

Status of an Endemic Taxa *Rhododendron cowanianum* in Langtang National Park, Central Nepal

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Abstract

A systematic investigation of status of *Rhododendron cowanianum* Davidian from Rasuwa district, Central Nepal was carried out. Study aimed at identifying the occurrence status, mean density, and habitat characteristics of the endemic taxa from the Langtang National Park. It was found in scattered forests under open canopy from 2898 m to 3600 m asl. The mean density of *R. cowanianum* was found to be 0.73 individuals/m² which shows a good status of this taxa in Langtang National Park. Altogether, 113 species of vascular plants, belonging to 88 genera and 53 families, were found to be associated with *R. cowanianum*, where Ericaceae with five genera and 12 species was found to be the largest family, followed by Rosaceae, Fabaceae, Ranunculaceae and so on. *Rhododendron* with seven species was the dominant genera of vascular plants in the study area. Usually, endemic species are confined to specific areas and thus they are the first to be affected by land use and other global changes. The current human population explosion, alarming rate of deforestation, habitat fragmentation and modern-day environmental changes are posing greater threats to these endemic plant species worldwide. But, the population status, conservation status and threats to these peculiar plant species are yet underrated. Therefore, local authorities, government and non-governmental organizations should pay special attention towards the study and conservation of such endemic plant species.

Keywords: Conservation status, Taxonomy, Threats, Vascular plants

Introduction

Nepal is located in the central main Himalaya thus it is characterized by the presence of six adjoining floristic regions. Together, the altitudinal range extends from 60m to 8848 m asl which has made Nepal rich in plant biodiversity, with 5309 species under 1515 genera of 193 families (Rajbhandari et al., 2017). Some plant species are found only in Nepal and not in other parts of the world, such plants are called as endemic to Nepal. Endemic taxa refers to any species, or a taxonomic unit, whose distribution is confined within a restricted geographical area (Gaston, 1991) and this phenomenon is known as endemism. In other words, endemic plant species are the plants that exist only in one geographical region. The diversity in topography due to altitudinal variations and climatic fluctuations has greatly contributed to the occurrence of a wide variety of endemic plants in Nepal. As per the recent estimate, a total of 312 endemic flowering plant species are found in Nepal belonging to 126

genera of 46 families (Rajbhandari et al., 2016) with higher endemism around the elevation of 3800–4200 m at sea level (Tiwari et al., 2019).

Usually an area that contains endemic species is isolated in some way, so that plant species have difficulty spreading to other areas, or it has unusual environmental characteristics to which endemic species are uniquely adapted. Most of such species and their habitats in many areas are under serious threat. Consequently, many of the endemic and useful species are now threatened, endangered and facing extinction. Particularly, the endemic species in mountains are more vulnerable to rapid climate change (Suwal & Vetaas, 2017). No precise estimate can be made of the number of species being endangered and lost in major habitats, but evidences indicate that the situation is alarming. If the current trends of habitat destruction and over-exploitation practices persist, majority of the endemic species will be lost forever. Hence, there is an urgent need to conserve the valuable but fast disappearing species

for the sake of establishing ecological balance. For this purpose, it is necessary to study the geographical location, population ecology, conservation status and threats of the endemic taxa.

Rhododendron cowanianum Davidian is a member of family Ericaceae, the Gurans family and is an endemic taxon reported from Nepal, named after Dr. J. M. Cowan (Milleville, 2002). It is a shrub predominantly occurring in scattered patches in *Betula- Abies* forests. This species is endemic to Western and Central Nepal, where it extends from the south of Dhaulagiri to Langtang and Gosainkunda, from 3000 to 4000 m asl (Milleville, 2002; Department of Plant Resources [DPR], 2005). This study was carried out to document the occurrence status, mean density, and habitat characteristics of *Rhododendron cowanianum* from the Langtang National Park.

