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Phytodiversity along an altitudinal gradient in Dudhatoli forest of Garhwal Himalaya, Uttarakhand, India

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Abstract: The present study was undertaken to enumerate the diversity of higher plants (Angiosperms and Gymnosperms) including important medicinal plants in biodiversity rich moist temperate Dudhatoli forest of Garhwal Himalaya, Uttarakhand, India. We have recorded a total of 268 plant species belonging to 182 genera and 69 families. Of these, Gymnosperms were represented by 6 species, 6 genera and 3 families only. Dicotyledons were represented by 243 species, 160 genera and 60 families, whereas monocotyledons by 19 species, 16 genera and 6 families. In the study area 226 species had common occurrence, whereas rest 42 species were uncommon. A total of 20, 7, 159, 53 and 29 species of climbers, grasses, herbs, shrubs and trees respectively were recorded from the study area.

Keywords: Altitude; Angiosperms; Dudhatoli; Gymnosperms; Phytodiversity.

Introduction

Mountains occupy about one fifth of the world's land surface and provide the direct life support basis for about one tenth of human population. The Indian Himalayan region is considered as rich repository of biological and cultural diversity and supports about 18,440 species of plants, including 1748 species of medicinal plants and 675 species of wild edibles (Negi and Gaur, 1994). The Himalayan forest vegetation ranges from tropical dry deciduous forests in the foothills to moist high temperate forests of timber line. The temperate forests of Western and Central Himalaya are usually distributed between 1200 and 3000 m asl. The Garhwal Himalayan region situated in the Western Himalaya has been a centre of floristic and ecological studies from past hundred years. The wide altitudinal range, rapid change in altitudinal gradient even at small distances and high endemism make this region interesting for floristic studies (Singh et al., 1992; Arora, 1995; Zobel and Singh, 1997). The Garhwal Himalaya embodies

a number of forest types that are distributed at various altitudes, geological formations and soil types (Champion and Seth, 1968; Saxena and Singh, 1982). The general composition of the forests in Himalaya is diverse and varies from place to place because of varying topography such as plains, foothills and upper mountains (Singh, 2006).

First attempt to collect plants from Garhwal Himalaya was made by an English officer Thomas Hardwicke in year 1796, when he collected plants from Alaknanda Valley (Burkill, 1965). Basing on the collections made by Strachey and Winterbottom during years 1846-1849, Duthie (1906) revised and supplemented the catalogue of the plants of Garhwal region. Since then various workers have contributed valuable information to flora of the region (Collett, 1921; Kanjilal, 1928; Rau, 1975; Raizada, 1976; Raizada and Saxena, 1978; Semwal et al., 1981; Polunin and Stainton, 1984; Semwal, 1984; Naithani, 1984-1985; Stainton, 1988; Uniyal, 1989; Hajra and Rao,

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1990; Saini and Singh, 1990; Gaur et al., 1993; Rawat, 1994; Gaur, 1999; Rawat et al., 2001; Samant and Joshi, 2003; Uniyal et al., 2007; Gairola et al., 2010; Suyal et al., 2010). In our earlier studies we have worked out forest utilization pattern in relation to socio-economic status of people in Dudhatoli area (Sharma et al., 2011a) and other parts of Garhwal Himalaya (Sharma et al., 2009a, 2009b); phytodiversity (Gairola et al., 2010; Suyal et al., 2010), forest regeneration (Gairola et al., 2012b); chemical (Gairola et al., 2012a; Sharma et al., 2009c) as well as physical (Sharma et al., 2009c, 2010a) properties of soils; effects of slope aspects (Sharma et al., 2010b), physiographic factors (Sharma et al., 2010c) and altitudinal gradient on forest composition and diversity (Sharma et al., 2009c, 2009d; Gairola et al., 2011a, 2011b, 2011c); and carbon stocks (Sharma and Gairola, 2007; Sharma et al., 2010d, 2011b; Gairola et al., 2011d) in different forest types of the Garhwal Himalaya. In the present study, we have tried to enumerate the diversity of higher

plants (Angiosperms and Gymnosperms) including important medicinal plants in biodiversity rich moist temperate Dudhatoli forest of Garhwal Himalaya, Uttarakhand, India.

Material and methods

Study area

Dudhatoli forest is spread over two districts *i.e.*, Pauri and Chamoli, of Uttarakhand state of India (Figure 1). Its maximum area lies in Garhwal Forest Division of Pauri district and a small area in the Kedarnath Forest Division of Chamoli district. The forest area is situated at an altitudinal range of 1800 to 3000 m asl, located between the latitudes 30° 0.993' to 30° 03.764' N and longitudes 79° 09.724' to 79° 12.040' E, covering an area of 3,843 ha. Reconnaissance survey of the study area revealed that according to altitude, slope aspects and dominant tree species Dudhatoli forest can be divided into fourteen forest types (Table 1).

Table 1: Different forest types in Dudhatoli forest area.

Forest type	Slope aspect (facing)	Altitude (m asl)	Dominant tree species
Pure <i>Quercus semecarpifolia</i>	North-West	3000-2900	<i>Q. semecarpifolia</i>
Mainly <i>Quercus semecarpifolia</i>	South-East	2950-2800	<i>Q. semecarpifolia</i> , <i>R. arboreum</i>
Pure <i>Abies pindrow</i>	North-East	2900-2650	<i>A. pindrow</i>
Mixed <i>Abies pindrow</i>	North-East	2650-2500	<i>A. pindrow</i> , <i>Acer acuminatum</i>
Mixed <i>Quercus floribunda</i>	West	2500-2350	<i>Q. floribunda</i> , <i>Cedrus deodara</i>
Conifer mixed broad-leaved	East	2500-2300	<i>C. deodara</i> , <i>R. arboreum</i> , <i>Q. semecarpifolia</i>
Mixed broad-leaved	West	2500-2300	<i>Q. semecarpifolia</i> , <i>R. arboreum</i>
Pure <i>Cedrus deodara</i>	West	2350-2250	<i>C. deodara</i>
Mainly <i>Quercus leucotrichophora</i>	South-East	2400-2200	<i>Q. leucotrichophora</i>
Mixed broad-leaved	South-East	2350-2250	<i>Q. leucotrichophora</i> , <i>Q. floribunda</i>
Pure <i>Alnus nepalensis</i>	North-East	2350-2250	<i>A. nepalensis</i>
Mixed <i>Quercus leucotrichophora</i>	South-East	2250-2100	<i>Q. leucotrichophora</i>
Mixed <i>Pinus roxburghii</i>	South-East	2150-2000	<i>P. roxburghii</i> , <i>Q. leucotrichophora</i>
Pure <i>Pinus roxburghii</i>	South-West	2000-1800	<i>P. roxburghii</i>

Climate

The climatic details of the study area are given in Figure 2. In the year 2008-09 a total of 1652 mm mean annual rainfall was recorded in the study area, in which major amount was received in the monsoon season between June to September. Frost is common during winters, while the higher elevations (like Kodyabagarh

at 3000 m asl) experience heavy spells of snowfall, which may persist up to April-May under shady locations. Mean minimum monthly temperature in the study area ranged between 6.4 °C (January) to 15.0 °C (July) whereas, mean maximum monthly temperature ranged between 13.20 °C (January) to 27.0 °C (July).

