<i>Persicaria amplexicaulis</i> (D.Don) Ronse Decr.	+	+	-	TF
37	<i>Persicaria nepalensis</i> (Meisn.) Miyabe	+	+	-	SF
38	<i>Phlomis bracteosa</i> Royle ex Benth.	-	+	-	SF
39	<i>Plantago depressa</i> Willd.	+	+	-	SF
40	<i>Polygonum aviculare</i> L.	-	+	-	SF
41	<i>Potentilla argrophylla</i> Wall. ex Lehm	+	+	-	TF
42	<i>Potentilla atrosanguinea</i> G.Lodd. ex D.Don	-	+	-	TF
43	<i>Potentilla leschenaultiana</i> Ser.	+	+	-	SF
44	<i>Potentilla lineata</i> Trevir.	+	+	-	SF
45	<i>Potentilla nepalensis</i> Hook.	-	+	-	TF
46	<i>Primula denticulata</i> Sm.	+	+	-	SF
47	<i>Prunella vulgaris</i> L.	+	+	-	SF
48	<i>Roscoea alpina</i> Royle	+	+	-	SF
49	<i>Rosularia rosulata</i> (Edgew.) H. Ohba	+	+	-	CS
50	<i>Rumex acetosa</i> L.	+	+	-	TF
51	<i>Rumex nepalensis</i> Spreng.	+	+	+	TF
52	<i>Saxifraga parnassifolia</i> D. Don	-	+	-	SF

Note: + = Presence, - = Absence, TF = Tall Forbs, SF = Short Forbs, CS = Cushion and Spreading Forbs, SS = Summer Season, RS = Rainy Season, WS = Winter Season

S.No.	Species	2017			Growth Form
		SS, 2017	RS, 2017	WS, 2017	
Grasses:					
53	<i>Selinum vaginatum</i> C.B. Clarke	-	+	-	TF
54	<i>Senecio laetus</i> Edgew.	+	+	+	TF
55	<i>Sibbaldia cuneata</i> Schouw ex Kunze	+	+	-	SF
56	<i>Swertia cordata</i> (Wall. ex G. Don) C.B. Clarke	-	+	-	SF
57	<i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg.	+	+	+	SF
58	<i>Thymus linearis</i> Benth.	+	+	-	SF
59	<i>Verbascum thapsus</i> L.	+	+	-	TF
60	<i>Viola biflora</i> L.	+	+	-	SF
Note: + = Presence, - Absence, TF = Tall Forbs, SF = Short Forbs, CS = Cushion and Spreading Forbs, SS = Summer Season, RS = Rainy Season, WS = Winter Season					

In rainy season total number of herb species was 72 belonging to 28 families and 58 genera. Out of which 6 species were grasses, 2 sedges, 4 leguminous and 60 species were non-leguminous forbs. The species present in the alpine pasture were analyzed for four different plant categories viz; grasses, sedges, leguminous and non-leguminous forbs. Tall forbs contributed 23.61% in the present alpine pasture flora. This category comprised of seventeen species of non-leguminous forbs. Short forbs contributed 63.89% to the present alpine pasture flora and comprised of thirty eight species of non-leguminous forbs, two species of sedges and six species of grasses. Grasses comprised in this category were *Agrostis munroana*, *Phleum alpinum*, *Poa alpina*, *Poa annua*, *Polypogon monspeliensis* and *Trisetum spicatum*. Cushion and spreading forbs comprised of herbaceous or rosette forming prostrate flora of the alpine pasture. It contributed 12.50% to the total alpine pasture flora. The species comprised of five species of non-leguminous forbs and four species of leguminous forbs. The four species included in the leguminous forbs category were *Lotus corniculatus*, *Parochetus communis*, *Trifolium pratense* and *Trifolium repens* (Table 1).