Taxonomy of *Rhododendron cowanianum*

Upright shrub, 0.5– 3 m tall, deciduous; stem branched, branchlets scaly, sparsely bristly or, glabrous; thin, oval to elliptic leaves, 2- 6.5 × 1.2- 3 cm, apex rounded, mucronate, base obtuse or, cuneate, margins ciliate, upper surface dark green and lepidote, lower surface pale green, lepidote with broadly rimmed scales; inflorescences raceme, racemes terminal, 3-5 flowered, umbellate, pedicels, 1- 2 cm, longer than corolla, scaly; flowers pink to mauve, appearing with or before the new leaves; calyx 5-lobed, 0.4- 1 cm, reddish, rounded, ovate, oblong, margin usually ciliate; corolla campanulate, tube short, 1.3- 2 cm long, pink to mauve, with or without darker spots; stamens 10, 0.8- 1.5 cm, longer than corolla tube, anthers white, filaments reddish, densely woolly-hairy at base; ovary 3- 5 mm, 5-celled, scaly, style short, sharply bent, not scaly; fruits capsule, 0.5- 1 cm, conic or oblong, scaly (Cullen, 1980; Milleville, 2002; DPR, 2005).

Type: Nepal, Langtang lateral valley, 3650 m, 7 June 1949, Polunin 175 (Holotype: BM, Isotype: E).

Local name: Kisur.

Flowering: April to June

Distribution: Endemic to Western and Central Nepal (DPR, 2005).

Conservation status and threat: This species of *Rhododendron* has been included in the list of endangered species (Milleville, 2002).

Materials and Methods

Study area

The spatial location of Nepal in the Himalaya made Central Nepal a meeting place of both western and eastern Himalayan floristic as well as a meeting place of characteristic taxa endemic to eastern and western Nepal. Thus, Central Nepal is rich in terms of biological diversity as well as endemic taxa, therefore Rasuwa district was selected for the present study. Rasuwa district lies within Central Nepal and covers an area of 1,544 km² and has a population of 43,300 as per the census of 2011 (Central Bureau of Statistics [CBS], 2012). Langtang valley of Rasuwa district which lies within the territory of Langtang National Park was selected for the present study. Langtang National Park (LNP, Nepal) provides unique habitat for a number of highly valuable medicinal and aromatic plants (MAPs) which have intense local utilization as well as high trade demand (Shrestha & Shrestha, 2012). The map of study area is given in Figure 1.

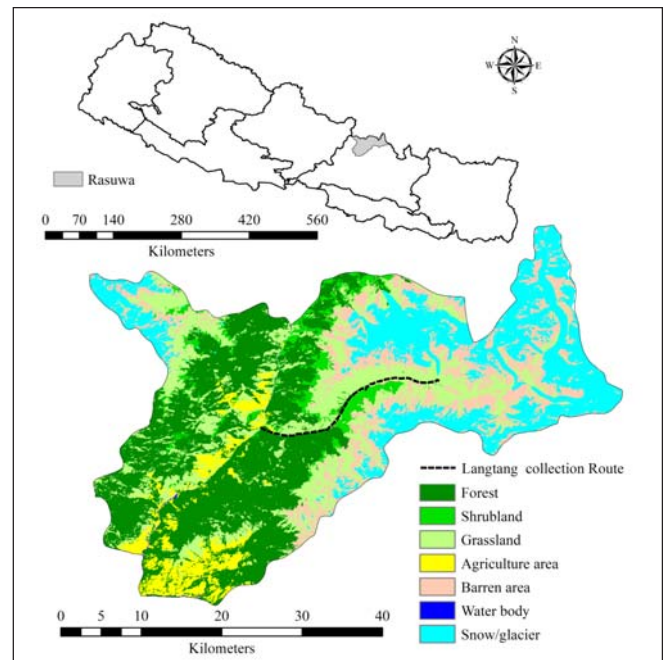


Figure 1: Map of study area showing Rasuwa district with different land use types and the collection route in Langtang valley.