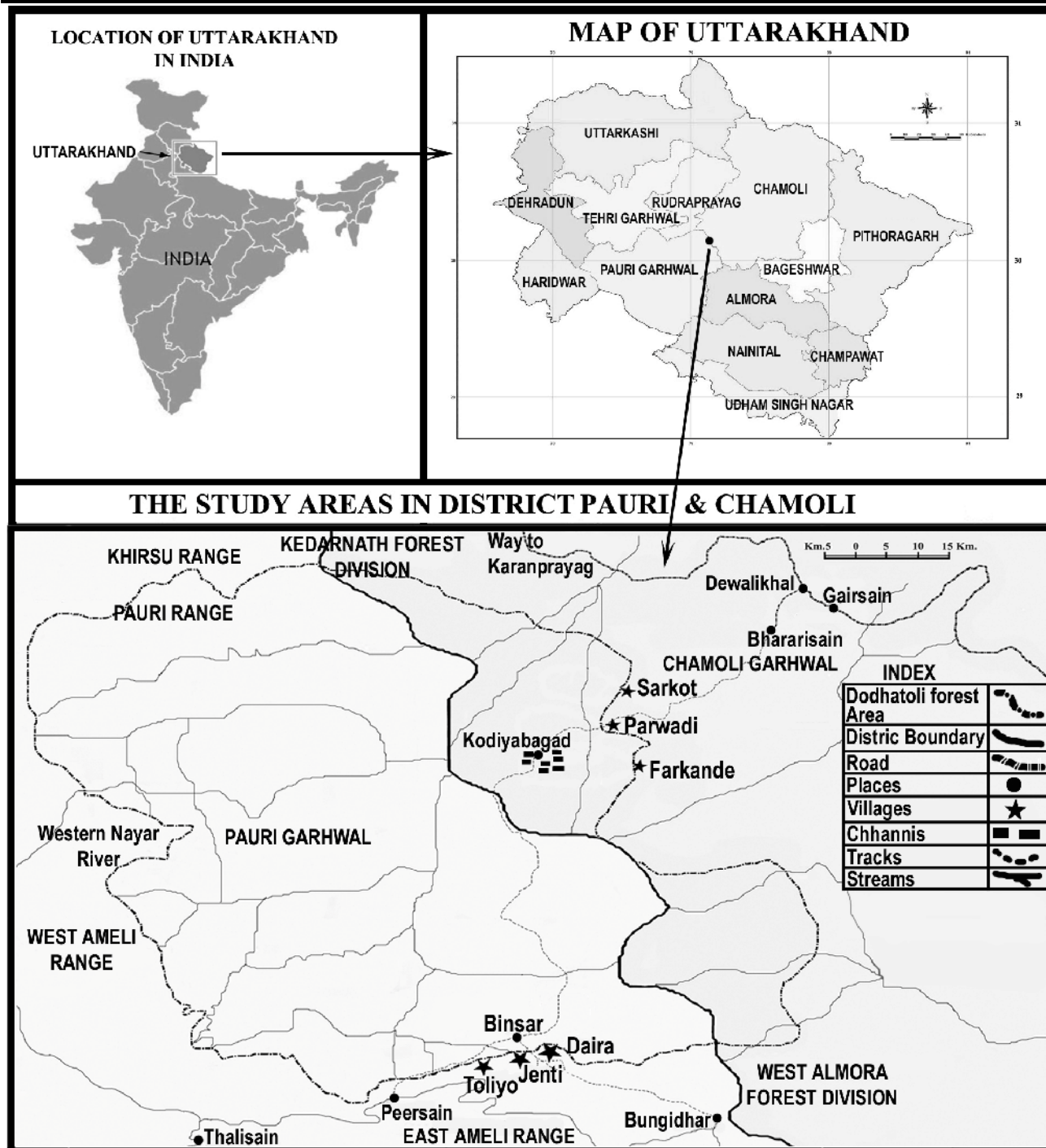


Figure 1: Map of the study area.

Data collection

Extensive field surveys were conducted in the Dudhatoli forest area from May 2008 to April 2010 in different seasons (rainy, winter and summer) to assess the diversity of higher plants (Gymnosperms and Angiosperms). The specimens of each species were collected and identified with the help of existing floras (Naithani, 1984-1985; Gaur, 1999) of the region and Herbariums of Department of Botany HNB

Garhwal University (GUH), Forest Research Institute (DD) and Botanical Survey of India, Northern Circle (BSD). After identification, the plants were classified according to Bentham and Hooker's system of classification (Bentham and Hooker, 1883). Taxonomical categories-genera and species within the family were arranged alphabetically and the species were described with usual citations. Additional information about vernacular names, habitat, life form, altitudinal range and occurrence were also recorded for

each of the collected species. Distribution in Himalaya was checked from available scientific literature and regional floras.

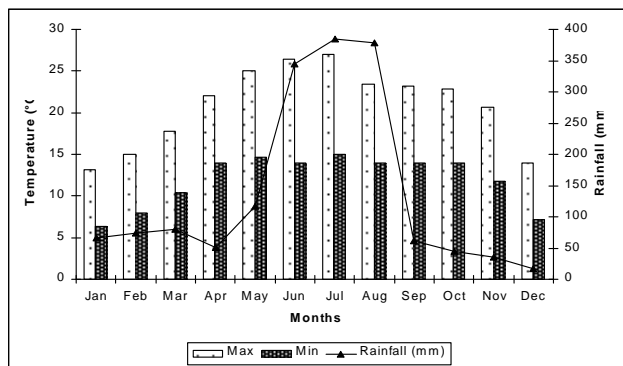


Figure 2: Climatic details of the study area. **Source:** Forest Department, Thalissain (Pauri Garhwal), Uttarakhand.

Results and discussion

A total of 268 plant species (262 Angiosperms and 6 Gymnosperms) belonging to 69 families (66 Angiosperms and 3 Gymnosperms) and 182 genera (176 Angiosperms and 6 Gymnosperms) were recorded from the study area (Table 2). Dicotyledons were represented by 243 species, 160 genera and 60 families, whereas Monocotyledons by 19 species, 16 genera and 6 families. Out of 69 families, 29 were represented by single species, 16 by two species, 2 by three species, 8 by 4 species and 14 by more than 4 species. Among the families of Angiosperms, Asteraceae was the dominant family with 42 species and 27 genera, followed by

Lamiaceae (20 species and 13 genera), Rosaceae (19 species and 11 genera), Ranunculaceae (16 species and 6 genera), Caryophyllaceae (11 species and 5 genera), Fabaceae (9 species and 7 genera), Polygonaceae (9 species and 5 genera), Apiaceae (8 species and 5 genera), Poaceae (7 species and 6 genera), Gentianaceae (7 species and 3 genera), Rubiaceae (6 species and 5 genera), Scrophulariaceae (5 species and 5 genera), Urticaceae (5 species and 4 genera), Caprifoliaceae (5 species and 2 genera), Asclepiadaceae (4 species and 4 genera), Ericaceae (4 species and 3 genera), Orchidaceae (4 species and 3 genera), Vitaceae (4 species and 3 genera), Berberidaceae (4 species and 2 genera), Fagaceae (4 species and 2 genera), Balsaminaceae (4 species and 1 genera), Liliaceae (3 species and 3 genera) and Hypericaceae (3 species and 1 genera).

The dominant genera in the study area were *Rubus* and *Thalictrum* with 5 species each followed by *Clematis* (4 spp.), *Elsholtzia* (4 spp.), *Impatiens* (4 spp.), *Senecio* (4 spp.), *Stellaria* (4 spp.), *Viburnum* (4 spp.), *Anaphalis* (3 spp.), *Berberis* (3 spp.), *Cotoneaster* (3 spp.), *Desmodium* (3 spp.), *Gentiana* (3 spp.), *Hypericum* (3 spp.), *Persicaria* (3 spp.), *Quercus* (3 spp.), *Ranunculus* (3 spp.), *Silene* (3 spp.) and *Swertia* (3 spp.). On the other hand among Gymnosperms, Pinaceae (4 species and 4 genera) was the dominant family.

