Environment and Ecology 37 (4B) : 1589—1594, October—December 2019 ISSN 0970-0420

# Floristic Diversity in Alpine Pasture of Thachi, District Mandi, Himachal Pradesh

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Received 5 September 2019; Accepted 21 October 2019; Published on 22 November 2019

# ABSTRACT

Study of floristic diversity provide basis for devising suitable strategies for conservation of the plant resources. Accordingly, a study was conducted to understand the floristic diversity of alpine pasture of Thachi, District Mandi, Himachal Pradesh during the year, 2017. The location of the pasture lies at 31°38' 14.94" N latitude, 77°15'23.52" E longitude and 2900-3100 m elevation. A total of 86 plant species belonging to 30 families and 72 genera were recorded from the study area. Dominant families were Asteraceae, Lamiaceae, Rosaceae, Poaceae and Ranunculaceae. On the basis of IVI, Geum elatum recorded the highest value (10.93) followed Trifolium repens (10.42) and Poa alpina (10.36). The lowest value of IVI was observed by Potentilla leschenaultiana and Thalictrum foliolosum (0.79). The ratio of A/F indicates the distribution pattern of all the species was contiguous. Out of 66 medicinal plant species recorded from the pasture, two species viz., Roscoea alpina and Selinum vaginatum fall in the category of threatened plants.

**Keywords** Alpine pasture, Dominant, Threatened plant, Distribution pattern, Conservation.

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### **INTRODUCTION**

The alpine pastures are an important constituent of the Himalayan ecosystem. The Himalayas constitute one of the richest and most unusual ecosystems on Earth (Salick et al. 2009). Alpine flora was probably first evolved in the Central Asian highlands during the periods of mountain building in late Myocene and early Pliocene (Billings 1974). 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). Himalayan alpine vegetation communities retain high ecological significance, because they control the soil stability of their catchment areas, play a major role in ecosystem functioning and are vital in cultural, ethical and aesthetic aspects (Stirling and Wilsey 2001). Alpine refers to those lands lying above climatic limit of upright trees. It is a region of open vegetation, above the timberline where general environment and the vegetation are significantly different from that of lowland. These regions are characterized by relatively low atmospheric pressure, low temperature, intense insulation, rapid and high ultraviolet radiation along with other related effects as chain reactions (Santvan 1993). The alpine pasture, locally known as Dhar in Himachal Pradesh. These pasture are rich in variety of grasses and medicinal herbs which grow naturally. The pastures in the alpine zone occupy about 1.52% of the total land area of the country and are mainly concentrated in the Himalayan states of Arunachal Pradesh, Sikkim, Uttarakhand, Himachal Pradesh and Jammu and Kashmir. In Himachal Pradesh alpine pastures cover

around 10,052 sq km which otherwise constitute 17% of the total geographical area of the state (Verma and Kapoor 2014). The phytosociological studies are also useful for comparing different communities. 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. Very little scientific attention has been given to the vegetation of the alpine regions. The present study was carried out to know the floristic diversity of alpine pasture, which in turn could be helpful in devising strategies for conservation of the plant resources.

## MATERIALS AND METHODS

Study was conducted in alpine pasture of Thachi, District Mandi, Himachal Pradesh during the year 2017 in rainy season. The site lies at 31°38'14.94''N latitude, 77°15'23.52'' E longitude between 2900-3100 m elevation range. Phytosociological studies was carried out by laying out the quadrats of size 1 m  $\times$  1 m randomly in the alpine pasture. The vegetation data were analyzed for density, frequency and abundance as per Curtis and McIntosh (1950). The relative values of density, frequency and dominance were summed to get importance value index (IVI) of individual species. The abundance to frequency ratio (A/F) of different species was determined for eliciting the distribution pattern of the floral elements. This ratio indicates regular (< 0.025), random (0.025 to (0.050) and continuous (> 0.050) distribution (Curtis and Cottam 1956). The plant species diversity was calculated following Shannon-Wiener Diversity Index (H) (Shannon-Wiener 1963) :

$$H = -\sum_{i=1}^{5} (Ni / N) \ln (Ni / N)$$

Where, Ni = Number of individuals of species i and N = Total number of individuals of all the species.

Dominance Index (C) was measured by Simpson's Index (Simpson 1949) :

$$C = \sum_{i=1}^{S} (Ni / N)^2$$

Where, Ni = Importance value of species i and N

= Total importance value of all the species. Richness Index was estimated as per Margalef (1958) i.e. : R=S-1/ln N

Evenness Index was calculated as per Hill (1973) i. e. :

E = H / ln S

Where, S = Total number of species, N = Total number of individuals of all the species, H = Index of diversity.

## **RESULTS AND DISCUSSION**

Total number of herb species was 86 in the alpine pasture of Thachi. Table 1 *Lotus corniculatus* species having highest value for abundance (5.50) followed by *Geum elatum* (4.67). In terms of density, *Trifolium repens* having highest value (0.67) followed by *Poa alpina* and *Thymus linearis* (0.63). In case of frequency, *Trifolium repens* recorded the highest value (30.00%) followed by *Poa alpina* and *Thymus linearis* (23.33%) and *Inula orientalis* (20.00%). On the basis of IVI, *Geum elatum* was the dominant species (10.93) followed *Trifolium repens* (10.42) and *Poa alpina* (10.36). The lowest value of IVI was observed by *Potentilla leschenaultiana* and *Thalictrum foliolosum* (0.79).

The ratio of A/F indicates the distribution pattern of all the species was contiguous (Table 1). The contiguous distribution is the commonest pattern which is usually observed in nature. The general preponderance of contiguous distribution in vegetation has been reported by several workers (Shameem et al. 2010, Verma and Kapoor 2010, Verma 2014). The value of Dominance Index (C), Diversity Index (H), Richness Index (R) and Evenness Index (E) for herbs was 0.017, 4.200, 12.310 and 0.943 respectively. The higher the value of dominance index, greater is the homogenous nature of the community and vice-versa (Kohli et al. 2004). The lower value of dominance show that dominance of plant is shared by many species. The higher values of index of diversity indicate the variability in the type of species and heterogeneity in the communities, whereas, the lesser value indicate the homogeneity in the community. The higher value of richness index indicates higher diversity of the