Methods

The field visit was carried out during June 2019 in Rasuwa district, Central Nepal. During this visit, 5m × 5m quadrats were laid down at every 200 m elevation interval from 2900 m to 3500 m in three different transects to access the population status of *Rhododendron cowanianum*. The plots were replicated twice such that three plots each with an area of 25 m² was studied in each transect. Hence a total of nine such plots each covering areas of 25 m² were studied during this period. The associated species recorded in the study plots as well as along the walking trail (flowering or fruiting) were collected and herbarium specimens are deposited at National Herbarium and Plant Laboratories (KATH). However, the vascular plant species which were not on the state of flowering or, fruiting were simply noted to determine the species diversity of vascular plants in the study area. The identification of vascular plant species was carried out based on standard literatures (Grierson & Long 1983-2000; Polunin & Stainton, 1984; Stainton, 1988; Press et al., 2000; Ohba et al., 2008; Fraser-Jenkins et al., 2015). Nomenclature follows Catalogue of life (<http://www.catalogueoflife.org>) and the Plants of World Online (<http://www.plantsoftheworldonline.org>).

The data gathered from the field were tabulated in MS Excel and the necessary calculations were made. The frequency and density of *R. cowanianum* were calculated by using the following formulas.

$$\text{Frequency} = \frac{\text{No. of plots with species}}{\text{Total No. of plots taken}} \times 100\%$$

$$\text{Density (individual/m}^2\text{)} = \frac{\text{Total No. of individual of the species}}{\text{Total No. of plots} \times \text{Size of quadrats}}$$

The pattern of distribution of the species along the elevation was analyzed by linear regression. The strength of which is given by regression equation and R² value. A positive regression equation indicates positive relationship between the parameters. The R² value lies between 0 to 1 where, a value close to 1 indicates strong relationship between the parameters.

Results and Discussion

R. cowanianum was found in scattered forests under open canopy from 2898 m to 3600 m asl. It resembles with another *Rhododendron* species; *R. lepidotum* but can be distinguished by its oval to elliptic leaves with ciliated margins; pink to mauve flowers borne in clusters of three to five flowers; anthers with filaments bearing feathers at base only; carpel with characteristic style which is sharply bent (Figure 2).

A total of 49 individuals of *R. cowanianum* were recorded in the study plots. The mean density of *R. cowanianum* was 0.73 individuals/m² and the frequency of the study species was found to be 100%. The total number of individuals of *R. cowanianum* increased with increasing elevation (Figure 3). The positive regression equation and R² value of 0.75 shows a strong relationship between the number of individuals and elevation. Similarly, the p-value of 0.0025 indicates that the number of individuals significantly increases with increase in elevation.

A total of 113 species of vascular plants, belonging to 88 genera and 53 families, were recorded during the present study. Ericaceae with 5 genera and 12 species was found to be the largest family, followed by Rosaceae (7 genera, 9 species), Fabaceae (6 genera, 8 species), Ranunculaceae (3 genera, 5 species) and so on (Figure 4). A total of 87 species of dicotyledonous plants, 17 monocotyledonous plants, 5 gymnosperms and 4 pteridophytes were recorded, where Ericaceae (5 genera and 12 species) was the largest family of dicots and Asparagaceae and Zingiberaceae (3 genera and 4 species each) were the largest family of monocots. Similarly, Pinaceae (3 genera and 4 species) was the largest family of gymnosperms.

Rhododendron with 7 species was the dominant genera of vascular plants, which were followed by *Clematis* (4 species), *Primula*, *Astragalus* (3 species each), *Salix*, *Gaultheria*, *Polygonatum*, *Daphne*, etc. (2 species each) and so on. The list of associated vascular plant species recorded during the study is presented in the Tables.



Figure 2: *Rhododendron cowanianum* Davidian. **a- b.** Plant in its habitat (**a.** Flowering twig, **b.** Vegetative branch), **c.** Lepidote leaves with brown scales and hairy margin, **d.** inflorescence bearing multiple flowers in a cluster, **e.** Stamens feathery at the base only, **f.** Carpel with a bent style.