Table 2: Checklist of higher plants (Angiosperms and Gymnosperms) including medicinal plants in Dudhatoli forest area.

Family/ Species	Vernacular name	LF	Altitude (m asl)	Oc. Habitat	Distribution in Himalaya	Me
Acanthaceae						
<i>Pteracanthus alatus</i> (Cl.) Bremekamp	Jaunya, Pathora	H	1800-2400	C SM, WS	WH	-
<i>Strobilanthes atropurpureus</i> Nees	Kangdai, Totna	H	2000-2500	C SM, WS	NWH, MH, AH	-
Aceraceae						
<i>Acer acuminatum</i> Wall. ex D. Don	Rath-Kanchula	T	2500-2900	C SM	MH	Me
<i>Acer caesium</i> Wall. ex Brandis	Kanjula	T	2500-2900	UC SM	MH	Me
Amaranthaceae						
<i>Cyathula capitata</i> Moq. In DC.	Arsilla	S	1800-2600	C WP, WS, BO	MH, SH	Me
Apiaceae						
<i>Apium graveolens</i> L.	Shalari	H	2000-2500	C SM, WS, WP	NWH,	-
<i>Bupleurum hamiltonii</i> Balak.	Jangli-jeera	H	2200-2700	UC SM, WS, WP	SH, MH	Me
<i>Bupleurum himalayense</i> Klotzsch in Klotzsch et Garcke	-	H	2300-3000	UC SM, WS, WP	SH, MH	-
<i>Chaerophyllum acuminatum</i> Lindl.	Kinjari	H	2200-3000	C SM, WS, WP	MH, AH	-
<i>Chaerophyllum reflexum</i> Lindl.	Kinjari	H	2500-3000	C SM, WS, WP	MH	-
<i>Heracleum lanatum</i>	Kakriya	H	1800-2200	C SM, WS, WP	MH	-
<i>Pimpinella acuminata</i> (Edgew.) Cl.	Raulee	H	1800-2200	C SM, WS, WP	SH, MH	Me
<i>Pimpinella diversifolia</i> DC.	Terai, Phoree	H	1800-3000	C SM, WS, WP	SH, MH	Me
Araliaceae						

<i>Hedera nepalensis</i> K.Koch	Laguli, Mithiari	Cl	1800-3000	C	EP, UF, SM, WS, RS	TH	-
Asclepiadaceae							
<i>Cryptolepis buchananii</i> Roem. & Schult.	Dudhi-Bel, Meda-singhi	Cl	1800-2100	C	EP, WS, UF	ST, SH	-
<i>Cynanchum auriculatum</i> Wight & Arn.	-	S	2000-2400	UC	WS, UF	MH	-
<i>Marsdenia roylei</i> Wight & Arn.	-	S	1800-2500	UC	WS, OS, WC	SH, MH	-
<i>Vincetoxicum hirundinaria</i> Medikus in Hist. Comm.	Bagmirchi	S	1800-2700	UC	WS, UF	MH	Me
Asteraceae							
<i>Adenocaulon himalaicum</i> Edgew.	-	H	2300-2700	C	UF, SM, WC	MH	-
<i>Adenostemma lavenia</i> (L.)	-	H	1800-2000	C	DS, SM	TH	-
<i>Ageratum conyzoides</i> L.	Gundrya, Semandulw	H	1800-2000	C	WP, WS, SM	SH, MH	Me
<i>Ageratum houstonianum</i> Miller	-	H	1800-2000	C	WP, WS, SM	SH, MH	-
<i>Ainsliaea aptera</i> DC.	Kauru, Khad-Jari	H	2000-2700	C	SM, UF, BO	MH, AH	Me
<i>Ainsliaea latifolia</i> (D.Don)	Kauru	H	2000-2900	C	SM, UF, BO	MH, SAH	Me
<i>Anaphalis adnata</i> Wall. ex DC.	Bugla	H	1800-2900	C	OP, WS, UF, SM	SH, AH	Me
<i>Anaphalis contorta</i> (D.Don) Hook.f.	Bugla, Buglya	H	1800-3000	C	OP, WS, UF, SM	MH, AH	-
<i>Anaphalis triplinervis</i> (Sm.) Cl.	Bugla, Buglya	H	1900-2900	C	OP, WS, UF, SM	MH, AH	-
<i>Artemisia nilagirica</i> (Cl.) Pamp.	Kunzu, Kunjaa	S	1800-2200	C	WS, OS	WH	Me
<i>Artemisia roxburghiana</i> Wall. ex Besser	Kunjaa, Chamur	H	1800-2700	C	OS	SH, MH, NWH	Me
<i>Aster peduncularis</i> Wall. ex Nees	Phulyan	H	2000-3000	C	OS, SM	WMH	-
<i>Bidens bipinnata</i> L.	-	H	1800-2000	UC	WS, WP	NWH, MH	-
<i>Bidens pilosa</i> L.	Kumur, Kumra	H	1800-2200	C	WS, WP	SH, MH	Me
<i>Carpesium abrotanoides</i>	Kuleo	H	2100-2800	UC	OS, WP	MH	-
<i>Carpesium nepalense</i> Less.	-	H	1800-2700	C	OS, WP	MH, WH	-
<i>Cirsium verutum</i> (D.Don) Sprengel	Kardra, Kandaya	H	1800-2000	C	UF, OS, WS, WC	SH, MH	Me
<i>Cirsium wallichii</i> DC.	Kandeyia, Kandra, Bungsee	H	2000-3000	C	UF, OS, WS, WC	SH, MH	Me
<i>Conyza japonica</i> (Thunb.) Lessing ex DC.	-	H	1800-2200	C	OS, WS, WP	SH, MH	-
<i>Conyza stricta</i> Willd.	-	H	1800-2200	C	OS, WS, WP	SH, MH	-
<i>Eclipta prostrata</i> (L.)	Bhangru	H	1800-2000	C	DS, SM	TH	-
<i>Erigeron multiradiatus</i> (Lindl. ex DC.) Cl.	-	H	1800-3000	C	OS, UF, BO	MH, AH	-
<i>Eupatorium adenophorum</i> Sprengel	Kharna, Bakura	S	1800-2300	C	CF, WP, WS, SM, US, BO, WC	SH, MH	Me
<i>Filago hurdwarica</i> (Wall. ex DC.)	-	H	1800-2000	C	WP, WS, SM	SH, WH	-
<i>Galinsoga parviflora</i> Cav.	Marchya	H	2000-2400	C	WS	SH	-
<i>Gerbera gossypina</i> (Royle) G. Beauv.	Kapasee	H	1800-2500	C	SM, BO	NWH, SH, MH	Me
<i>Gerbera maxima</i> D.Don	-	H	2000-2500	UC		MH	-
<i>Gnaphalium affine</i> D.Don	-	H	1800-2000	C	WS, OS	SH, MH	-
<i>Inula cuspidata</i> (DC.) C.B. Clarke	Jhuri, Pushkar	S	1800-2300	UC	OS, WS, UF	SH, MH	Me
<i>Inula cappa</i> (Buch.-Ham. ex D.Don) DC.	Athhu, Tamagari	S	1800-2500	UC	OS, WS, UF	SH, MH	Me
<i>Ligularia amplexicaulis</i> DC.	-	H	2800-3000	UC	WP, WS, SM	WH, AH	Me
<i>Myriactis nepalensis</i> Lessing in Linnaea	Bakura	H	2200-3000	C	OS, WP	MH	-
<i>Myriactis wallichii</i> Lessing in Linnaea	-	H	2000-2600	C	OS, WP	MH	-
<i>Prenanthes violaeifolia</i> Decne. Jacquem	Pitlya	H	2200-3000	C	WS, SM	MH, AH	Me
<i>Senecio kunthianus</i> Wall. ex DC.	-	H	1800-2700	C	WS, OS, UF	SH, MH	-
<i>Senecio laetus</i> Edgew.	-	H	2500-2900	C	WS, OS, UF	NWH, MH, AH	Me
<i>Senecio nudicaulis</i> Buch.-Ham. ex D.Don	Neelkanthi, Ratpati, Kakrata	H	1800-2500	C	OS, CF	ST, SH	Me
<i>Senecio wightianus</i> DC. ex Wight	-	H	2200-3000	UC	OS, CF	MH, AH	-
<i>Siegesbeckia orientalis</i> L.	Gobariya	H	1800-2000	C	WS, SM	MH	-
<i>Solidago virgaurea</i> L.	Pinja-phool, Sonali	H	2000-2800	C	WS, SM	SH, MH	Me
<i>Sonchus oleraceus</i> L.	Dudiya	H	1800-2500	C	WP	MH	-
<i>Taraxacum officinale</i> Weber	Kan-fulya, Karatu, Dudhee	H	2000-2900	C	OS, WP, WS, SM, WC, BO	MH, AH	Me
Balsaminaceae							
<i>Impatiens racemosa</i> DC.	Chunchuni	H	2200-2700	C	WC, SM	MH	Me
<i>Impatiens scabrida</i> DC.	Ban-til, Tillua	H	1800-2700	C	UF, SM	TH	-
<i>Impatiens sulcata</i> Wall.	Chaul, Kwal	H	2500-3000	C	WC, SM, WS	MH, AH	Me
<i>Impatiens thomsonii</i> Hook.	Ghad-chaal	H	2200-2800	C	WC, SM, WS	MH	-
Berberidaceae							
<i>Berberis aristata</i> DC.	Kingore, Kasmor	S	2000-2700	C	WS, BO, CF	NWH	Me
<i>Berberis asiatica</i> Roxb. ex DC.	Kingor, Kilmora	S	2000-2500	C	WS, DS, OS, CF	NWH	Me
<i>Berberis lycium</i> Royle	Kingor, Rasaut	S	2000-2500	UC	WS	NWH, SM, MH	Me
<i>Mahonia borealis</i> Takeda in Notes Royal	Haldia, Bara Totar	S	2250-2400	UC	WS	WH	-
Betulaceae							
<i>Alnus nepalensis</i> D.Don	Utees	T	2000-2600	C	BO, WC, WS	SH, MH	Me
Brassicaceae							
<i>Cardamine flexuosa</i> Wither.	-	H	1800-2500	C	SM	TH	-
Buxaceae							
<i>Sarcococca saligna</i> (D.Don) Muell.-Arg.	Paliyala, Geru, Tiliara	S	1800-2900	C	WS, UF, BO	MH	Me
Caprifoliaceae							
<i>Lonicera quinquelocularis</i> Hardw.	Bad-kukura, Chamaksin	S	2500-2800	C	WS, OS	SH, MH	-
<i>Viburnum cylindricum</i> Buch.-Ham. ex D.Don	Tita, Lampatiya	S	1800-2500	C	UF, WS, BO	NWH	-
<i>Viburnum grandiflorum</i> wall. ex DC.	Thakla	S	1800-2800	C	UF, WS, BO	NWH	-
<i>Viburnum mullaha</i> Buch.-Ham. ex D.Don	Maleo, Lat-titmolya, Richhoi	S	1800-2900	UC	UF, WS, BO	MH	-
<i>Viburnum nervosum</i> D.Don	Tirmoi, Tileen	S	2500-3000	C	UF, WS, BO	MH	-