Achillea millefolium L.         0.13         5.00         2.67         0.533         2.54           2         Adirotium edgeworthii Hook.         0.07         5.00         1.33         0.267         1.49           3         Agrostis muroana Alche. & Hemsl.         0.13         8.33         1.60         0.192         2.45           4         Agrostis pilosula Trin.         0.12         6.67         1.75         0.263         2.15           5         Ausiace latofilo (Don) Ship.         0.07         5.00         1.33         0.267         1.42           6         Anaphalis tripilnervis (Sims) Sims ex            C. B. Clarke         0.13         5.00         2.67         0.533         2.36           9         Anemone obusitoba D. Don         0.30         6.67         4.50         0.675         5.90           10         Areararia feequemoniti Blume         0.10         3.33         1.00         0.300         0.900         1.92           12         Arisaema jacequemoniti Blume         0.13         5.00         1.00         0.200         1.26           13         Aster himalaicos C. B. Clarke         0.05         5.00         1.00         0.203         3.33     <	Sl. No.	Herbs species	Density (m <sup>-2</sup> )	Frequ- ency	Abun- dance	A/F	IVI
2         Adiantum eigeworthi Hook         0.07         5.00         1.33         0.267         1.49           3         Agrostis munroana Aitch, & Hemsl.         0.13         8.33         1.60         0.192         2.45           4         Agrostis pilosula Trin.         0.12         6.67         1.75         0.263         2.15           5         Anishieea latifolia (D. Don) Hook. ft.         0.07         5.00         1.33         0.267         1.42           7         Anaphalts controt, O. Don) Hook. ft.         0.03         5.00         1.30         0.267         0.533         2.36           8         Androsace lanuginosa Wall.         0.37         8.33         4.40         0.528         6.14           9         Arenaria festicoides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema propinguum Schott         0.05         5.00         1.00         0.200         1.26           13         Aster hinalacius C. B. Clarke         0.05         5.00         1.00         0.200         1.26           14         Bregenia ciliaat (Hw.) Sternb.         0.13         5.00         1.00         0.200         1.31           15         Bupleurum longi	1	Achillea millefolium L.	0.13	5.00	2.67	0.533	2.54
3         Agrostis mi <sup>o</sup> cana Aitch. & Hemsl.         0.13         8.33         1.60         0.192         2.45           4         Agrostis pilosula Trin.         0.12         6.67         1.75         0.263         2.15           6         Anaphalts contorta (D. Don) Hock. f.         0.05         5.00         1.00         0.200         1.31           7         Anaphalts tripilnervis (Sims) Sims ex	2	Adiantum edgeworthii Hook.	0.07	5.00	1.33	0.267	1.49
4         Agrostis pilosula Trin.         0.12         6.67         1.75         0.263         2.15           5         Ainsliaea laifolia (D. Don) Sch. Bip.         0.07         5.00         1.33         0.267         1.42           7         Anaphalis controta (D. Don) Hook, f.         0.05         5.00         1.00         0.200         1.31           7         Anaphalis controta (D. Don) Hook, f.         0.03         5.00         1.00         0.200         1.31           7         Anaphalis controta (O. Don) Hook, f.         0.03         3.33         4.40         0.528         6.14           9         Anemace obnsiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arenaria festucoides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema propringum Schott         0.05         S.00         1.00         0.200         1.26           13         Aster himalicus C. B. Clarke         0.05         S.00         1.00         0.200         1.26           14         Bergenia ciliaa (Hav) Sternb.         0.13         S.00         1.00         0.200         1.31           15         Bupleurum longicaule Wall.<	3	Agrostis munroana Aitch. & Hemsl.	0.13	8.33	1.60	0.192	2.45
5         Ansilace latifolia (D. Don) Sch. Bip.         0.07         5.00         1.33         0.267         1.42           6         Anaphalis contorta (D. Don) Hock. f.         0.05         5.00         1.00         0.200         1.31           7         Anaphalis triplinervis (Sims) Sims ex         0.13         5.00         2.67         0.533         2.36           8         Androsace langinoso Wall.         0.37         8.33         4.40         0.528         6.14           9         Anemone obnasiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arenaria festucoides Benth.         0.03         3.33         1.00         0.300         0.920           11         Arisaema jacquemoniti Blume         0.10         3.33         1.00         0.450         1.26           14         Bergeria ciliata (Haw.) Stemb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longicaule Wall. ex DC.         0.27         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         2.00         1.31           18         Cirsium wallichi DC	4	Agrostis pilosula Trin.	0.12	6.67	1.75	0.263	2.15
6         Anaphalis contorta (D. Don) Hook, f.         0.05         5.00         1.00         0.200         1.31           7         Anaphalis triplinervis (Sims) Sims ex	5	Ainsliaea latifolia (D. Don) Sch. Bin.	0.07	5.00	1.33	0.267	1.42
7         Anaphalis triplinervis (Sims) Sims ex         0.13         5.00         2.67         0.533         2.36           8         Androsace lanuginosa Wall.         0.37         8.33         4.40         0.528         6.14           9         Anemone obtusiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arenaria festuccides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema jacquemontii Blume         0.10         3.33         1.00         0.300         0.92           12         Arisaema propinquam Schott         0.05         5.00         1.00         0.200         1.26           14         Bergenia ciliata (Haw,) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longiccule Wall, ex DC.         0.27         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         0.200         1.31           18         Ciristium falconeri (Hook, f.) Petr.         0.07         5.00         1.33         0.00         2.53           20         Cimpodium umbrosum (M. Bieb.) Kuntze <td>6</td> <td>Anaphalis contorta (D. Don) Hook, f.</td> <td>0.05</td> <td>5.00</td> <td>1.00</td> <td>0.200</td> <td>1.31</td>	6	Anaphalis contorta (D. Don) Hook, f.	0.05	5.00	1.00	0.200	1.31
C. B. Clarke         0.13         5.00         2.67         0.533         2.36           8         Androsace lanuginosa Wall.         0.37         8.33         4.40         0.528         6.14           9         Anenone obnsiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arenaria festucoides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema propinguum Schott         0.05         3.33         1.50         0.450         1.74           13         Aster himalacius C. B. Clarke         0.05         5.00         1.00         0.200         1.26           14         Bergenia cilitat (Haw) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longicaule Wall. ex DC.         0.27         6.67         4.00         0.600         3.33           16         Campanula pallida Wall.         0.05         5.00         1.00         2.00         2.33           17         Carex invalis Boott         0.05         5.00         1.00         0.200         2.53           20         Clinopodium umbrosum (Ho. Bioth.         0.10         3.33         1.	7	Anaphalis triplinervis (Sims) Sims ex					
8         Androsace lanuginosa Wall.         0.37         8.33         4.40         0.528         6.14           9         Anemone obtusiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arriseema jacquemontii Blume         0.10         3.33         1.00         0.300         0.92           11         Ariseema propinguum Schott         0.05         3.00         0.900         1.99           12         Ariseema propinguum Schott         0.05         5.00         1.00         0.200         1.74           13         Aster himalaicus C. B. Clarke         0.05         5.00         1.00         0.200         1.31           14         Bergenia ciliata (Haw) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupterum longicaule Wall. ex DC.         0.27         6.67         3.00         0.450         2.95           16         Carsium falconeri (Hook. f.) Petr.         0.07         5.00         1.33         0.267         2.53           20         Clinopodium umbrosum (M. Bieb.) Kuntze         0.20         6.67         3.00         0.450         4.51           21         Crynglossum aulilchii G. Don         0.13 <td></td> <td>C. B. Clarke</td> <td>0.13</td> <td>5.00</td> <td>2.67</td> <td>0.533</td> <td>2.36</td>		C. B. Clarke	0.13	5.00	2.67	0.533	2.36