While in winter season, total number of herb species was 13 belonging to 6 families and 10 genera. Out of which 2 species were grasses, 2 leguminous and 9 species were non-leguminous forbs. The species present in the alpine pasture were analyzed for four different plant categories viz; grasses, sedges, leguminous and non-leguminous forbs. Tall forbs contributed 30.77% in the present alpine pasture flora. This category comprised of four species of non-leguminous forbs. Short forbs contributed 46.15% to the present alpine pasture flora and comprised of four species of non-leguminous forbs and two species of grasses. Grasses comprised in this category were *Poa alpina* and *Poa annua*. Cushion and spreading

forbs comprised of herbaceous or rosette forming prostrate flora of the alpine pasture. It contributed 23.08% to the total alpine pasture flora. The species comprised of one species of non-leguminous forbs and two species of leguminous forbs. The two species included in the leguminous forbs category were *Parochetus communis* and *Trifolium repens* (Table 1).

Medicinal And Threatened Plants

The important plants of medicinal value found in alpine pasture of Prashar were compiled following Chopra et al., 1956; Kirtikar and Basu, 1987; Kala, 2002; Kala, 2006; Samant et al., 2007; Singh et al., 2009; Devi et al., 2013; Kumar and Sharma, 2013, Kumari et al., 2018, Devi et al., 2019; Kumar and Verma (2019a); Kumar and Verma (2019b) and Verma and Chauhan (2022). These include; *Achillea millefolium*, *Ainsliaea latifolia*, *Ajuga bracteosa*, *Anaphalis contorta*, *Anaphalis triplinervis*, *Anemone obtusiloba*, *Arisaema jacquemontii*, *Bergenia ciliata*, *Chenopodium album*, *Cirsium falconeri*, *Cirsium wallichii*, *Clinopodium umbrosum*, *Cynoglossum wallichii*, *Cynoglossum zeylanicum*, *Delphinium vestitum*, *Diplazium esculentum*, *Fragaria vesca*, *Gentiana argentea*, *Geranium wallichianum*, *Gypsophila cerastoides*, *Hackelia uncinata*, *Impatiens scabrida*, *Impatiens sulcata*, *Lactuca macrorhiza*, *Lotus corniculatus*, *Mazus surculosus*, *Mentha spicata*, *Nepeta elliptica*, *Origanum vulgare*, *Parnassia nubicola*, *Parochetus communis*, *Pedicularis hoffmeisteri*, *Persicaria amplexicaulis*, *Persicaria nepalensis*, *Phlomis bracteosa*, *Plantago depressa*, *Polygonum aviculare*, *Potentilla argyrophylla*, *Potentilla atosanguinea*, *Primula denticulata*, *Prunella vulgaris*, *Roscoea alpina*, *Rosularia rosulata*, *Rumex acetosa*, *Rumex nepalensis*, *Saxifraga parnassifolia*, *Selinum vaginatum*, *Senecio laetus*, *Sibbaldia cuneata*, *Swertia cordata*, *Taraxacum officinale*, *Thymus linearis*, *Trifolium pratense* *Trifolium repens*, *Verbascum thapsus*, *Viola biflora* (Table 2). Out of the total plant species recorded from the alpine pasture, two species i.e. *Roscoea alpina* and *Selinum vaginatum* fall in the category of threatened species (Goraya et al., 2013).

Table 2
Diversity and indigenous use of medicinal plants of Prashar alpine pasture

Taxa	Common Name	Part Used	Indigenous Uses
Amaranthaceae			
<i>Chenopodium album</i> L.	Bathu	Lf, Sd	To revive taste, skin diseases, Abdominal pain and diuretic, indigestion, urinary problems
Apiaceae			
<i>Selinum vaginatum</i> C.B. Clarke	Matosal, Bhutkeshi	Rh, AP, Rt	Skin disease, hysteria, liquor, nervine sedative swelling muscle
Araceae			
<i>Arisaema jacquemontii</i> Blume	Khaprya	Rh, Fr	Poisonous mushroom, snake bite antidote, rhizome paste mixed with oil is applied in sprains and regains muscular strength.
Asteraceae			
<i>Achillea millefolium</i> L.	Chabu, Fye	Fl, WP	Carminative, toothache, tonic, cough, cold, antipyretic
<i>Ainsliaea latifolia</i> (D. Don) Sch. Bip.	-	Rt	Decoction of whole plant is given in Colic pain
<i>Anaphalis contorta</i> (D. Don) Hook. f.	Telgang	Fl, WP	Antibacterial, cold, cough, insect repellent
<i>Anaphalis triplinervis</i> (Sims) Sims ex C.B. Clarke	-	WP, Lf	Diuretic, eye infection
<i>Cirsium falconeri</i> (Hook. f.) Petr.	Bhoosh	Rt	High blood pressure
<i>Cirsium wallichii</i> DC	Chawag	St, Lf	Chest pain, dysentery
<i>Lactuca macrorhiza</i> (Royle) Hook. f.	-	AP	Jaundice, headache
<i>Senecio laetus</i> Edgew.	Parpat	WP	Fever, abdominal pain, inflammation of mouth
<i>Taraxacum officinale</i> (L.) Weber ex F.H. Wigg.	Dudhi, Paranbala	WP	Cuts, headache, fever, kidney, tonic, blood purifier, antibiotic, food poisoning, migraine
Athyriaceae			
<i>Diplazium esculentum</i> (Retz.) Sw.	Lingadu	Frd	Boiled vegetable consumed to relieve Constipation
Balsaminaceae			