Caryophyllaceae							
<i>Arenaria serpyllifolia</i> L.	-	H	1800-2200	C OS, WS,	SH, MH	-	
<i>Cerastium fontanum</i> Baumgart, Enum.	-	H	1800-2400	C WS, UF, SM	MH	-	
<i>Cerastium glomeratum</i> Thuillier	-	H	1800-3000	C WS, UF, SM	MH, AH	-	
<i>Gypsophylla cerasoides</i> D. Don	Bakarchee	H	1800-2700	C BO, WS, SM, WC, UF	TH	-	
<i>Silene edgeworthii</i> Bocquet in Candollea	Bakrolya	H	2000-2400	UC OS, W	MH, AH	-	
<i>Silene indica</i> Roxb. ex Oth	-	H	2000-2800	UC OS, W	MH, AH	-	
<i>Silene viscosa</i> (L.)	-	H	2200-3000	UC OS, W	MH, AH	-	
<i>Stellaria media</i> (L.) Vill.	Badyalu	H	1800-2000	C WC, WS	SH	Me	
<i>Stellaria monosperma</i> D. Don	-	H	2000-2700	C WS, OS, UF	SH	Me	
<i>Stellaria patens</i> D. Don	-	H	2200-3000	C WS, OS	MH, AH	-	
<i>Stellaria semivestita</i> Edgew. & Hook	-	H	2200-2800	C WS, OS, UF	NWH	-	
Combretaceae							
<i>Anogeissus latifolius</i> (Roxb. ex DC.)	Dhauri, Dhawadi	T	1800-2200	C OS, SM	SH	-	
Commelinaceae							
<i>Commelina maculata</i> Edgew.	Kapla	H	2000-2800	C UF	SH	-	
Convolvulaceae							
<i>Ipomoea nil</i> (L.) Roth.	Kaludanu	Cl	1800-2200	C WS, BO	SH, MH	Me	
<i>Ipomoea purpurea</i> (L.) Roth.	-	Cl	1800-2200	C WS, BO	MH	Me	
Corylaceae							
<i>Carpinus viminea</i> Lindl	Chamkharik	T	2200-2400	C UF, SM	MH, SAH	-	
<i>Corylus jacquemontii</i> Decne.	Kabasi	T	2300-2900	UC SM, BO	MH	-	
Crassulaceae							
<i>Sedum multicaule</i> Wall. ex Lindl.	Miragha	H	1800-2500	C WS, UF, SM	MH	-	
Cupressaceae							
<i>Cupressus torulosa</i> D. Don	Surai	T	1800-2700	C OS, BO, WS	MH	Me	
Daphniphyllaceae							
<i>Daphniphyllum himalense</i> (Benth.) Muell.-Arg.	Ratniyalu	T	2200-2350	C UF, SM	NW	Me	
Dipsacaceae							
<i>Dipsacus inermis</i> Wallich	Phulee	H	1900-2500	C WS, OS	MH, AH	Me	
<i>Morina longifolia</i> Wallich ex DC.	Biskandru	H	2700-3000	UC WS, OS	MH, AH	Me	
Elaeagnaceae							
<i>Elaeagnus parvifolia</i> Wall. ex Royle	Giwain	S	1800-3000	UC SM, WP	MH	Me	
Ericaceae							
<i>Gaultheria nummularioides</i> D. Don	Bhwinla	H	1800-2700	C UF, BO, OS	MH, AH	-	
<i>Lyonia ovalifolia</i> (Wall.) Drude	Anyar	T	1800-2800	C SM, OS, WS, UF	MH	-	
<i>Rhododendron arboretum</i> Sm.	Burans	T	1800-3000	C SM, WP	MH	Me	
<i>Rhododendron barbatum</i> Wall. ex G. Don	Byanr	T	2500-3000	C SM, WP	MH	-	
Euphorbiaceae							
<i>Euphorbia peplus</i> L.	-	H	1800-2500	C WP	WH	-	
<i>Euphorbia pilosa</i> L.	Chuplya, Chounpalu	H	1850-2800	C WP	WH	-	
Fabaceae							
<i>Argyrobolium roseum</i> (Cambess.)	-	H	2000-2300	C SM, WP	SMH, WH	-	
<i>Crotalaria albida</i> Heyne ex Roth	Chunchuni	H	1800-2200	C SM, WP	SH, MH	Me	
<i>Desmodium elegans</i> DC.	Chamlai	S	2000-2400	C SM, WP	SH, MH	Me	
<i>Desmodium multiflorum</i> DC.	-	H	2300-2600	C WS, UF	SH, MH	-	
<i>Desmodium triflorum</i> (L.) DC.	Kudaliya	H	2000-2700	C WS, UF	SH, MH	-	
<i>Flemingia fruticulosa</i> Wall. ex Benth.	Churan	H	1800-2700	C WP, WS	WH	Me	
<i>Indigofera heterantha</i> Wall. ex Brandis	Sakina, Kathi, Kathoj	S	1800-2200	C SM, WP	SH, MH	Me	
<i>Parochetus communis</i> Buch.-Ham. ex D. Don	Tripatri	H	2000-2600	C WS, UF, OS, SM	MH	Me	
<i>Trifolium repens</i> L.	Tipatiya	H	2200-2800	C OS, WS	MH, AH	Me	
Fagaceae							
<i>Castanopsis tribuloides</i> (J.E. Smith)	Katonj	T	2100-2400	C SM, WC	MH	-	
<i>Quercus floribunda</i> Lindl. ex Rehder	Tilonj, Moru	T	2500-3000	C SM, WC	MH	-	
<i>Quercus leucotrichophora</i> A. Camus	Banj	T	1800-2500	C SM, WC	SH, MH	-	
<i>Quercus semecarpifolia</i> Sm.	Kharsu	T	2400-3000	C SM, WC	MH	-	
Gentianaceae							
<i>Gentiana capitata</i> Buch.-Ham. ex D. Don	-	H	1800-2400	C UF, OS	NW, MH	-	
<i>Gentiana pedicellata</i> (D. Don) Wall.	Chhoti buggi	H	2300-2800	C UF, OS	SH, MH	-	
<i>Gentiana stipitata</i> Edgew.	-	H	1800-2700	C UF, OS	MH	-	
<i>Halenia elliptica</i> D. Don	Hasela	H	2000-2500	C UF, OS	MH	-	
<i>Swertia chirayita</i> (Roxb. ex Fleming) Karsten	Chiraita	H	1800-2700	UC WS, UF, OS	SH, MH	Me	
<i>Swertia cordata</i> (D. Don ex G. Don)	Safed-Chirotu	H	2300-2900	C WS, UF, OS	MH	Me	
<i>Swertia paniculata</i> Wall.	-	H	2000-2500	UC WS, UF, OS	NW, MH	Me	
Geraniaceae							
<i>Geranium nepalense</i> Sw.	Phori, Syunli	H	1800-2400	C OS, UF	MH	Me	
<i>Geranium wallichianum</i> D. Don ex Sw.	Ratanjot	H	2000-2900	C OS, UF	MH	Me	
Hydrangeaceae							
<i>Deutzia staminea</i> R. Br. ex Wall.	Ghugtai	S	1800-3000	C UF, OS	WH	Me	
<i>Hydrangea anomala</i> D. Don	Kathmora	Cl	1800-3000	C UF, OS	MH	-	
Hypericaceae							
<i>Hypericum elodeoides</i> Choisy	Basanti	H	1800-2900	C UF, OS	MH	-	
<i>Hypericum oblongifolium</i> Choisy	Chaya, Chitroi	S	1800-2500	C WS, UF, OS	NWH	Me	