9         Anemone obtusiloba D. Don         0.30         6.67         4.50         0.675         3.90           10         Arenaria festucoides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema jacquemonti Blume         0.10         3.33         3.00         0.900         1.99           12         Arisaema propinguum Schott         0.05         3.33         1.50         0.450         1.74           13         Aster himalaicus C. B. Clarke         0.05         5.00         1.00         0.200         1.26           14         Bergenia cilitad (Haw.) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longicaule Wall. ex DC.         0.27         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         0.200         1.33           18         Cirsium valichir DC         0.10         3.33         3.00         0.450         4.31           21         Coroglossum microglochin Benth.         0.10         5.03         1.00         0.400         3.00           23         Cynoglossum avalichiii G. Don         0.13	8	Androsace lanuginosa Wall.	0.37	8.33	4.40	0.528	6.14
10         Arenaria festuccides Benth.         0.03         3.33         1.00         0.300         0.92           11         Arisaema jacquemontii Blume         0.10         3.33         1.00         0.300         0.990           12         Arisaema projnaum Schott         0.05         5.00         1.00         0.200         1.26           13         Aster himalacias C. B. Clarke         0.05         5.00         1.00         0.200         1.26           14         Bergenia ciliata (Haw.) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurun longicaule Wall. ex DC.         0.27         6.67         4.00         0.600         3.33           16         Carsa nivalis Boott         0.05         5.00         1.03         0.267         2.73           17         Carea nivalis Boott         0.07         5.00         1.33         0.267         2.73           18         Cirsium valichii DC         0.01         3.33         1.50         0.450         4.33           21         Corydais govaniana Wall         0.05         3.33         1.50         0.450         1.05           22         Cynoglossum mulilichii G. Don         0.13         6.	9	Anemone obtusiloba D. Don	0.30	6.67	4.50	0.675	3.90
11         Arisaema jacquemontii Blume         0.10         3.33         3.00         0.900         1.99           12         Arisaema propinguum Schott         0.05         3.33         1.50         0.450         1.74           13         Aster hinalaicus C. B. Clarke         0.05         5.00         1.00         0.200         1.26           14         Bergenia ciliata (Haw.) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longiccule Wall, ex DC.         0.27         6.67         4.00         0.600         3.33           16         Campanula pallida Wall.         0.20         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.30         0.267         2.73           18         Cirsium vallichii DC         0.10         3.33         1.00         0.450         4.31           21         Corydalis govaniana Wall         0.05         3.33         1.50         0.450         1.05           22         Cynoglossum wallichii G. Don         0.13         6.67         4.50         0.675         4.59           26         Delphininum vestitum Wall, ex Royle         0.30	10	Arenaria festucoides Benth.	0.03	3.33	1.00	0.300	0.92
12       Arisaema projinguum Schott       0.05 $3.33$ $1.50$ $0.450$ $1.74$ 13       Aster himalaticus C. B. Clarke       0.05 $5.00$ $1.00$ $0.200$ $1.26$ 14       Bergenia cilitar (Haw), Sternb.       0.13 $5.00$ $2.67$ $0.533$ $2.36$ 15       Bupleurum longicaule Wall. ex DC. $0.27$ $6.67$ $4.00$ $0.600$ $3.33$ 16       Campanula pallida Wall. $0.20$ $6.67$ $3.00$ $0.450$ $2.95$ 17       Carex nivalis Boott $0.05$ $5.00$ $1.33$ $0.267$ $2.73$ 18       Cirsium vallichii DC $0.07$ $5.00$ $1.33$ $0.267$ $2.73$ 19       Carsium vallichii DC $0.10$ $3.33$ $1.50$ $0.450$ $1.05$ 21       Coryadis govaniana Wall $0.05$ $3.33$ $1.50$ $0.450$ $1.05$ 22       Cynoglossum microglochin Benth. $0.10$ $5.00$ $2.00$ $0.300$ $3.72$ 24       Cynoglossum valichii G. Don $0.13$ $6.67$ $4.50$ <	11	Arisaema jacauemontii Blume	0.10	3.33	3.00	0.900	1.99
13       Aster himitalizus <sup>7</sup> C, B. Clarke       0.05       5.00       1.00       0.200       1.26         14       Bergenia cilitati (Haw.) Sternb.       0.13       5.00       2.67       0.533       2.36         15       Bupleurum longicaule Wall.       0.27       6.67       4.00       0.600       3.33         16       Carex nivalis Boott       0.05       5.00       1.00       0.200       1.31         18       Cirsium falconeri (Hook, f.) Petr.       0.07       5.00       1.33       0.267       2.73         19       Cirsium vallichii DC       0.10       3.33       3.00       0.900       2.53         20       Clinopodium umbrosum (M. Bieb.) Kuntze       0.20       6.67       3.00       0.450       4.31         21       Cynoglossum vallichii G. Don       0.13       6.67       2.00       0.400       3.00         22       Cynoglossum vallichii G. Don       0.13       6.67       4.50       0.675       4.59         25       Cyperus squarrosus L.       0.30       6.67       4.50       0.675       4.59         26       Delphinium vestium Wall.ex Royle       0.30       6.67       4.50       0.675       3.90         27	12	Arisaema propinguum Schott	0.05	3.33	1.50	0.450	1.74
14         Bergenia ciliata (Haw.) Sternb.         0.13         5.00         2.67         0.533         2.36           15         Bupleurum longicaule Wall. ex DC.         0.27         6.67         4.00         0.600         3.33           16         Campanula pallida Wall.         0.20         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         0.200         1.31           18         Cirsium falconeri (Hook. f.) Petr.         0.07         5.00         1.33         0.267         2.73           20         Clinopodium unbrosum (M. Bieb. ) Kuntze         0.20         6.67         3.00         0.450         4.31           21         Corydalis govaniana Wall         0.05         3.33         1.50         0.450         1.05           22         Cynoglossum wallichii G. Don         0.10         5.00         2.00         0.400         3.00           23         Cynoglossum reylanicum (Vahl) Brand         0.10         8.33         1.20         0.144         3.52           24         Cynoglossum reylanicum Vahl, ex Royle         0.30         6.67         4.50         0.675         3.90           25         Cyperus squarrosus L	13	Aster himalaicus C. B. Clarke	0.05	5.00	1.00	0.200	1.26
Bupleurum longicaule Wall. ex DC.         0.27         6.67         4.00         0.600         3.33           16         Campanula pallida Wall.         0.20         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         0.200         1.31           18         Cirsium falconeri (Hook, f.) Petr.         0.07         5.00         1.33         0.267         2.73           19         Cirsium falconeri (Hook, f.) Petr.         0.01         3.33         3.00         0.900         2.53           20         Clinopodium umbrosum (M. Bieb.) Kuntze         0.20         6.67         3.00         0.450         4.31           21         Cynoglossum microglochin Benth.         0.10         5.03         3.31         1.50         0.450         1.05           22         Cynoglossum wallichii G. Don         0.13         6.67         4.50         0.675         4.59           24         Cypeolossum seylanicum (Yahl) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         4.59           26         Delphininium vestitum Wal	14	Bergenia ciliata (Haw.) Sternb.	0.13	5.00	2.67	0.533	2.36