Taxa	Common Name	Part Used	Indigenous Uses
Amaranthaceae			
<i>Impatiens scabrida</i> DC.	-	Sd, WP	The extract is used to treat intestinal worms.
<i>Impatiens sulcata</i> Wall.	-	Sd	Pimples
Boraginaceae			
<i>Cynoglossum wallichii</i> G.Don	-	Rt	Root is used in Dyspepsia and digestive disorders
<i>Cynoglossum zeylanicum</i> (Vahl) Brand	-	Lf, Rt	Infusion taken in Asthma, cough and vomiting
<i>Hackelia uncinata</i> (Benth.) C.E.C.Fisch.	-	Rt	Piles
Caryophyllaceae			
<i>Gypsophila cerastoides</i> D.Don	-	WP	Wounds
Celastraceae			
<i>Parnassia nubicola</i> Wall. ex Royle	-	Tu	Paste of tuber is applied on snake bite
Crassulaceae			
<i>Rosularia rosulata</i> (Edgew.) H. Ohba	-	Lf	Crushed leaves applied to skin ailments for fast healing
Fabaceae			
<i>Lotus corniculatus</i> L.	-	AP	Anti-inflammatory
<i>Parochetus communis</i> D.Don	-	Fl	Used to relieve stomach/intestinal pain due to worm
<i>Trifolium pratense</i> L.	-	AP	Cough, bronchitis
<i>Trifolium repens</i> L.	-	WP	Astringent, health drink, menopause
Gentianaceae			
<i>Gentiana argentea</i> (Royle ex D.Don) Royle ex D.Don	Pungen Karpo	Lf, Fl	Sore throat
<i>Swertia cordata</i> (Wall. ex G. Don) C.B. Clarke	Charaite	WP	Appetite, stomachic, blood diseases

Taxa	Common Name	Part Used	Indigenous Uses
Amaranthaceae			
Geraniaceae			
<i>Geranium wallichianum</i> D.Don ex Sweet	-	Rt	Astringent, toothache, ear & eye disease
Lamiaceae			
<i>Ajuga bracteosa</i> Wall. ex Benth.	Neelkanthi	Lf, WP	Malaria, tonic, astringent
<i>Clinopodium umbrosum</i> (M.Bieb.) Kuntze	-	WP	Juice applied to cuts as blood purifier
<i>Mentha spicata</i> L.	Jangali Pudina	Lf	Carminative, stomachache, dysentery
<i>Nepeta elliptica</i> Royle ex Benth.	-	Sd, Lf	Digestive disorder, cold and fever
<i>Origanum vulgare</i> L.	Bantulsi	WP	Antiseptic, cold, mild feverish illness, colic, indigestion, bronchitis, childbirth
<i>Phlomis bracteosa</i> Royle ex Benth.	-	Fl, AP	Eye tonic
<i>Prunella vulgaris</i> L.	Patindu	WP	The whole plant is boiled and filtered and taken against cerebral problems and also during heavy breathing.
<i>Thymus linearis</i> Benth.	Ban jira	WP	Antifungal, antibacterial, cold, whooping cough, toothache, stomachic
Mazaceae			
<i>Mazus surculosus</i> D. Don	-	WP	Cuts and wounds
Orobanchaceae			
<i>Pedicularis hoffmeisteri</i> Klotzsch	-	Rt	Cattle flatulence
Plantaginaceae			
<i>Plantago depressa</i> Willd.	Isabgol	WP, St	Dysentery, wounds, piles
Polygonaceae			

