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Floristic diversity and medicinally important plant species in the hillside of Landour, Mussoorie

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Abstract
Himalayan region is well recognized for a plethora of medicinal plants. Landour is located at an altitude of about 6,800 to 7,798 ft in the Lower Western Himalaya, in the Mussoorie Range. It encompasses a considerable forested area, of Banj Oak (*Quercus leucotrichophora*) with intermittent Deodars, Pines and Rhododendrons. The present paper reveals the floristic diversity and medicinally important plant species present in the hillside of Landour, Mussoorie. During the study 97 species of vascular plants (Angiosperms and Gymnosperms) belonging to 54 families were recorded from the study area. There were 24 tree species, 44 species of herbs, 24 species of shrubs, 5 species of climbers. The major families of Angiosperms in the region are Asteraceae (8 genera, 9 species), followed by Rosaceae (5 genera, 6 species), Lamiaceae (3 genera, 4 species) and 4 genera of Pinaceae, Acanthaceae, Polygonaceae, 3 genera of Cornaceae, Sapindaceae, Urticaceae. The majority percentage of the ground cover is comprised of herbs. A total of 74 plant species were identified in the region which have medicinal properties among which 20 plant species are trees, 16 plant species are shrubs, 36 plant species are herbs and 2 climbers. All plants with botanical names, common names, family, habit, and medicinal properties were listed and tabulated.

Keywords: Medicinal plants, Landour, Mussoorie

Introduction
The Himalayas are one of richest floristic zone of India and provide thousands of species of medicinal plants. Since ancient times, the Himalayan flora has been sought after for a myriad of purposes, including its many scientifically proven therapeutic benefits. Ancient Indian texts such as the Rigveda, Atharvaveda, and Charka Sanhita, have extensively detailed the vast array of uses for plants found in the Himalayan region. Medicinal plants are one of the most important components of the forests of Himalaya and are well known for their efficacy in coping with various diseases [1]. Landour, Mussoorie, is nestled in the foothills of the Himalayas in Uttarakhand, India. Major part of Landour comprises of old forest growth consisting mainly of Deodar, Banj Oak, Chir Pine, Blue Pine, West Himalayan Fir, Himalayan Maple, Rhododendron, and other tree species. A considerable area (330 acres appx.) of Landour, lies under the property of Woodstock School, Mussoorie, India. Major forest tree species in the school campus comprise of Banj Oak (*Quercus leucotrichophora*), Deodar (*Cedrus deodara*), Rhododendron, Maple, Chir Pine. The flora of the region has been extensively studied by botanists over the years, revealing a wide range of plant species belonging to various families and genera. These species occupy diverse habitats, including temperate forests, mixed deciduous forests and rocky outcrops. The region's unique geography and climatic conditions have fostered the evolution of a wide array of endemic and threatened species. 'Flora Indica' [2] and 'Flora of British India' spanning seven volumes provides extensive information on the region's flora. The first documented collection of plants from Mussoorie was done in 1824 followed by subsequent researchers who also delved into the region's floristic diversity [3]. In the past various studies were conducted on region's flora [4] and ferns [5]. Various other work including supplementation of Duthie's flora of the Upper Gangetic plains, as well as the adjacent Shiwalik and sub-Himalayan regions [6] and examination of the herbaceous flora of Dehradun and the flora of Mussoorie [7] was carried by different researchers. Raizada (1977) documented the floristic diversity of the Mussoorie region, describing approximately 1331 plants, including Phanerogams, Ferns, and Fern Allies.. Fleming (1930-1950), identified and recorded biodiversity in Woodstock School, Landour, Mussoorie [8, 9, 103].

Another mention of different trees, herbs and shrubs in the region was found in a field guide of Woodstock School [10]. There is variation in the floristic composition of the region while one traverses through the hill ranges in and around Mussoorie. The floristic diversity of the Binog Wildlife Sanctuary adjacent to Mussoorie and Dhanaulti region reported 335 species belonging to 237 genera under 102 families [11], [12]. Besides, during recent times various researchers and botanists in the region have attempted to identify and record various floral diversity near Mussoorie, Uttarakhand. The broad study of different plant species helps to learn about plant phenology, conservation status, medicinal properties, ethnobotanical as well as traditional uses of various plant parts. Even though various botanical studies have been conducted in the region from time to time, there is very little, and scattered information about the local floral diversity in Landour cantonment region, Mussoorie.