16         Campanula pallida Wall.         0.20         6.67         3.00         0.450         2.95           17         Carex nivalis Boott         0.05         5.00         1.00         0.200         1.31           18         Cirsium falconeri (Hook f.) Petr.         0.07         5.00         1.33         0.267         2.73           20         Clinopodium umbrosum (M. Bieb.) Kuntze         0.20         6.67         3.00         0.450         4.31           21         Corydalis govaniana Wall         0.05         3.33         1.50         0.450         4.31           22         Synoglossum microglochin Benth.         0.10         5.00         2.00         0.400         3.00           23         Cynoglossum valichii G. Don         0.13         6.67         4.50         0.675         4.59           24         Cynoglossum zeylanicum (Vahl) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.	15	Bupleurum longicaule Wall. ex DC.	0.27	6.67	4.00	0.600	3.33
17Carex nivals Boott0.055.001.000.2001.3118Cirsium falconeri (Hook, f.) Petr.0.075.001.330.2672.7319Cirsium wallichii DC0.103.333.000.9002.5320Clinopodium umbrosum (M. Bieb. ) Kuntze0.206.673.000.4504.3121Corydalis govaniana Wall0.053.331.500.4501.0522Cynoglossum microglochin Benth.0.105.002.000.4003.0033Cynoglossum vallichii (G. Don0.136.672.000.3003.7224Cynoglossum zeylanicum (Vahl) Brand0.108.331.200.1443.5225Cyperus squarrosus L.0.306.674.500.6754.5926Delphinium vestitum Wall. ex Royle0.306.674.500.6753.9027Elsholtzia strobilifera (Benth.) Benth.0.105.002.000.4002.1028Epilobium royleanum Hausskn.0.106.671.500.2252.2229Erigeron multiraditaus (Lindl. ex DC.) Benth. &	16	Campanula pallida Wall.	0.20	6.67	3.00	0.450	2.95
18Cirsium falconeri (Hook, f.) Petr. $0.07$ $5.00$ $1.33$ $0.267$ $2.73$ 19Cirsium wallichii DC $0.10$ $3.33$ $3.00$ $0.900$ $2.53$ 20Clinopodium umbrosum (M. Bieb.) Kuntze $0.20$ $6.67$ $3.00$ $0.450$ $4.31$ 21Corydalis govaniana Wall $0.05$ $3.33$ $1.50$ $0.450$ $1.05$ 22Cynoglossum microglochin Benth. $0.10$ $5.00$ $2.00$ $0.400$ $3.00$ 23Cynoglossum zeylanicum (Vahl) Brand $0.10$ $8.33$ $1.20$ $0.144$ $3.52$ 24Cynoglossum zeylanicum (Vahl) Brand $0.10$ $8.33$ $1.20$ $0.144$ $3.52$ 25Cyperus squarrosus L. $0.30$ $6.67$ $4.50$ $0.675$ $4.59$ 26Delphinium vestitum Wall. ex Royle $0.30$ $6.67$ $4.50$ $0.675$ $3.90$ 27Elsholtica strobilifera (Benth.) Benth. $0.10$ $6.67$ $1.50$ $0.225$ $2.22$ 29Erigeron multiradiatus (Lindl. ex DC.) Benth. & Hook. f. $0.20$ $8.33$ $2.40$ $0.288$ $3.21$ 30Fragaria vesca L. $0.20$ $6.67$ $3.00$ $0.450$ $3.16$ 32Geranium polyanthes Edgew. & Hook. f. $0.05$ $3.33$ $1.50$ $0.450$ $1.11$ 33Geranium wallichinam D. Don ex Sweet $0.17$ $10.00$ $1.67$ $0.467$ $10.93$ 34Geum elatum Wall. ex G. Don $0.20$ $6.67$ $3.00$ $0.4$	17	Carex nivalis Boott	0.05	5.00	1.00	0.200	1.31
19         Cirsium vallichii DC         0.10         3.33         3.00         0.900         2.53           20         Clinopodium umbrosum (M. Bieb.) Kuntze         0.20         6.67         3.00         0.450         4.31           21         Corydalis govaniana Wall         0.05         3.33         1.50         0.450         1.05           22         Cynoglossum microglochin Benth.         0.10         5.00         2.00         0.400         3.00           23         Cynoglossum zeylanicum (Vahl) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         4.59           26         Delphinium vestitum Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         5.00         2.00         0.400         2.10           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. &         Hock.f.         0.20         8.33         2.40         0.288         3.21           30	18	Cirsium falconeri (Hook, f.) Petr.	0.07	5.00	1.33	0.267	2.73
20Clinopodium umbrosum (M. Bieb. ) Kuntze0.206.673.000.4504.3121Corydalis govaniana Wall0.053.331.500.4501.0522Cynoglossum microglochin Benth.0.105.002.000.4003.0023Cynoglossum vallichii G. Don0.136.672.000.3003.7224Cynoglossum zeylanicum (Vahl) Brand0.108.331.200.1443.5225Cyperus squarrosus L.0.306.674.500.6754.5926Delphinium vestitum Wall. ex Royle0.306.674.500.6753.9027Elsholtzia strobilifera (Benth.) Benth.0.105.002.000.4002.1028Epilobium royleanum Hausskn.0.106.671.500.2252.2229Erigeron multiradiatus (Lindl. ex DC.) Benth. & Hook. f.0.208.332.400.2883.2130Fragaria vesca L.0.4713.333.500.2636.1031Galium aparine L.0.206.673.000.4503.1632Geranium polyanthes Edgew. & Hook. f.0.053.331.500.4571.9335Gypsophila cerastoides D. Don0.2011.671.710.1473.9436Hackelia uncinata (Benth.) C. E. C. Fisch.0.053.331.500.4502.7637Halenia elliptica D. Don0.206.673.000.4502.7638	19	Cirsium wallichii DC	0.10	3.33	3.00	0.900	2.53
21Corydalis govaniana Wall0.053.331.500.4501.0522Cynoglossum microglochin Benth.0.105.002.000.4003.0023Cynoglossum wallichii G. Don0.136.672.000.3003.7224Cynoglossum zeylanicum (Vahl) Brand0.108.331.200.1443.5225Cyperus squarrosus L.0.306.674.500.6754.5926Delphinium vestitum Wall. ex Royle0.306.674.500.6753.9027Elsholtzia strobilifera (Benth.) Benth.0.105.002.000.4002.1028Epilobium royleanum Hausskn.0.106.671.500.2252.2229Erigeron multiradiatus (Lindl. ex DC.) Benth. &Hook. f.0.208.332.400.2883.2130Fragaria vesca L.0.47713.333.500.2636.1031Galum aparine L.0.206.673.000.4503.1632Geranium polyanthes Edgew. & Hook. f.0.053.331.500.4501.1133Geranium wallichianum D. Don ex Sweet0.1710.001.670.46710.9335Gypsophila cerastoides D. Don0.206.673.000.4502.7638Inula orientalis Lam.0.3720.001.830.927.4639Lactuca macrorhiza (Bonth.) C. E. C. Fisch.0.053.331.500.4502.763	20	Clinopodium umbrosum (M. Bieb.) Kuntze	0.20	6.67	3.00	0.450	4.31
22         Cynoglossum microglochin Benth.         0.10         5.00         2.00         0.400         3.00           23         Cynoglossum wallichii G. Don         0.13         6.67         2.00         0.300         3.72           24         Cynoglossum zeylanicum (Vahl) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         3.90           26         Delphinium vestium Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         6.67         1.50         0.225         2.22           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. &	21	Corvdalis govaniana Wall	0.05	3.33	1.50	0.450	1.05
23         Cynoglossum vallichii G. Don         0.13         6.67         2.00         0.300         3.72           24         Cynoglossum zeylanicum (Vahl) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         4.59           26         Delphinium vestitum Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         6.67         1.50         0.225         2.22           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. & Hook. f.         0.20         8.33         2.40         0.288         3.21           30         Fragaria vesca L.         0.47         13.33         3.50         0.263         6.10           31         Galium aparine L.         0.20         6.67         3.00         0.450         1.11           33         Geranium vallichianum D. Don ex Sweet         0.17         10.00         1.67         0.167         3.00           34         Geum elat	22	Cynoglossum microglochin Benth	0.10	5.00	2.00	0.400	3.00
24         Cynoglossum zeylanicum (Vall) Brand         0.10         8.33         1.20         0.144         3.52           25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         4.59           26         Delphinium vestitum Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         6.67         1.50         0.225         2.22           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. &         Hook. f.         0.20         8.33         2.40         0.288         3.21           30         Fragaria vesca L.         0.47         13.33         3.50         0.263         6.10           31         Galium aparine L.         0.20         6.67         3.00         0.450         3.16           32         Geranium wallichianum D. Don ex Sweet         0.17         10.00         1.67         0.167         3.00           34         Geum elatum Wall. ex G. Don         0.20         1.67         3.00         0.450         1.00           35	23	Cynoglossum wallichii G. Don	0.13	6.67	2.00	0.300	3.72