Taxa	Common Name	Part Used	Indigenous Uses
Amaranthaceae			
<i>Persicaria amplexicaulis</i> (D.Don) Ronse Decr.	-	Lf, Rt	Paste applied on insect sting
<i>Persicaria nepalensis</i> (Meisn.) Miyabe	Nalora	Lf	Paste applied on skin to reduce swelling
<i>Polygonum aviculare</i> L.	-	Sd, Lf, Rt	Tonic, dysentery, stomachache, antipyretic, astringent
<i>Rumex acetosa</i> L.	-	Lf, AP, Fr	Appetizer, stomach diseases
<i>Rumex nepalensis</i> Spreng.	Jangali Palak	Lf, Rt	Cooling, colic, Scurvy, Swelling of muscle, stomach ache, etching
Primulaceae			
<i>Primula denticulata</i> Sm.	-	AP, Fl, Rt	Diabetes, headache, appetizer, muscular pain, pulmonary diseases
Ranunculaceae			
<i>Anemone obtusiloba</i> D.Don	-	Rt, Sd	Cooling, cuts, burns
<i>Delphinium vestitum</i> Wall. ex Royle	Kelulu	WP	Extract of whole plant acts as antidote to snake bite, cuts wound, fever
Rosaceae			
<i>Fragaria vesca</i> L.	Jangali strawberry	Fr, Infl	Earache
<i>Potentilla argrophylla</i> Wall. ex Lehm	-	Rt, Fl	Toothache, wound
<i>Potentilla atosanguinea</i> G.Lodd. ex D.Don	-	Lf	Juice used in treating indigestion
<i>Sibbaldia cuneata</i> Schouw ex Kunze	-	Fr, Rt	Juice mixed wuth salt and taken orally to get relief from bodyache
Saxifragaceae			
<i>Bergenia ciliata</i> (Haw.) Sternb.	-	Rh, Lf,	Kidney stones, ulcer, constipation, cold, cough
<i>Saxifraga parnassifolia</i> D. Don	-	Rt	Root juice used for dissolving stones in the kidney

Taxa	Common Name	Part Used	Indigenous Uses
Amaranthaceae			
Scrophulariaceae			
<i>Verbascum thapsus</i> L.	Jangali Tamaku	Fl, Lf, Sd	Smoke of flowers and leaves useful for asthma. Infusion of whole plant is used for snake bite. constipation, cough, dysentery of sheep
Violaceae			
<i>Viola biflora</i> L.	Banaksha	Lf, Fl	Antiseptic, cold, cough, laxative, cure indigestion
Zingiberaceae			
<i>Roscoea alpina</i> Royle	-	Rt	Paste used to heal veterinary cuts and wounds, tonic

Abbreviations Used: AP= Aerial part; Bb= Bulb; Fl= Flower; Fr= Fruit; Infl= Inflorescence; Lf=Leaf; Rh= Rhizome; Rt= Root; Sd= Seed; St= Stem; Tu= Tuber; WP= Whole plant; Frd= Frond

Discussion

Floristic composition is an important component of the community that determines the functioning of an ecosystem and can vary from place to place according to habitat heterogeneity of the area itself. In the present study a distinct change in plant diversity of Prashar alpine pasture site was recorded in different seasons. In Prashar alpine pasture, the maximum numbers of species recorded were 72 in rainy season, 44 in summer season and 13 were in winter season during the study period respectively. It may also be that rainy season plants were active in favorable season and are controlled by physical conditions. More number of species during rainy season can be attributed to the optimum climatic conditions for the growth and development of different species. However, drastic reduction in number of species in winter season may be due to environmental severeness. Similar findings were observed by Dhaulakhandi et al. (2010) and Prakash and Paliwal (2012). In these alpine pastures, the annuals and perennials grow; develop flower and fruits by September/October, thereafter the senescence of aerial parts start, which holds true to the present study sites. This also, accounted for the low number of species in winter season. However, species increase in the summer season as compared to the winter season was recorded during study period because of the availability of water in summer season due to snow melts which support the growth of the plant. However, in these alpine regions the melting of the snow provided a major trigger for the germination of dormant buds and seeds. Germination started from summer season onwards. Mortality in annuals plants is due to their short life period, poor establishment and lack of competitive power. All these factors directly affect the seasonality of species distribution.