Plants also have a major role in our everyday life and the development of the advanced medical care system. Over the past years, the research of medicinal plants and its traditional herbal cure has remarkably raised. In India, traditional medicines are widely used in pharmaceutical fields and also as a dietary therapy [13]. Several research studies on traditional medicinal herbs have been reported that, they have potential cure against numerous health disorders and diseases [14-16].The region harbours a diverse array of plant species, each possessing unique ecological and medicinal significance. Traditional healers have long utilized these plants to treat a variety of ailments. There are various studies which are focussed on the study of medicinal plants of different plants in Uttarakhand, however, there is little or no report on the medicinal plants present in Landour, Mussoorie. As a result an attempt was made to study and document the trees, herbs and shrubs as well as their medicinal properties, growing in this region.

The hillside of Landour is also a popular spot for tourism and is susceptible to phases of progress and potential in fringements from humans as a result of mismanagement. The floral diversity in the region is constantly under threat from various sources such as forest fires, grazing and browsing, tree cutting, climatic fluctuations, earthquakes, surface run offs and most importantly anthropogenic pressures. So implementing conservation methods as a part of a comprehensive long term conservation program is crucial in preventing the further decline of endangered, endemic, and rare medicinal plant species. Hence this analysis serves as a foundation for forthcoming research and advancement strategies for forest custodians, herbal practitioners, preservationists, ethnobotanist, students, educators and research scholars.

Materials and Methods

Study area: Landour is in the Lower Western Himalaya, in the Mussoorie Range. It lies at an altitude of 6,800 to 7,798 ft. The outermost ridge of the Himalayas in the Landour area runs in a north-west to south-east direction, and the forests are mostly situated on the north-eastern slopes. The aspect is chiefly north-west or south-east with the rounded crests of the spurs facing north-east. The western aspect of the hillside is mostly drained by various streams. The slope gradients in the hillside are generally steep to very steep with unworkable rocky outcrops in a few places. The underlying rocks belong to the ancient Purana group. The commonest rock is limestone with decomposing schists and shales. The soil varies considerably, often shallow on spurs but with a deep sandy loam in depressions and streams.

According to Champion and Seth [17], the forests in the region fall under moist temperate forest type (Group 12). Himalayan Moist Temperate Forests are distributed in northern India at altitude ranging from 1500m to 3300m. Several species of Oak predominate in the temperate forests, but the major area which is covered under forests in the region is majorly divided into Banj Oak forest, Chir Pine forest and Plantations [18].

a. **Banj Oak Forest:** It occupies all the higher slopes, the deeper nalas and the lower slopes which have a northern aspect. The principal tree associates of the Oak are *Rhododendron arboreum* and *Lyonia ovalifolia*. Other common species are *Carpinus viminea*, *Cornus capitata*, *Cornus macrophylla*, *Euonymus pendulus*, *Pyrus pashia* and *Aesculus indica*.

   The natural regeneration of Banj Oak is comparatively lower as compared to its associates. In the past, the forests underwent various management practices which comprised of majorly Coppice system, improvement felling and seedling regeneration systems. Coppice system and seedling regeneration system were a huge success in the area, as a result the density of the understory varies considerably from very open to dense. The open areas in the region have been invaded by various shrubs like *Ageratina adenophora*, *Berberis* spp., *Daphne* sp., *Desmodium tiliaefolium, lnula cappa, Rhus cotinus, Rubus ellipticus*, and *Viburnum* spp. The climber *Rosa moschata* is also common. The invasion of Mexican Devil (*Ageratina adenophora*) is a major problem in the region as its gradually covering up most of the open areas in the region limiting the growth of local species. It was possibly having first been brought to India with wheat shipments from the United States [10].

b. **Chir forest:** The Chir forest only occupies the lower slopes up to an altitude of 6,700 feet and then on the spurs or on slopes with a southern aspect. Mixed Chir and Oak forests can be found along the higher elevations in the region. Elsewhere it is typical pure Chir forest with little shrubby undergrowth, although occasionally there may be a thin understory of Oak. Density varies from almost normal on favorable sites to a very thin crop on steep stony ground. Natural regeneration of Chir is almost entirely absent.

c. **Plantations:** The forests comprise of conifers have been introduced to such an extent that the natural oak forest has already been radically altered.

d. **Pure plantations:** According to the past forest working Plans around 21 acres under naturally growing Oak Forest have undergone plantations with conifers. They consist chiefly of Deodar (*Cedrus deodara*) with a few Cypress (*Cupressus* sp.) and a few Kail (*Pinus wallichiana*).