25         Cyperus squarrosus L.         0.30         6.67         4.50         0.675         4.59           26         Delphinium vestitum Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         6.67         1.50         0.225         2.22           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. &         Hook. f.         0.20         8.33         2.40         0.288         3.21           30         Fragaria vesca L.         0.47         13.33         3.50         0.263         6.10           31         Galium aparine L.         0.20         6.67         3.00         0.450         1.11           33         Geranium polyanthes Edgew. & Hook. f.         0.05         3.33         1.50         0.450         1.11           33         Geranium wallichianum D. Don ex Sweet         0.17         10.00         4.67         0.467         10.93           35         Gypsophila cerastoides D. Don         0.20         11.67         1.71         0.147         3.94           36	24	Cynoglossum zevlanicum (Vahl) Brand	0.10	8 33	1 20	0.144	3.52
Delphinis organizations with Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           26         Delphinis vestitum Wall. ex Royle         0.30         6.67         4.50         0.675         3.90           27         Elsholtzia strobilifera (Benth.) Benth.         0.10         5.00         2.00         0.400         2.10           28         Epilobium royleanum Hausskn.         0.10         6.67         1.50         0.225         2.22           29         Erigeron multiradiatus (Lindl. ex DC.) Benth. & Hook. f.         0.20         8.33         2.40         0.288         3.21           30         Fragaria vesca L.         0.47         13.33         3.50         0.263         6.10           31         Galium aparine L.         0.20         6.67         3.00         0.450         1.11           33         Geranium vallichianum D. Don ex Sweet         0.17         10.00         1.67         0.167         3.00           34         Geum elatum Wall. ex G. Don         0.47         10.00         4.67         0.467         10.93           35         Gypsophila cerastoides D. Don         0.20         11.67         1.71         0.147         3.94           36         Hackelia unc	25	Cyperus sauarrosus L	0.30	6.67	4 50	0.675	4 59
27       Elsholtzia strobiljera (Benth.) Benth.       0.10       5.00       2.00       0.400       2.10         28       Epilobium royleanum Hausskn.       0.10       6.67       1.50       0.225       2.22         29       Erigeron multiradiatus (Lindl. ex DC.) Benth. & Hook. f.       0.20       8.33       2.40       0.288       3.21         30       Fragaria vesca L.       0.47       13.33       3.50       0.263       6.10         31       Galium aparine L.       0.20       6.67       3.00       0.450       3.16         32       Geranium polyanthes Edgew. & Hook. f.       0.05       3.33       1.50       0.450       1.11         33       Geranium wallichianum D. Don ex Sweet       0.17       10.00       1.67       0.167       3.00         34       Geum elatum Wall. ex G. Don       0.47       10.00       4.67       0.467       10.93         35       Gypsophila cerastoides D. Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.7	26	Delphinium vestitum Wall ex Royle	0.30	6.67	4 50	0.675	3 90
28       Epilobium royleanum Haussh.       0.10       6.67       1.50       0.105       2.105         29       Erigeron multiradiatus (Lindl. ex DC.) Benth. &       0.20       8.33       2.40       0.288       3.21         30       Fragaria vesca L.       0.47       13.33       3.50       0.263       6.10         31       Galium aparine L.       0.20       6.67       3.00       0.450       3.16         32       Geranium polyanthes Edgew. & Hook. f.       0.05       3.33       1.50       0.450       1.11         33       Geranium wallichianum D. Don ex Sweet       0.17       10.00       1.67       0.167       3.00         34       Geum elatum Wall. ex G. Don       0.20       1.67       1.71       0.147       3.94         35       Gypsophila cerastoides D. Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46	27	Elsholtzia strobilifera (Benth) Benth	0.10	5.00	2.00	0 400	2.10
29       Erigeron multiradiatus (Lindl. ex DC.) Benth. &       0.20       8.33       2.40       0.288       3.21         30       Fragaria vesca L.       0.47       13.33       3.50       0.263       6.10         31       Galium aparine L.       0.20       6.67       3.00       0.450       3.16         32       Geranium polyanthes Edgew. & Hook. f.       0.05       3.33       1.50       0.450       1.11         33       Geranium wallichianum D. Don ex Sweet       0.17       10.00       1.67       0.167       3.00         34       Geum elatum Wall. ex G. Don       0.47       10.00       4.67       0.467       10.93         35       Gypsophila cerastoides D. Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42	28	Enilohium rovleanum Hausskn	0.10	6.67	1.50	0.225	2.22
Hook, f.0.208.332.400.2883.2130Fragaria vesca L.0.4713.333.500.2636.1031Galium aparine L.0.206.673.000.4503.1632Geranium polyanthes Edgew. & Hook, f.0.053.331.500.4501.1133Geranium wallichianum D. Don ex Sweet0.1710.001.670.1673.0034Geum elatum Wall, ex G. Don0.4710.004.670.46710.9335Gypsophila cerastoides D. Don0.2011.671.710.1473.9436Hackelia uncinata (Benth.) C. E. C. Fisch.0.053.331.500.4501.0037Halenia elliptica D. Don0.206.673.000.4502.7638Inula orientalis Lam.0.3720.001.830.0927.4639Lactuca macrorhiza (Royle) Hook, f.0.075.001.330.2671.4241Malva neglecta Wallr.0.4713.333.500.2637.6042Mazus surculosus D. Don0.103.333.000.9001.4743Mentha spicata L.0.3013.332.400.2884.9344Microula sikkimensis (C. B. Clarke) Hemsl.0.208.332.400.2884.9345Myriactis nepalensis Less.0.175.003.330.6673.50	29	Erigeron multiradiatus (Lindl. ex DC.) Benth. &					
30         Fragaria vesca L.         0.47         13.33         3.50         0.263         6.10           31         Galium aparine L.         0.20         6.67         3.00         0.450         3.16           32         Geranium polyanthes Edgew. & Hook. f.         0.05         3.33         1.50         0.450         1.11           33         Geranium wallichianum D. Don ex Sweet         0.17         10.00         1.67         0.167         3.00           34         Geum elatum Wall. ex G. Don         0.47         10.00         4.67         0.467         10.93           35         Gypsophila cerastoides D. Don         0.20         11.67         1.71         0.147         3.94           36         Hackelia uncinata (Benth.) C. E. C. Fisch.         0.05         3.33         1.50         0.450         1.00           37         Halenia elliptica D. Don         0.20         6.67         3.00         0.450         2.76           38         Inula orientalis Lam.         0.37         20.00         1.83         0.092         7.46           39         Lactuca macrorhiza (Royle) Hook. f.         0.07         5.00         1.33         0.267         1.42           40         Lotus corniculatus L.		Hook, f.	0.20	8.33	2.40	0.288	3.21
31       Galium aparine L.       0.20       6.67       3.00       0.450       3.16         32       Geranium polyanthes Edgew. & Hook. f.       0.05       3.33       1.50       0.450       1.11         33       Geranium wallichianum D. Don ex Sweet       0.17       10.00       1.67       0.167       3.00         34       Geum elatum Wall. ex G. Don       0.47       10.00       4.67       0.467       10.93         35       Gypsophila cerastoides D. Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Wallr.       0.47       13.33       3.50       0.263       7.60         42 </td <td>30</td> <td>Fragaria vesca L.</td> <td>0.47</td> <td>13.33</td> <td>3.50</td> <td>0.263</td> <td>6.10</td>	30	Fragaria vesca L.	0.47	13.33	3.50	0.263	6.10
32       Geranium polyanhes Edgew. & Hook. f.       0.05       3.33       1.50       0.450       1.11         33       Geranium wallichianum D. Don ex Sweet       0.17       10.00       1.67       0.167       3.00         34       Geum elatum Wall. ex G. Don       0.47       10.00       4.67       0.467       10.93         35       Gypsophila cerastoides D. Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Wallr.       0.47       13.33       3.50       0.263       7.60         42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47 <td< td=""><td>31</td><td>Galium anarine L</td><td>0.20</td><td>6.67</td><td>3.00</td><td>0.450</td><td>3.16</td></td<>	31	Galium anarine L	0.20	6.67	3.00	0.450	3.16