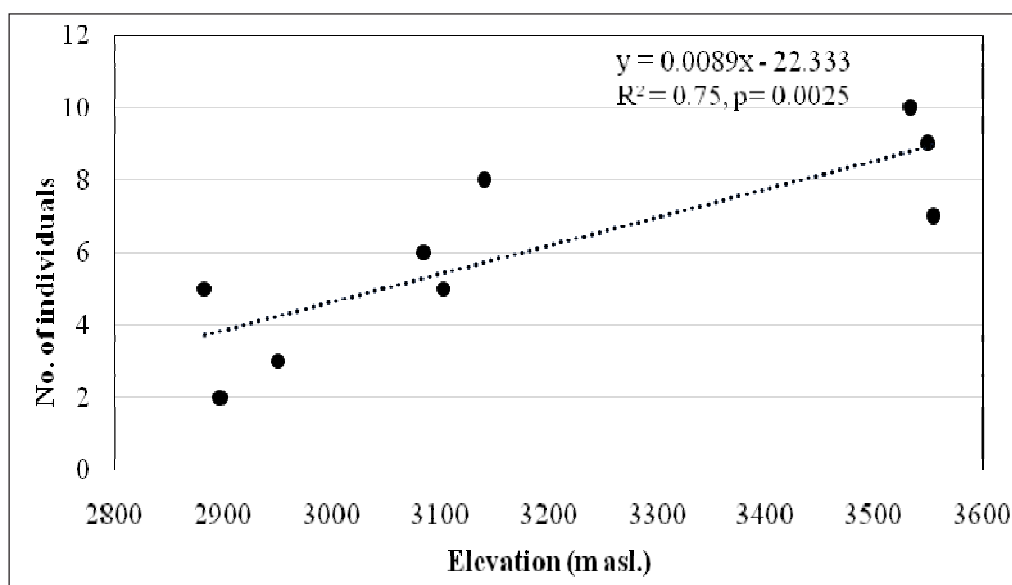


Figure 3: Variation in number of individuals with elevation

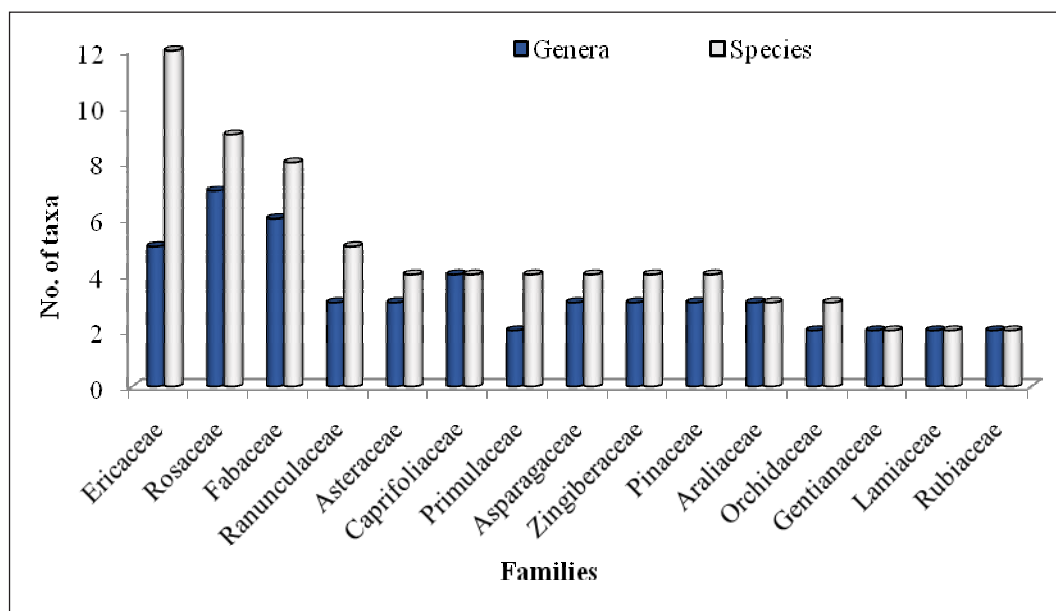


Figure 4: Distribution of families, genera and species of vascular plants

Conclusion

The study came up with the basic idea about the occurrence status of an endemic plant species *Rhododendron cowanianum* from Langtang National Park in Rasuwa district. It was found in scattered forests under open canopy from 2898 m to 3600 m asl. With the mean density of 0.73 individuals/m² which shows a good status of this taxa in Langtang National Park. Apart from *R. cowanianum*, another taxa *Sorbus sharmae* M. F. Watson, V. Manandhar and Rushforth which is endemic to Eastern and Central Nepal was also recorded during this study. Since it is a tall tree and a single individual of this plant was recorded, the population status of this plant could not be studied in detail. Usually, endemic species are confined to specific areas and thus they are the first to be affected by land use and other global changes. The current human population explosion, alarming rate of deforestation, habitat fragmentation and modern-day environmental changes are posing greater threats to these endemic plant species worldwide. But, the population status, conservation status and threats to these peculiar plant species are yet underrated. Therefore, local authorities, government and non-governmental organizations should pay special attention towards the study and conservation of such endemic plant species.

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Table 1: List of Angiosperms (Dicots)

S.N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
1.	<i>Acer sterculiaceum</i> Wall.	Aceraceae	28°9.5278' N	85°25.2601' E	2743.1	R0007
2.	<i>Achyranthes aspera</i> L.	Amaranthaceae	-	-	-	-
3.	<i>Ainsliaea latifolia</i> (D. Don) Sch. Bip.	Asteraceae	28°9.5278' N	85°25.2601' E	2786.7	R0010
4.	<i>Alnus nepalensis</i> D.Don	Betulaceae	-	-	-	-
5.	<i>Anaphalis margaritacea</i> (L.) Benth. and Hook.f	Asteraceae	-	-	-	-
6.	<i>Anaphalis triplinervis</i> Sims. ex C.B. Clarke.	Asteraceae	-	-	-	-