<i>Hypericum uralum</i> Buch.-Ham. ex D.Don	Bhyoul	S	1800-2700	C	WS, UF, OS	TH	Me	
Juglandaceae								
<i>Juglans regia</i> L.	Akhror	T	2250-2350	UC	UF, BO	SH, MH	Me	
Lamiaceae								
<i>Ajuga brachystemon</i> Maxim.	Rathpathi	H	1800-2000	C	SM, WP	WH	Me	
<i>Ajuga parviflora</i> Benth.	Neelkanthi	H	1800-2100	C	SM, WP	TH	Me	
<i>Clinopodium umbrosum</i> (M.Bieb.) Koch.	Birchee	H	1800-2500	C	OS, WS	SH, MH	Me	
<i>Elsholtzia flava</i> (Benth.) Benth.	-	S	2000-2400	C	SM, WP	MH	Me	
<i>Elsholtzia fruticosa</i> (D.Don) Rehder	Pothi	S	2000-2500	C	SM, WP	MH	Me	
<i>Elsholtzia pilosa</i> (Benth.) Benth.	-	S	1800-2900	C	SM, WP	MH	-	
<i>Elsholtzia strobilifera</i> (Benth.)	Pothi	H	2300-3000	C	SM, WP	MH, AH	-	
<i>Leucas lanata</i> Benth.	Bis-kapra, Gumma	H	1800-2300	C	WS, OS	WH	Me	
<i>Micromeria biflora</i> (Buch.-Ham. ex D.Don) Benth.	Ban-ajwain	H	1800-2000	C	OS, SM	SH, MH	Me	
<i>Origanum vulgare</i> L.	Bantulsi	H	1800-2500	C	SM, WP	MH	Me	
<i>Plectranthus mollis</i> (Aiton) Sprengel	-	H	1800-2800	C	WS, SM, BO	WH	-	
<i>Prunella vulgaris</i> L.	-	H	2200-2800	C	SM, WP	MH	Me	
<i>Salvia lanata</i> Roxb.	Ghanyajhar, Ghaniya	H	1800-2500	C	WS, OS	MH	Me	
<i>Salvia nubicola</i> Wall. ex Sweet	Ganya	H	2000-2500	C	WS, OS	MH	Me	
<i>Scutellaria linearis</i> Benth.	-	H	1800-2200	C	SM, WP	SH, MH	-	
<i>Scutellaria scandens</i> Buch.-Ham. ex D.Don	Kutlaphul	H	2000-2500	C	SM, WP	SH, MH	Me	
<i>Stachys sericea</i> Wall. ex Benth	-	H	2500-3000	C	OS	MH, AH	Me	
<i>Teucrium quadrifarium</i> Buch.-Ham. ex D.Don	Bilmga	H	1800-2300	C	OS	SH, MH	Me	
<i>Teucrium royleanum</i> Wall. ex Benth.	-	H	2000-2300	C	OS	MH	-	
<i>Thymus linearis</i> Benth.	Ban ajwain	H	2200-3000	C	OS, UF, SM	MH	Me	
Lardizabalaceae								
<i>Holboellia angustifolia</i> (Wall.)	-	S	1800-2100	UC	OS, SM	MH	-	
Lauraceae								
<i>Neolitsea pallens</i> (D.Don) Memiyama & Hara ex Hara	Bilaru	T	1800-2500	C	SM, UF	SH, MH	-	
<i>Persea duthiei</i> (King ex Hook. F.) Kostermans	Kaula Sairi, Bhadrao	T	1800-2800	C	SM, UF	SH, MH	-	
Liliaceae								
<i>Asparagus adscendens</i> Buch.-Ham. ex Roxb.	Jhirni	S	1800-2400	C	WS, OS	SH, MH	Me	
<i>Cardiocrinum giganteum</i> (Wall.) Mak.	Kanphuli	H	2300-2700	UC	SM, WC, UF	MH	Me	
<i>Lilium polyphyllum</i> D.Don	Kand-mool	H	1800-2400	UC	SM, WC	MH	-	
Linaceae								
<i>Reinwardtia indica</i> Dum.	Phiyunli	S	1800-1900	C	SM, WP	SH, MH	Me	
Lythraceae								
<i>Woodfordia fruticosa</i> (L.) Kurz	Dhaura	S	2000-2500	C	SM, WP	SH	Me	
Moraceae								
<i>Ficus hederacea</i> Roxb.	Beduli	Cl	1800-2500	C	UF, SM	SH, MH	-	
Myricaceae								
<i>Myrica esculenta</i> Buch.-Ham. ex D.Don	Kaphal	T	1800-2250	C	SM, UF, WS, BO	MH	-	
Myrsinaceae								
<i>Myrsine africana</i> L.	Chupra, Paharicha	S	1800-2000	C	UF, SM	SH, MH	Me	
Oleaceae								
<i>Jasminum humile</i> L.	Surmarchi, Pilichameli	S	1800-2800	C	BO, WS, SM WC, UF	WH	Me	
<i>Jasminum officinale</i> L.	Jai, Champa	Cl	1800-3000	C	WS, BO	WH	Me	
Onagraceae								
<i>Epilobium royleanum</i> Haussk.	Meelu, Bakury	H	1800-2800	C	SM, WP	MH	Me	
Orchidaceae								
<i>Calanthe plantaginea</i> Lindl.	-	H	1800-2200	C	SM, WP	MH	Me	
<i>Calanthe tricarinata</i> Lindl.	Kalenth, Syoru	H	2000-2800	C	SM, WP, OS	MH, SAH	Me	
<i>Goodyera repens</i> (L.) R.Br.	-	H	2200-2800	C	SM, OS	MH, AH	Me	
<i>Habenaria marginata</i> Colebr. In Hook	Haldya-jari	H	2000-2400	C	SM, WP, OS	MH	Me	
Oxalidaceae								
<i>Oxalis corniculata</i> L.	Chalmori, Bhilmori	H	1800-2200	C	SM, WP	TH	Me	
Pinaceae								
<i>Abies pindrow</i> Royle	Raga	T	2500-2900	C	BO, SM, OS	MH, WH	Me	
<i>Cedrus deodara</i> (Roxb. ex D.Don)	Devdar	T	2100-2500	C	SM, OS	MH, WH	Me	
<i>Picea smithiana</i> (Wall.)	Rai	T	2800-3000	UC	SM, OS	MH	Me	
<i>Pinus roxburghii</i> Sarg.	Chir, Kulain	T	1800-2250	C	BO, DS	SH, MH	-	
Piperaceae								
<i>Piper mullesua</i> D.Don	Pahari Pipar	S	1800-2000	UC	SM	SH, MH	-	
Plantaginaceae								
<i>Plantago erosa</i> Wall.	Luhurya, Lahyrya	H	1800-2000	C	SM, WP	MH, AH	Me	
<i>Plantago himalaica</i> Pilger	-	H	2800-2900	C	SM, WP	MH, AH	Me	
Poaceae								
<i>Agrostis nervosa</i> Nees ex Trinius in Mem. Henr.	-	G	2200-3000	UC	SM, WP	MH, AH	-	
<i>Helictotrichon virescens</i> (Nees ex Steud.)	-	G	1800-2900	C	SM, WP	MH	-	
<i>Poa pratensis</i> L.	-	G	2500-3000	UC	SM, WS	NWH	-	
<i>Saccharum filifolium</i> Steudel	-	G	1800-2000	C	SM	NWH	-	
<i>Sinarundinaria falcata</i> (Nees) Chao &	Gad-Ringal	G	1800-2600	C	SM, WP, UF	WH, MH	-	