33         Geranium wallichianum D. Don ex Sweet         0.17         10.00         1.67         0.167         3.00           34         Geum elatum Wall. ex G. Don         0.47         10.00         4.67         0.467         10.93           35         Gypsophila cerastoides D. Don         0.20         11.67         1.71         0.147         3.94           36         Hackelia uncinata (Benth.) C. E. C. Fisch.         0.05         3.33         1.50         0.450         1.00           37         Halenia elliptica D. Don         0.20         6.67         3.00         0.450         2.76           38         Inula orientalis Lam.         0.37         20.00         1.83         0.092         7.46           39         Lactuca macrorhiza (Royle) Hook. f.         0.07         5.00         1.33         0.267         1.42           40         Lotus corniculatus L.         0.37         6.67         5.50         0.825         4.54           41         Malva neglecta Wallr.         0.47         13.33         3.50         0.263         7.60           42         Mazus surculosus D. Don         0.10         3.33         3.00         0.900         1.47           43         Mentha spicata L.         0.	32	Geranium polvanthes Edgew. & Hook, f.	0.05	3.33	1.50	0.450	1.11
34Geum elatum Wall. ex G. Don0.4710.004.670.46710.9335Gypsophila cerastoides D. Don0.2011.671.710.1473.9436Hackelia uncinata (Benth.) C. E. C. Fisch.0.053.331.500.4501.0037Halenia elliptica D. Don0.206.673.000.4502.7638Inula orientalis Lam.0.3720.001.830.0927.4639Lactuca macrorhiza (Royle) Hook. f.0.075.001.330.2671.4240Lotus corniculatus L.0.376.675.500.8254.5441Malva neglecta Wallr.0.4713.333.500.2637.6042Mazus surculosus D. Don0.103.333.000.9001.4743Mentha spicata L.0.3013.332.250.1696.4944Microula sikkimensis (C. B. Clarke) Hemsl.0.208.332.400.2884.9345Myriactis nepalensis Less.0.175.003.330.6673.5046Nepeta elliptica Royle ex Benth.0.105.002.000.4001.73	33	Geranium wallichianum D. Don ex Sweet	0.17	10.00	1.67	0.167	3.00
35       Gypsophila cerastoides D.Don       0.20       11.67       1.71       0.147       3.94         36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Wallr.       0.47       13.33       3.50       0.263       7.60         42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47         43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46 <td< td=""><td>34</td><td>Geum elatum Wall, ex G. Don</td><td>0.47</td><td>10.00</td><td>4.67</td><td>0.467</td><td>10.93</td></td<>	34	Geum elatum Wall, ex G. Don	0.47	10.00	4.67	0.467	10.93
36       Hackelia uncinata (Benth.) C. E. C. Fisch.       0.05       3.33       1.50       0.450       1.00         37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Waltr.       0.47       13.33       3.50       0.263       7.60         42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47         43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46       Nepeta elliptica Royle ex Benth.       0.10       5.00       2.00       0.400       1.73	35	Gypsophila cerastoides D. Don	0.20	11.67	1.71	0.147	3.94
37       Halenia elliptica D. Don       0.20       6.67       3.00       0.450       2.76         38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Wallr.       0.47       13.33       3.50       0.263       7.60         42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47         43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46       Nepeta elliptica Royle ex Benth.       0.10       5.00       2.00       0.400       1.73	36	Hackelia uncinata (Benth.) C. E. C. Fisch.	0.05	3.33	1.50	0.450	1.00
38       Inula orientalis Lam.       0.37       20.00       1.83       0.092       7.46         39       Lactuca macrorhiza (Royle) Hook. f.       0.07       5.00       1.33       0.267       1.42         40       Lotus corniculatus L.       0.37       6.67       5.50       0.825       4.54         41       Malva neglecta Wallr.       0.47       13.33       3.50       0.263       7.60         42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47         43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46       Nepeta elliptica Royle ex Benth.       0.10       5.00       2.00       0.400       1.73	37	Halenia elliptica D. Don	0.20	6.67	3.00	0.450	2.76
39Lactuca macrorhiza (Royle) Hook. f.0.075.001.330.2671.4240Lotus corniculatus L.0.376.675.500.8254.5441Malva neglecta Wallr.0.4713.333.500.2637.6042Mazus surculosus D. Don0.103.333.000.9001.4743Mentha spicata L.0.3013.332.250.1696.4944Microula sikkimensis (C. B. Clarke) Hemsl.0.208.332.400.2884.9345Myriactis nepalensis Less.0.175.003.330.6673.5046Nepeta elliptica Royle ex Benth.0.105.002.000.4001.73	38	Inula orientalis Lam.	0.37	20.00	1.83	0.092	7.46
40         Lotus corniculatus L.         0.37         6.67         5.50         0.825         4.54           41         Malva neglecta Wallr.         0.47         13.33         3.50         0.263         7.60           42         Mazus surculosus D. Don         0.10         3.33         3.00         0.900         1.47           43         Mentha spicata L.         0.30         13.33         2.25         0.169         6.49           44         Microula sikkimensis (C. B. Clarke) Hemsl.         0.20         8.33         2.40         0.288         4.93           45         Myriactis nepalensis Less.         0.17         5.00         3.33         0.667         3.50           46         Nepeta elliptica Royle ex Benth.         0.10         5.00         2.00         0.400         1.73	39	Lactuca macrorhiza (Royle) Hook, f.	0.07	5.00	1.33	0.267	1.42
41Malva neglecta Wallr.0.4713.333.500.2637.6042Mazus surculosus D. Don0.103.333.000.9001.4743Mentha spicata L.0.3013.332.250.1696.4944Microula sikkimensis (C. B. Clarke) Hemsl.0.208.332.400.2884.9345Myriactis nepalensis Less.0.175.003.330.6673.5046Nepeta elliptica Royle ex Benth.0.105.002.000.4001.73	40	Lotus corniculatus L.	0.37	6.67	5.50	0.825	4.54
42       Mazus surculosus D. Don       0.10       3.33       3.00       0.900       1.47         43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46       Nepeta elliptica Royle ex Benth.       0.10       5.00       2.00       0.400       1.73	41	Malva neglecta Wallr.	0.47	13.33	3.50	0.263	7.60
43       Mentha spicata L.       0.30       13.33       2.25       0.169       6.49         44       Microula sikkimensis (C. B. Clarke) Hemsl.       0.20       8.33       2.40       0.288       4.93         45       Myriactis nepalensis Less.       0.17       5.00       3.33       0.667       3.50         46       Nepeta elliptica Royle ex Benth.       0.10       5.00       2.00       0.400       1.73	42	Mazus surculosus D. Don	0.10	3.33	3.00	0.900	1.47
44         Microula sikkimensis (C. B. Clarke) Hemsl.         0.20         8.33         2.40         0.288         4.93           45         Myriactis nepalensis Less.         0.17         5.00         3.33         0.667         3.50           46         Nepeta elliptica Royle ex Benth.         0.10         5.00         2.00         0.400         1.73	43	Mentha spicata L.	0.30	13.33	2.25	0.169	6.49
45         Myriactis nepalensis Less.         0.17         5.00         3.33         0.667         3.50           46         Nepeta elliptica Royle ex Benth.         0.10         5.00         2.00         0.400         1.73	44	Microula sikkimensis (C. B. Clarke) Hemsl.	0.20	8.33	2.40	0.288	4.93
46 Nepeta elliptica Royle ex Benth. 0.10 5.00 2.00 0.400 1.73	45	Myriactis nepalensis Less.	0.17	5.00	3.33	0.667	3.50
	46	Nepeta elliptica Royle ex Benth.	0.10	5.00	2.00	0.400	1.73
47 Origanum vulgare L. 0.30 6.67 4.50 0.675 5.45	47	Origanum vulgare L.	0.30	6.67	4.50	0.675	5.45
48 Parnassia nubicola Wall. ex Royle 0.20 6.67 3.00 0.450 3.41	48	Parnassia nubicola Wall. ex Rovle	0.20	6.67	3.00	0.450	3.41
49 Parochetus communis D. Don 0.40 15.00 2.67 0.178 5.78	49	Parochetus communis D Don	0.40	15.00	2.67	0.178	5.78
50 Pedicularis gracilis Wall, ex Benth. 013 500 2.67 0.533 2.05	50	Pedicularis gracilis Wall ex Benth	0.13	5.00	2.67	0.533	2.05
51 Persicaria amplexicaulis (D. Don) Ronse Decr. 0.23 667 3.50 0.525 3.52	51	Persicaria amplexicaulis (D Don) Ronse Decr	0.23	6.67	3.50	0.525	3.52
52 Phleum alpinum L. 010 333 300 0900 147	52	Phleum alpinum L	0.10	3.33	3.00	0.900	1.47
53         Phlomis bracteosa         Royle ex Benth.         0.23         6.67         3.50         0.525         3.80	53	Phlomis bracteosa Royle ex Benth.	0.23	6.67	3.50	0.525	3.80