The climate is temperate with a monsoon rainfall. The winter lasts from November to February with snow falls particularly in January and February. The snow disappears rapidly from the ridges and southern aspects but lies for a considerable time in depressions on northern aspects. March and April are cooler, but in May and June temperatures may go high. The hillside also experiences thunderstorms which are often accompanied by hail. The monsoon season starts setting in mostly in the end of June.

Floristic analysis: This study was carried out between the

periods 2020 - 2023. Periodical floristic survey of angiosperms and gymnosperms was carried through extensive nature walks. Survey was done across various trails in search of vascular plants in the region. The floristic surveys and specimen collections were carried out at different altitudinal zones and landforms e.g., valleys, forested areas and rocky outcrops. Primarily three existing forest types *viz*., a) Banj Oak Forests (BOF), b) Chir-Pine Forests (CPF) and c) Plantations were identified to collect samples. The plants were freshly collected and their digital photographs were also taken. Identification of plants in the field was made with the help of available floras, research papers and reports (Raizada, 1977; Polunin and Stainton, 1984; Osmaston, 1927) of the region. Herbarium of Botanical Survey of India and Forest Research Institute, Dehra Dun were consulted to cross check the identity of various species.

Results and Discussion

Present study represents not only the different species of plants in the region but also their potential medicinal benefits. During the study 97 species of vascular plants (Angiosperms and Gymnosperms) belonging to 54 families were recorded from the study area (Fig. 2). There were 24 tree species, 44 species of herbs, 24 species of shrubs, 5 species of climbers. The major families of Angiosperms in the hillside of Landour are Asteraceae (8 genera, 9 species), followed by Rosaceae (5 genera, 6 species), Lamiaceae (3 genera, 4 species) and 4 genera of Pinaceae, Acanthaceae, Polygonaceae, 3 genera of Cornaceae, Sapindaceae, Urticaceae. The majority percentage of the ground cover is comprised of herbs (Fig 1).

About 76% of the plants in the area have high medicinal importance. Many of the medicinally important forest tree species were also recorded in the region (Table 1) which comprise of *Abies pindrow, Acer oblongum, Aesculus indica, Benthamidia capitata, Cornus capitata, Cornus macrophylla, Cupressus sempervirens, Euonymus pendulus, Ilex dipyrena, Juglans regia, Lyonia ovalifolia, Myrica esculenta, Pinus roxburghii, Pyrus pashia, Quercus floribunda, Quercus leucotrichophora, Rhododendron arboretum, Thuja occidentalis, Toona ciliata, Ulmus* sp. Besides having medicinal properties these forest trees have various ethnobotanical uses too. Leaves of few trees are also used as fodder for cattles by the local people for e.g. *Quercus leucotrichophora, Quercus floribunda, Aesculus indica.* Few tree bear fruits which are edible too for e.g. *Pyrus pashia, Juglans regia.*

The study revealed the presence of many species of shrubs also which have medicinal, ethnobotanical, ecological significance. The local population in the region also depends on these plants for their everyday needs. The fruits, flowers, leaves and sometimes even the entire plant is used. *Berberis aristata, Berberis lycium, Cyathula tomentosa, Daphne* sp., *Ageratina adenophora, Hypercium oblongifolium, Indigofera gerardiana, Rosa moschata, Rubus ellipticus, Viburnum cotonifolium, Wikstroemia canescens, Lonicera quinquelocularis, Desmodium tilifolium, Myrisine africana, Cotoneaster bacillaris, Jasminum humile, Arundinaria falcata, Lantana camara are some of medicinal shrubs which are reported to have medicinal properties. Ageratina adenophora* and *Lantana camara* are major invasive species found in the region (Table 2).

According to Fig 1. Majority of the plant species found in the area are comprised of herbs (Table 3). They mostly cover the forest understory and comprise of *Arisaema tortuosum, Begonia picta, Berginia ciliata, Bonninghausenia albiflora, Cauteleya spicata, Dicliptera bulbleuroides, Erigeron belliloides, Fragaria indica, Fragaria nubicola, Galinsoga parviflora, Geranium wallichianum, Girardinia heterophylla, Hedychium spicatum, Impatiens sulcata, Isodon coesta, Oenothera rosea, Oxalis corniculata, Oxyria digyna, Strobilanthes alatus, Reinwardita indica, Roscoea pururea, Rumex hastatus, Rumex nepalensis, Rumex obtusifolius, Sagerita oppositifolia, Salvia lanata, Scutellaria scandens, Silene conoidea, Solanum xanthocarpum, Taraxicum officinale, Tinantia erecta, Trifolium repens, Verbascum thapsus, Viola canescans, Viola serpens, Veronica persica, Inula cappa, Artemisia vulgaris. Bergenia ciliata* (Haw.) and *Valeriana jatamansi Jones* was also recorded from the region, which is listed as vulnerable under various threat categories [19].