Renoize							
<i>Thamnocalamus falconeri</i> Hook.f. ex Munro	Dev-Ringal	G	1800-2700	C	SM, WP, UF	MH	-
<i>Thamnocalamus spathiflora</i> (Trinius) Munro	Tham Ringal	G	2000-2700	C	SM, WP, UF	WH, MH	-
Polygonaceae							
<i>Bistorta amplexicaulis</i> (D.Don)	Kutrya	H	2400-2800	C	WC, SM, WS	MH, AH	Me
<i>Bistorta macrophylla</i> (D.Don)	Kukhri	H	2700-3000	UC	WC, SM, WS	MH, AH	-
<i>Koenigia nepalensis</i> D.Don	-	H	2400-3000	UC	WS, SM, BO	MH, AH	-
<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don)	Kaflya	H	2000-2500	C	WS, SM, BO	SH, MH	-
H.Gross							
<i>Persicaria hydropiper</i> (L.) Spach	Ameta	H	1800-2000	C	WS, SM, BO	SH, MH	Me
<i>Persicaria nepalensis</i> (Meisn.)	-	H	2200-2600	C	SM, CF, WS	MH	-
<i>Polygonum capitatum</i> Buch.-Ham. ex D.Don	-	H	2000-2400	C	WS, SM, BO	MH	-
<i>Polygonum sphaerocephalum</i> Wall.	-	H	1600-2900	C	WC, SM, WS	MH	-
<i>Rumex nepalensis</i> Spreng.	Khatur	H	2000-3000	C	WP, RS, WP	MH, AH	Me
Primulaceae							
<i>Primula denticulata</i> Sm.	Jalkutra	H	1800-2500	C	SM, WS, MP, BO, WC	MH	Me
Ranunculaceae							
<i>Aconitum balfourii</i> Stapf in Ann.	Meetha bish, Visha	H	2900-3000	C	OS, WC	SAH, WH	Me
<i>Anemone obtusiloba</i> D.Don	Kanchphool, Kakrya	H	2500-2650	C	OP, WS, UF, SM	AH, MH	Me
<i>Anemone vitifolia</i> Buch.-Ham. ex DC.	Mudeela	H	1850 -2250	C	WS, SM, CF	AH, MH	-
<i>Clematis barbellata</i> Edgew.	Kanrya, Santai	Cl	1800-3000	C	UF	NWH	-
<i>Clematis buchananiana</i> DC.	Lagulia	Cl	1800-2900	UC	UF	MH, SH	Me
<i>Clematis connata</i> DC.	-	Cl	1800-3000	C	UF, OS, WS, WC	MH	-
<i>Clematis montana</i> Buch.-Ham. ex DC.	Kujju	Cl	1800-2900	C	UF, WS	MH, SH	Me
<i>Delphinium denudatum</i> Wall. ex Hook.f.	-	H	1500-2400	C	WS, OS	MH, SH	Me
<i>Ranunculus hirtellus</i> Royle	Simariya	H	1800-2800	C	SM, OS, WS	NWH	Me
<i>Ranunculus laetus</i> Wall. ex D.Don	-	H	1800-2000	C	SM, OS, WS	TH	-
<i>Ranunculus pulchellus</i> C. Meyer	Kursingi	H	2200-3000	C	SM, OS, WS	WH	Me
<i>Thalictrum cultratum</i> Wall.	-	H	1800-2500	C	WS, SM	MH	-
<i>Thalictrum foliolosum</i> DC.	Mamiri	H	1800-2500	C	WS, SM	TH	Me
<i>Thalictrum reniforme</i> Wall.	-	H	2000-3000	UC	WS, SM	MH	-
<i>Thalictrum saniculaeforme</i> DC.	-	H	2000-2900	C	WS, SM	MH	-
<i>Thalictrum secundum</i> Edgew.	Peelijari	H	2200-3000	C	WS, SM	WH	-
Rhamnaceae							
<i>Rhamnus virgatus</i> Roxb.	Choudelu	S	1800-2200	C	WS, OS	SH, MH	Me
Rosaceae							
<i>Agrimonia pilosa</i> Ledebour	Lesukuri	H	1800-2800	C	UF, OS, SM	MH	Me
<i>Cotoneaster acuminatus</i> Lind.	Cham-ruins	S	2300-3000	C	UF, OS, WS, WC	MH	-
<i>Cotoneaster bacillaris</i> Wall.	Ruins, Rensu	S	2000-3000	C	UF, OS, WS, WC	MH	-
<i>Cotoneaster microphyllus</i> Wall. ex Lindl	Bugarchilla	S	2100-3000	C	BO, OS	MH	-
<i>Fragaria indica</i> Andr.	Bhiun-kaphal	H	1800-2300	C	WS, SM, UF, OS	MH	Me
<i>Fragaria nubicola</i> Lindl ex Lacaita	Gand-Kaphal	H	1800-3000	C	WS, SM, UF, OS	MH	Me
<i>Potentilla fulgens</i> Wall. ex Hook.	Bajradanti	H	2500-3000	C	OS, UF, SM	MH	Me
<i>Prinsepia utilis</i> Royle	Bhenkuli	S	1800-2500	C	WS, OS, CF	MH	Me
<i>Prunus venosa</i> Koehne	Gadh-aru, Aria	T	2500-2900	C	SM	MH	Me
<i>Pyracantha crenulata</i> (D.Don) M. Roemer	Ghingaru	S	1800-2300	C	OS, WS	SH	-
<i>Pyrus pashia</i> Buch. Ham. ex D.Don	Melu	T	2000-2400	C	UF, WS, SM	SHT, MH	Me
<i>Rosa brunonii</i> Lindl	Kujju	Cl	1800-2800	C	OS, WS	MH, SH	Me
<i>Rosa sericea</i> Lindl	Dhurkunja	S	2000-3000	C	OS	MH	Me
<i>Rubus ellipticus</i> Sm.	Hinssar, Hisalu, Hinshoi	S	1800-2000	C	OS, DS, WS	SH, MH	-
<i>Rubus foliolosus</i> D.Don	Kala Hissar	S	1800-2400	C	OS, SM, WS	WH	-
<i>Rubus nepalensis</i> (Hook.f.) Kuntze	Gangoor	Cl	2000-3000	C	SM, WS	MH	Me
<i>Rubus niveus</i> Thunb.	Anchu	S	1800-2500	C	OS, WS	MH	Me
<i>Rubus paniculatus</i> Sm.	Kala-Hinsar	S	1800-2700	C	OS, WS	MH	Me
<i>Sorbus cuspidata</i> (Spach) Hedlund	Mouli	T	2500-2800	C	UF	MH	Me
Rubiaceae							
<i>Galium asperifolium</i> Wall.	Leswakuri	H	2200-2700	C	WS, UF, SM	MH, AH	-
<i>Galium cryptanthum</i> Hemsley in Hook	-	H	2100-3000	UC	WS, UF, SM	WH	-
<i>Himalrandia tetrasperma</i> (Roxb.) Hook.f.	-	S	1800-2200	C	UF, WS	MH	Me
<i>Leptodermis kumaonensis</i> Parker	-	S	2000-3000	C	OP, WP, WS	NWH	-
<i>Rubia manjith</i> Roxb. ex Fleming	-	Cl	1800-2500	C	UF, WS	TH	Me
<i>Spermadictyon sauveolens</i> Roxb.	Padera	S	1800-2000	C	WS, OP	SH, MH	Me
Rutaceae							
<i>Boenninghausenia albiflora</i> (Hook.) Reichb. ex Meisn	Pishumar	H	1800-2900	C	UF, SM, WC	SH, MH	Me
<i>Zanthoxylum armatum</i> DC.	Timroo	S	1800-2000	UC	WS, SM	SHT	Me
Salicaceae							
<i>Salix acutifolia</i> Willd.	Bhains, Bharroi	T	2250-2350	UC	SM	MH	-
Saxifragaceae							
<i>Bergenia ciliata</i> (Haworth) Sternberg	Silpara	H	1800-3000	C	SM, UF, BO	MH	Me
Scrophulariaceae							
<i>Astilbe rivularis</i> Buch.-Ham. ex D.Don	Pothe	S	1800-2500	C	SM, OS, UF	MH	Me
<i>Hemiphragma heterophyllum</i> Wall.	-	H	1800-3000	C	SM, OS, UF	MH	-
<i>Pedicularis hoffmeisteri</i> Klotzsch in Garcke	Haldya-phul	H	2200-2900	C	OS, CF	MH, AH	-
<i>Scrophularia himalensis</i> Royle	Sikula	H	2000-2400	C	OS, WS	WH, MH	Me