 Table 1. Phytosociological attributes of herb species in alpine pasture of Thachi.

Table 1. Contin
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Sl.	Harba anaoina	Density	Frequ-	Abun-	A /E	IVI
INO.	Herbs species	(111-)	ency	dance	A/Γ	1 V I
54	Plantago depressa Willd.	0.13	5.00	2.67	0.533	2.20
55	Platanthera edgeworthii (Hook. f. ex Collett)					
	R. K. Gupta	0.07	3.33	2.00	0.600	1.16
56	Poa alpina L.	0.63	23.33	2.71	0.116	10.36
57	Poa annua L.	0.40	16.67	2.40	0.144	7.33
58	Polygonum aviculare L.	0.40	11.67	3.43	0.294	7.70
59	Potentilla argyrophylla Wall. ex Lehm.	0.10	5.00	2.00	0.400	2.10
60	Potentilla atrosanguinea G. Lodd. ex D. Don	0.07	3.33	2.00	0.600	1.31
61	Potentilla leschenaultiana Ser.	0.05	1.67	3.00	1.800	0.79
62	Potentilla lineata Trevir.	0.10	3.33	3.00	0.900	1.47
63	Potentilla polyphylla Wall. ex Lehm.	0.23	8.33	2.80	0.336	3.78
64	Primula denticulata Sm.	0.07	5.00	1.33	0.267	1.42
65	Prunella vulgaris L.	0.13	5.00	2.67	0.533	1.93
66	Ranunculus diffusus DC.	0.17	5.00	3.33	0.667	2.55
67	Ranunculus hirtellus Royle	0.07	3.33	2.00	0.600	1.31
68	Roscoea alpina Royle	0.37	13.33	2.75	0.206	5.97
69	Rosularia rosulata (Edgew.) H. Ohba	0.17	10.00	1.67	0.167	5.62
70	Rumex acetosa L.	0.13	6.67	2.00	0.300	4.61
71	Rumex nepalensis Spreng.	0.47	16.67	2.80	0.168	7.55
72	Saxifraga parnassifolia D. Don	0.13	5.00	2.67	0.533	2.36
73	Selinum vaginatum C. B. Clarke	0.12	5.00	2.33	0.467	2.16
74	Senecio laetus Edgew.	0.13	3.33	4.00	1.200	1.94
75	Sibbaldia cuneata Schouw ex Kunze	0.40	10.00	4.00	0.400	5.81
76	Silene indica (Roxb.) Roxb. ex Otth	0.07	3.33	2.00	0.600	1.40
77	Swertia ciliata (D. Don ex G. Don) B. L. Burtt	0.08	3.33	2.50	0.750	1.75
78	Swertia cordata (Wall. ex G. Don) C. B. Clarke	0.13	5.00	2.67	0.533	2.96
79	Tanacetum dolichophyllum (Kitam.) Kitam.	0.17	6.67	2.50	0.375	2.63
80	Taraxacum officinale (L.) Weber ex F. H. Wigg.	0.10	5.00	2.00	0.400	1.73
81	Thalictrum foliolosum DC.	0.05	1.67	3.00	1.800	0.79
82	Thymus linearis Benth.	0.63	23.33	2.71	0.116	9.09
83	Trifolium repens L.	0.67	30.00	2.22	0.074	10.42
84	Verbascum thapsus L.	0.05	5.00	1.00	0.200	2.38
85	Veronica persica Poir.	0.37	13.33	2.75	0.206	7.47
86	Viola biflora L.	0.23	13.33	1.75	0.131	4.84