7.	<i>Androsace sarmentosa</i> Wall.	Primulaceae	28°11.7479' N	85°27.1352' E	2979	R0016
8.	<i>Astragalus rhizanthus</i> Benth.	Fabaceae	28°12.6362' N	85°33.1590' E	3713.6	R0052
9.	<i>Astragalus</i> sp.	Fabaceae	28°12.9550' N	85°30.9268' E	3482.7	R0035
10.	<i>Astragalus</i> sp.	Fabaceae	28°12.6748' N	85°32.0843' E	3599	R0046
11.	<i>Aralia leschenaultii</i> (DC.) J. Wen.	Araliaceae	28°11.5285' N	85°26.8841' E	2800	R0011
12.	<i>Begonia picta</i> Sm.	Begoniaceae	-	-	-	-
13.	<i>Berberis</i> sp.	Berberidaceae	28°12.6645' N	85°32.2054' E	3616	R0047
14.	<i>Bergenia ciliata</i> (Haw.) Sternb.	Saxifragaceae	-	-	-	-
15.	<i>Bupleurum longicaule</i> Wall. ex DC.	Apiaceae	-	-	-	-
16.	<i>Campanula pallida</i> Wall.	Campanulaceae	-	-	-	-
17.	<i>Caragana sukiensis</i> C. K. Schneid	Fabaceae	28°12.2776' N	85°27.9631' E	3097.2	R0029
18.	<i>Cassiope fastigiata</i> (Wall.) D. Don	Ericaceae	28°12.6748' N	85°32.0843' E	3599	R0045
19.	<i>Ceropegia pubescens</i> Wall.	Apocynaceae	28°9.5278' N	85°25.2601' E	2654	R0005
20.	<i>Clematis barbellata</i> Edgew.	Ranunculaceae	28°12.7171' N	85°32.0594' E	3596.1	R0041
21.	<i>Clematis buchananiana</i> DC.	Ranunculaceae	-	-	-	-
22.	<i>Clematis connata</i> DC.	Ranunculaceae	-	-	-	-
23.	<i>Clematis montana</i> Buch.-Ham. ex DC.	Ranunculaceae	28°12.9091' N	85°30.9238' E	3489.7	R0037
24.	<i>Clinopodium umbrosum</i> (M. Bieb.) K. Koch	Lamiaceae	-	-	-	-
25.	<i>Cotoneaster microphyllus</i> Wall. ex Lindl.	Rosaceae	28°12.4531' N	85°28.4808' E	3170.1	R0024
26.	<i>Crotalaria</i> sp.	Fabaceae	28°11.8098' N	85°27.1951' E	2995.7	R0022
27.	<i>Cynoglossum zeylanicum</i> (Sw. ex Lehm.) Thunb. ex Brand	Boraginaceae	-	-	-	-
28.	<i>Daphne bholia</i> Buch.-Ham. ex D. Don.	Thymelaeaceae	-	-	-	-
29.	<i>Daphne papyracea</i> Wall. ex G. Don.	Thymelaeaceae	-	-	-	-
30.	<i>Dipsacus inermis</i> Wall.	Caprifoliaceae	-	-	-	-
31.	<i>Epilobium wallichianum</i> Hausskn.	Onagraceae	-	-	-	-
32.	<i>Euphorbia stracheyi</i> Boiss.	Euphorbiaceae	28°11.5022' N	85°34.8554' E	4081	R0063
33.	<i>Gaultheria fragrantissima</i> Wall.	Ericaceae	-	-	-	-
34.	<i>Gaultheria trichophylla</i> Royle.	Ericaceae	28°12.7204' N	85°33.8289' E	3836.9	R0056