<i>Verbascum thapsus</i> L.	Akulbir	H	1800-2500	C	WS	SH, MH	Me
Smilacaceae							
<i>Smilax aspera</i> L.	Kukardara	Cl	2000-2600	C	OS, WS, UF	MH, SH	Me
<i>Smilax menispermoides</i> DC.	-	Cl	1800-2400	C	OS, WS, UF	MH	-
Solanaceae							
<i>Solanum nigrum</i> L.	Makoi, Kirmoi	H	1800-2000	C	WS	TH	Me
Symplocaceae							
<i>Symplocos paniculata</i> (Thunb.) Miq.	Lodh	T	2000-2500	C	UF, SM	MH, SH	-
Taxaceae							
<i>Taxus baccata</i> L.	Thuner	T	2500-2900	UC	UF, BO, SM	MH	Me
Thymelaeaceae							
<i>Daphne papyracea</i> Wall. ex Steudel	Satpura	S	2200-2900	UC	UF, SM, WC	MH	Me
Urticaceae							
<i>Girardinia diversifolia</i> (Link) Friis	Bhainsya Kandali	H	1800-2600	C	WS	SH, MH	Me
<i>Lecanthus wallichii</i> Wedd.	Chaulu	H	2000-2500	C	OP, WP, WS, SM	MH	-
<i>Pilea umbrosa</i> Wedd.	Chailu	H	2000-2800	C	OP, WP, SM	MH	-
<i>Urtica ardens</i> Link	-	S	1800-2500	C	OP, WP, WS, SM, WC	SH, MH	Me
<i>Urtica dioica</i> L.	Kandali	S	1800-3000	C	OP, WP, WS, SM, WC	MH, SH, NWH	Me
Valerianaceae							
<i>Valeriana hardwickii</i> Wall.	Shammia	H	2000-2400	C	SM	MH	Me
<i>Valeriana jatamansii</i> Wall	Balchhari, sumaya	H	2200-3000	C	SM	MH, AH	Me
Violaceae							
<i>Viola biflora</i> L.	Vanfsa	H	2000-2700	C	UF, SM	AH, MH	Me
<i>Viola pilosa</i> Blume	Vanfsa	H	2000-2600	C	WS, SM	MH, AH	Me
Vitaceae							
<i>Parthenocissus semicordata</i> (Wall.) Planchon	Laguli	Cl	1800-2200	C	BO, WS	SH, MH, NWH	-
<i>Tetrastigma obtectum</i> (Wallich ex Lawson)	Malkiya	Cl	1800-2500	UC	BO, WS	WH	-
<i>Tetrastigma serrulatum</i> (Roxb.) Planchon	-	Cl	1800-2500	C	BO, WS	MH	-
<i>Vitis lanata</i> Roxb.	Puraini	Cl	1500-2500	C	BO, WS, UF	MH	-
Zingiberaceae							
<i>Hedychium spicatum</i> Buch.-Ham.	Ban-Haldi	H	2200-2500	C	BO, WS, SM WC, UF	SH, MH	Me
<i>Roscoea purpurea</i> Smith	Kakoli	H	1850-2700	C	OS, WS	MH	-