In the present study, tall forbs varied from 20.45–30.77%, short forbs varied from 46.15–63.89% and cushion spreading forbs varied from 12.50–23.08% were observed during the year in different season.

Similar findings were reported by different workers while conducted the study in alpine pasture such as Santvan (1993) for the alpine pasture near Rahla, reported 22.5% tall forbs, 45.0% short forbs and 32.5% cushion and spreading forbs, Verma et al. (2006) reported 25.00% tall forbs, 60.52% short forbs and 14.48% cushion and spreading forbs whereas Verma and Chauhan (2022) reported 41.46% tall forbs, 52.44% short forbs and 6.10% cushion and spreading forbs. The short forbs usually have hairy leaves which protect them against frost condition.

The dominant families recorded at Prashar alpine pastures were Asteraceae, Lamiaceae, Rosaceae, Poaceae and Polygonaceae during the year in different season. The dominance of these families in the alpine pasture was due to their phytogeographic origin and specific niches adapted for the alpine climates. Similar findings were reported by several workers while conducted study in alpine pastures and other high altitude forest ecosystems such as Gaur et al. (2005); Singh and Sundriyal, (2005); Chawla et al. (2008); Dad and Khan (2010); Kaur et al. (2010); Sharma et al. (2014); Verma and Kapoor (2014); Rawat et al. (2016); Kumar and Verma (2019a); Kumar and Verma (2019b) and Verma and Chauhan (2022).

In the present study the occurrence of non leguminous forbs is more than the grasses, sedges and leguminous forbs in all season may be due to heavy grazing pressure. The dominant non leguminous forbs plant species i.e. *Anemone obtusiloba*, *Cynoglossum zeylanicum*, *Hackelia uncinata*, *Impatiens scabrada*, *Impatiens sulcata*, *Pedicularis hoffmeisteri*, *Rumex acetosa*, *Rumex nepalensis*, *Senecio laetus*, *Verbascum thapsus* etc. are not preferred by the animal to eat. Similar results were reported by Santvan (1993); Verma et al. (2006); Verma et al. (2008); Verma and Chauhan (2022). The overgrazing does not only alter their botanical compositions but also cause degradation of pasture. Due to higher degradation, the present level of production of these alpine pastures is less than that of their possible potential. If suitable steps are not taken in times, there must be further decline in the floristic composition and potential of the pasture. It is recommended to suitably manage the precious and diverse flora of Prashar alpine pasture by regulating the intensity of grazing pressure and controlling habitat degradation.

Conclusion

Present paper documented the floristic composition of Prashar alpine pasture and helped to explore the flora of the pasture. The study had documented the highest number of plant species was recording during rainy season followed by summer season and least in winter season with the dominancy of family Asteraceae, Lamiaceae, Rosaceae, Poaceae and Polygonaceae. In the present study the occurrence of non leguminous forbs is more than the grasses, sedges and leguminous forbs in all season may be due to heavy grazing pressure. The major threats to floristic diversity, in the Prashar alpine pasture are expansion of overgrazing, uncontrolled and unscientific extraction of important medicinal plant species from their habitats, unregulated tourism and construction of roads. To minimize the impacts on the floristic diversity, there is an urgent need for the conservation of pasture important habitats by implementing scientific conservation measures such as create awareness about the usefulness of the flora, promote community based conservation, *in situ* and *ex situ* conservation, cultivation of important

medicinal plants, restoration of degraded pasture, controlled and rotational grazing, herb collectors should be educated with the sustainable harvest of these species so that there is a continuous regeneration of flora.

Declarations

Conflict of interests: The authors declare that they have no competing interests.

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