S.N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
35.	<i>Gentiana capitata</i> Buch.-Ham. ex D.Don	Gentianaceae	-	-	-	-
36.	<i>Geranium nepalense</i> Sweet	Geraniaceae	-	-	-	-
37.	<i>Hedera nepalensis</i> K.Koch	Araliaceae	-	-	-	-
38.	<i>Hemiphragma heterophyllum</i> Wall.	Plantaginaceae	-	-	-	-
39.	<i>Hypericum elodeoides</i> Choisy.	Hypericaceae	-	-	-	-
40.	<i>Hypericum uralum</i> Buch.-Ham. ex D. Don	Hypericaceae	-	-	-	-
41.	<i>Impatiens racemosa</i> DC.	Balsaminaceae	-	-	-	-
42.	<i>Lonicera</i> sp.	Caprifoliaceae	28°12.9310' N	85°31.2119' E	3491.8	R0038
43.	<i>Papaver paniculatum</i> D.Don	Papaveraceae	28°12.8526' N	85°29.7165' E	3390.5	R0034
44.	<i>Morina polyphylla</i> Wall. ex DC.	Caprifoliaceae	28°12.7171' N	85°32.0594' E	3596.1	R0044
45.	<i>Myrica esculenta</i> Buch.-Ham. ex D.Don	Myricaceae	-	-	-	-
46.	<i>Myricaria rosea</i> W. W. Sm.	Tamaricaceae	28°12.6362' N	85°33.1590' E	3713.4	R0053
47.	<i>Neohymenopogon parasiticus</i> (Wall.) Bennet	Rubiaceae	-	-	-	-
48.	<i>Panax pseudoginseng</i> Wall.	Araliaceae	28°11.6913' N	85°27.0389' E	2883.5	R0012
49.	<i>Parochetus communis</i> Buch.-Ham. ex D.Don	Fabaceae	28°9.5278' N	85°25.2601' E	2760.3	R0008
50.	<i>Pieris formosa</i> (Wall.) D. Don	Ericaceae	28°9.5278' N	85°25.2601' E	2738.5	-
51.	<i>Piptanthus nepalensis</i> (Hook.) Sweet	Fabaceae	-	-	-	-
52.	<i>Dasiphora fruticosa</i> (L.) Rydb.	Rosaceae	28°13.0087' N	85°35.9546' E	4787.7	R0070
53.	<i>Potentilla</i> sp.	Rosaceae	28°12.7171' N	85°32.0594' E	3596.1	R0042
54.	<i>Primula atrodentata</i> W. W. Sm.	Primulaceae	28°12.9460' N	85°36.0433' E	4864.7	R0071
55.	<i>Primula minutissima</i> Jacquem. ex Duby.	Primulaceae	28°12.7948' N	85°36.0271' E	4984.2	R0065
56.	<i>Primula sikkimensis</i> Hook.	Primulaceae	28°12.5774' N	85°32.7900' E	3646.5	R0049
57.	<i>Prunella vulgaris</i> L.	Lamiaceae	-	-	-	-
58.	<i>Prunus napaulensis</i> (Ser.) Steud.	Rosaceae	-	-	-	-
59.	<i>Quercus semecarpifolia</i> Sm.	Fagaceae	-	-	-	-
60.	<i>Ranunculus diffusus</i> DC.	Ranunculaceae	-	-	-	-
61.	<i>Rhodiola bupleuroides</i> (Wall. ex Hook.f. and Thomson) S.H.Fu	Crassulaceae	28°12.6647' N	85°32.2057' E	3624.9	R0048
62.	<i>Rhododendron anthopogon</i> D. Don	Ericaceae	-	-	-	-
63.	<i>Rhododendron arboreum</i> Sm.	Ericaceae	-	-	-	-
64.	<i>Rhododendron campanulatum</i> D. Don	Ericaceae	28°12.6362' N	85°33.1590' E	3713.4	R0058
65.	<i>Rhododendron cowaniamum</i> Davidian	Ericaceae	28°11.7598' N	85°27.1387' E	2978.3	R0018
66.	<i>Rhododendron lepidotum</i> Wall. ex G.Don	Ericaceae	28°11.7479' N	85°27.1352' E	2979	R0014
67.	<i>Rhododendron nivale</i> Hook.f	Ericaceae	28°12.9188' N	85°36.0469' E	4888.5	R0068
68.	<i>Rhododendron setosum</i> D. Don	Ericaceae	28°12.7204' N	85°33.8289' E	3836.9	R0055
69.	<i>Ribes griffithii</i> Hook.f and Thomson	Grossulariaceae	28°11.5285' N	85°26.8841'	2800.	R0009