Abbreviations: BO= Bouldry; C= Common; Cl= Climber; DS= Dry Slopes; EP= Epiphytes; G= Grass; H= Herb; LF= Life Form; Me= Medicinal; Oc= Occurrence; OS= Open Slopes; PA= Parasite; S= Shrub; SE= Sedge; SM= Shady Moist; T= Tree; UC= Uncommon; UF= Under Forest; WC= Water Courses; WP= Waste Places; WS= Wayside; MH= Montane Himalaya; SH= Sub-Montane Himalaya; NWH= North-West Himalaya; AH= Alpine Himalaya; WH= Western Himalaya; TH= Throughout Himalaya; OH= Outer Himalaya; SAH= Sub-alpine Himalaya; SHT= Sub-Himalayan Tract; CH= Central Himalaya.

Hooker (1906) described Orchidaceae, Leguminaceae (Fabaceae), Graminaeae (Poaceae), Rubiaceae, Euphorbiaceae, Acanthaceae, Compositae (Asteraceae), Cyperaceae, Labiatae (Lamiaceae) and Urticaceae as 10 dominant families of India. Recently in similar moist temperate Mandal-Chopta forest of Garhwal Himalaya, Gairola et al. (2010) have recorded Asteraceae, Lamiaceae, Rosaceae, Orchidaceae, Poaceae, Urticaceae, Polygonaceae, Fabaceae, Ranunculaceae and Euphorbiaceae as 10 dominant families. Whereas, Suyal et al. (2010) have documented Lamiaceae, Asteraceae, Rosaceae, Ranunculaceae, Fabaceae, Caryophyllaceae, Polygonaceae, Rubiaceae, Gentianaceae and Poaceae as 10 dominant families in Chaurangikhal forest area of Garhwal Himalaya. In the present study, 10 dominant families were Asteraceae, Lamiaceae, Rosaceae, Ranunculaceae, Caryophyllaceae, Fabaceae, Polygonaceae, Apiaceae, Poaceae and Gentianaceae. The dominant families of

Dudhatoli forest area showed 40 % similarity with the dominant families of India. Number of individuals of Dicotyledons, Monocotyledons and Gymnosperms in different taxonomic groups in Dudhatoli forest area are graphically depicted in Figure 3.

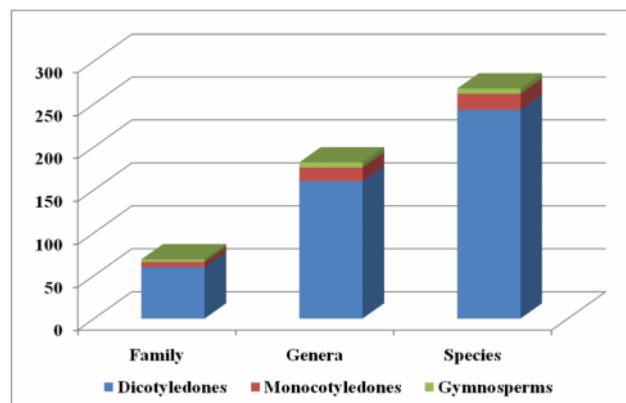


Figure 3: Number of individuals of Dicotyledons, Monocotyledons and Gymnosperms of different taxonomic groups in Dudhatoli forest area.

In the study area, the ratio of family to genera was 1: 2.64; family to species was 1: 3.88; genera to species was 1: 1.47. Among all the recorded species, 84.33 % (226 spp.) of the total species had common occurrence, whereas rest 15.67 % (42 spp.) had uncommon occurrence in the study area. The percentages of families (4.35%), genera (3.30%) and species (2.24%) for Gymnosperms, percentage of families (86.96%), genera (87.91%) and species (90.67%) for dicotyledones and families 8.70%, genera 8.79% and species 7.09% for monocotyledons in the study area indicates that majority flora was represented by dicotyledones. Out of 268 species recorded 20, 7, 159, 53 and 29 species of climbers, grasses, herbs, shrubs and trees respectively were recorded in the study area (Figure 4). Comparison of floristic diversity of the Dudhatoli forest area with other studies in the similar forests of the Uttarakhand Himalaya is given in Table 3. Family to Genus and Genus to Species ratio recorded in the Dudhatoli forest area in the present study is comparable to similar forests in the other parts of the Garhwal Himalaya.

Most of the plant species recorded from the study area are highly medicinal in nature and are used to cure variety of ailments by local

'Vaidas' or traditional herbal healers. The present study suggests that Dudhatoli forest is very rich in plant diversity, but unplanned use of forest resources and habitat degradation is threatening diversity in this forest area. The habitat wise monitoring of the important medicinal plant species using standard ecological methods is suggested. This study provides comprehensive information on altitudinal and habitat wise distribution pattern of higher plants in Dudhatoli forest area, which will be of great help to the scientists, planners and particularly to the state forest department for developing a strategies and action plans for the management of this biodiversity rich forest area.

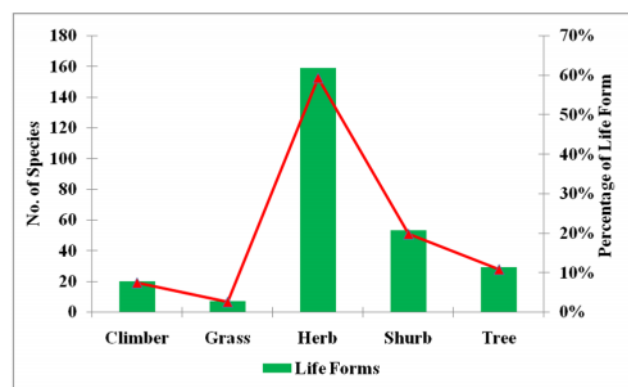


Figure 4: Number of species according to different life forms in Dudhatoli forest area.

Table 3: Comparison of floristic diversity of the Dudhatoli forest area with other studies in the similar forests of the Uttarakhand Himalaya.

Flora (Source)	Family (F)	Genera (G)	Species (S)	Ratio (F:G)	Ratio (G:S)
Dudhatoli forest, Garhwal (Present study)	69	182	268	1:2.64	1: 1.47
Chaurangikhal forest, Garhwal (Suyal et al., 2010)	69	159	231	1: 2.30	1: 1.45
Mandal-Chopta forest, Garhwal (Gairola et al., 2010)	93	249	338	1: 2.68	1: 1.36
Mussorie forest (Raizada and Saxena, 1978)	131	649	1219	1: 4.95	1: 1.88
Chamoli Garhwal (Naithani, 1984-1985)	163	892	1934	1: 5.47	1: 2.17
Garhwal Himalaya (Gaur, 1999)	189	978	2035	1: 5.17	1: 2.08

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