species. The area having high eveness index indicate that species are evenly distributed in the area. The lower value of dominance index and higher value of diversity index was observed by Verma (2015) while studied Floristic Diversity in Khajjiar beat of Kalatop Khajjiar wild life sanctuary of district Chamba, Himachal Pradesh.

## **Medicinal plants**

The important plants of medicinal value found in alpine pasture of Thachi were compiled following Chopra et al. (1956), Kirtikar and Basu (1987), Kala (2002), Verma et al. (2006), Paulsamy et al. (2007), Samant et al. (2007), Bhat et al. (2012), Kumari et al. (2018). These include ; Achillea millefolium, Ainsliaea latifolia, Anaphalis contorta, Anemone obtusiloba, Arisaema jacquemontii, Arisaema propinquum, Bergenia ciliata, Bupleurum longicaule, Campanula pallida, Carex nivalis, Cirsium wallichii, Clinopodium umbrosum, Corydalis govaniana, Cynoglossum wallichii, Cynoglossum zeylanicum, Delphinium vestitum, Elsholtzia strobilifera, Epilobium royleanum, Erigeron multiradiatus, Fragaria vesca, Galium aparine, Geranium wallichianum, Geum elatum, Gypsophila cerastoides, Hackelia uncinata, Inula orientalis, Lactuca macrorhiza, Lotus corniculatus, Malva neglecta, Mazus surculosus, Mentha spicata, Nepeta elliptica, Origanum vulgare, Parnassia nubicola, Parochetus communis, Persicaria amplexicaulis, Phlomis bracteosa, Plantago depressa, Platanthera edgeworthii, Polygonum aviculare, Potentilla argyrophylla, Potentilla atrosanguinea, Primula denticulata, Prunella vulgaris, Ranunculus hirtellus, Roscoea alpina, Rosularia rosulata, Rumex acetosa, Rumex nepalensis, Saxifraga parnassifolia, Selinum vaginatum, Senecio laetus, Senecio laetus, Sibbaldia cuneata, Silene indica, Swertia ciliata, Swertia cordata, Tanacetum dolichophyllum, Taraxacum officinale, Thalictrum foliolosum, Thymus linearis, Trifolium repens, Verbascum thapsus, Veronica persica, Viola biflora.

## **Threatened** plants

Out of total plant species recorded from the alpine pasture, two species viz., Roscoea alpina and Selinum vaginatum are fall in the category of threatened species (Goraya et al. 2013). The habitat of most of the plant species has shrunk due to expansion of human population and environmental degradation primarily due to heavy livestock grazing, uncontrolled and unscientific harvest of species, unregulated tourism and construction of roads. The better conservation of natural resources can be done by inclusion of a section on the plant conservation especially of rare and endangered medicinal plants in the wildlife protection act, promotion of community - based conservation, in situ conservation, ex situ conservation through tissue culture, developing cultivation technologies and nurseries of medicinal plants and conducting of regular training on the procedure of medicinal plants.

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