S.N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
70.	<i>Rosa macrophylla</i> Lindl.	Rosaceae	28°11.8098' N	85°27.1951' E	2995.7	R0021
71.	<i>Rosa sericea</i> Wall. ex Lindl.	Rosaceae	28°12.7171' N	85°32.0594' E	3596.1	?
72.	<i>Rubia manjith</i> Roxb.	Rubiaceae	-	-	-	-
73.	<i>Rubus ellipticus</i> Sm.	Rosaceae	-	-	-	-
74.	<i>Salix daltoniana</i> Andersson.	Salicaceae	28°12.2769' N	85°27.9652' E	3071.6	R0025
75.	<i>Salix lindleyana</i> Wall. ex Andersson	Salicaceae	28°12.5069' N	85°34.7966' E	4045.4	R0066
76.	<i>Schisandra grandiflora</i> (Wall.) Hook.f & Thomson	Schisandraceae	28°9.5278' N	85°25.2601' E	2738.5	R0006
77.	<i>Sibbaldia cuneata</i> Hornem. ex Kuntze	Rosaceae	28°12.8569' N	85°29.7073' E	3358.5	R0033
78.	<i>Sorbus sharmae</i> M. F. Watson, V. Manandhar & Rushforth.	Rosaceae	28°12.3977' N	85°28.4052' E	3102	R0031
79.	<i>Stauntonia latifolia</i> (Wall.) R.Br. ex Wall.	Lardizabalaceae	-	-	-	-
80.	<i>Swertia chirayita</i> (Roxb.) H.Karst.	Gentianaceae	-	-	-	-
81.	<i>Taraxacum</i> sp.	Asteraceae	28°11.8301' N	85°27.2072' E	3001.7	R0023
82.	<i>Tetrastigma serrulatum</i> (Roxb.) Planch	Vitaceae	-	-	-	-
83.	<i>Tetrastigma</i> sp.	Vitaceae	28°9.2622' N	85°22.4208' E	1929.3	R0003
84.	<i>Thalictrum foliolosum</i> DC.	Ranunculaceae	-	-	-	-
85.	<i>Thermopsis barbata</i> Benth.	Fabaceae	28°12.2769' N	85°27.9652' E	3071.6	R0027
86.	<i>Vaccinium nummularia</i> Hook.f. & Thomson ex C.B. Clarke	Ericaceae	-	-	-	-
87.	<i>Viburnum cotinifolium</i> D. Don	Caprifoliaceae	28°12.2769' N	85°27.9652' E	3071.6	R0028

Table 2: List of Angiosperms (Monocots)

S. N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
1.	<i>Asparagus racemosus</i> Willd.	Asparagaceae	-	-	-	-
2.	<i>Arisaema propinquum</i> Schott	Araceae	-	-	-	-
3.	<i>Bulbophyllum</i> sp.	Orchidaceae	-	-	-	-
4.	<i>Cautleya spicata</i> (Sm.) Baker	Zingiberaceae	-	-	-	-
5.	<i>Disporum cantoniense</i> (Lour.) Merr.	Colchicaceae	28°11.8098' N	85°27.1951' E	2995.7	R0020
6.	<i>Fritillaria cirrhosa</i> D. Don	Liliaceae	28°12.6352' N	85°33.1590' E	3714.5	R0051
7.	<i>Globba clarkei</i> Baker.	Zingiberaceae	-	-	-	-
8.	<i>Iris</i> sp.	Iridaceae	28°12.2776' N	85°27.9631' E	3097.2	R0030
9.	<i>Juncus thomsonii</i> Buchenau.	Juncaceae	28°12.6362' N	85°33.1590' E	3713.4	R0054
10.	<i>Calanthe</i> sp.	Orchidaceae	28°9.2022' N	85°22.9622' E	1831.1	R0001
11.	<i>Pleione hookeriana</i> (Lindl.) Rollisson	Orchidaceae	28°9.5278' N	85°25.2601' E	2739	R0004
12.	<i>Polygonatum hookeri</i> Baker.	Asparagaceae	28°12.7406' N	85°31.9564' E	3601.4	R0040
13.	<i>Polygonatum verticillatum</i> (L.) All.	Asparagaceae	28°12.9091' N	85°30.9238' E	3489.7	R0036
14.	<i>Roscoea alpina</i> Royle.	Zingiberaceae	28°11.7479' N	85°27.1352' E	2979	R0015

S. N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
15.	<i>Roscoeia purpurea</i> Sm.	Zingiberaceae	-	-	-	-
16.	<i>Smilax elegans</i> Wall. ex Kunth.	Smilacaceae	-	-	-	-
17.	<i>Theropogon pallidus</i> (Wall. ex Kunth) Maxim.	Asparagaceae	-	-	-	-

Table 3: List of Gymnosperms

S.N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
1.	<i>Abies spectabilis</i> (D. Don) Mirb.	Pinaceae	28°12.7171' N	85°32.0594' E	3596.1	R0043
2.	<i>Ephedra gerardiana</i> Wall. ex Klotzsch & Garcke	Ephedraceae	28°12.7406' N	85°31.9564' E	3601.4	R0039
3.	<i>Larix griffithii</i> Hook.f.	Pinaceae	28°12.4531' N	85°28.4808' E	3170.1	R0032
4.	<i>Pinus roxburghii</i> Sarg.	Pinaceae	-	-	-	-
5.	<i>Pinus wallichiana</i> A. B. Jacks	Pinaceae	-	-	-	-

Table 4: List of Pteridophytes

S. N.	Scientific Names	Family	Latitude	Longitude	Altitude (m asl)	Collection No.
1.	<i>Japanobotrychum lanuginosum</i> (Wall. ex Hook. and Grev.) M. Nishida ex Tagawa	Ophioglossaceae	-	-	-	-
2.	<i>Onychium cryptogrammoides</i> Christ.	Pteridaceae	-	-	-	-
3.	<i>Equisetum</i> sp.	Equisetaceae	-	-	-	-
4.	<i>Lepisorus</i> sp.	Polypodiaceae	-	-	-	-