Only 5% of the total plant species found in the area comprise of climbers. *Rubia cordifolia*, *Hedera helix*, *Hedera nepalensis*, *Vitis himalayana*, *Smilax* sp. are the major climbers in the area (Table 4). There is certain species of Ivy which poses a serious threat to local plants and trees. The vines grow alongside the tree and gradually increase in girth and eventually covers the tree canopy. While the vine thrives the host tree slowly gets devoid of nutrition and sunlight.

A total of 74 plant species were identified in the region which have medicinal properties among which 20 plant species are trees, 16 plant species are shrubs, 36 plant species are herbs and 2 climbers. *Abies pindrow* Royle commonly known as Himalayan silver fir has been earlier reported to be used in the treatment of anxiety, pain and inflammation. The plant has been reported to exhibit anti-inflammatory, anxiolytic, antioxidant and bronchospasm activities [20]. Pharmacological studies of *Acer* species have shown that the extracts and compounds isolated from this genus exhibit a broad spectrum of biological activities such as antioxidant, antitumor, anti-inflammatory, antidiabetic, hepatoprotective, and anti-obesity activities [21]. *Aesculus indica* or the horse chestnut tree has medicinal properties which can cure skin diseases and rheumatism [22]. Himalayan Dogwood is reported to have antibacterial properties [23]. *Cedrus deodara* (Roxb.) Loud. commonly called as Deodar has anti-inflammatory, analgesic, anti-hyperglycemia, antispasmodic, insecticidal, anti-cancer, immunomodulatory properties [24]. Research carried out during the recent past has shown that plants in genus Cornus are a source of beneficial bioactive compounds. *C. macrophylla* is a medicinal plant. Its bark can be used orally in powder form or in black tea to treat backache, jaundice, and stomach ulcers [25], [26]. The young buds of *Lyonia ovalifolia* are poisonous, the plant exhibits diverse biological properties as analgesic, anti-inflammatory, antimicrobial, antioxidant, anti-cancer, and antiviral [27]. *Juglans regia* Linn. is a valuable medicinal plant that possesses antimicrobial, antioxidant, anti-fungal, and anticancer properties to treat a wide range of diseases in humans [28]. *Quercus leucotrichophora* A. Camus for treatment of urinary infection, stomach pain, gonorrhoea, asthma, haemorrhages, diarrhoea, dysentery, urinary disorder, and diuretics [29]. Rhododendron plants have number of health benefits along with antimicrobial activities [30]. Almost each plant part of Berberis has medicinal use and is used for treating different diseases such as diabetes, arthritis, joint pain, and stomach ulcer [31]. *Ageratina adenophora* extract has various biological therapeutic properties such as antiviral, anti-inflammatory, wound-healing, antioxidant, antibacterial, antipyretic, wound-healing, and analgesic properties [32, 33]. *Wikstroemia* sp. has been regarded as a worthy genus with

numerous phytochemicals and various pharmacological potentials such as anticancer, anti-inflammatory, anti-aging, anti-viral, antimicrobacterial, antimalarial, neuroprotective, and hepatoprotective activities [34]. *Rubus ellipticus* is a highly nutritious wild fruit with many health benefits including antioxidant, antidiabetic, anticancer, anti-inflammatory, nephroprotective, antipyretic, anticonvulsant, and anti-infective activities [35]. *Hypericum oblongifolium* possesses antispasmodic, bronchodilator, hypotensive, cardiac inhibitory and vasodilator effects [36]. The crude extract of fruits of *Rosa moschata* possesses antispasmodic effects [37]. *Myrisine africana* showed promising antioxidant and anti-inflammatory activity [38]. *Arisaema tortuosum* (Wall.) also called as Whipcord Cobra Lily is used in Indian folk medicine to cure different diseases related to stress and inflammation [39-41]. *Berginia ciliata* was reported to possess high antifungal, antiviral, anti-plasmodial and antibacterial activities and pharmacological studies reported that it has good antioxidant, anti-inflammatory, anti-tussive, anti-ulcer and anti-neoplastic activities [42]. *Galinsoga parviflora* (Cav.) is a member of the asteraceae family traditionally used for treatment of various ailments such as malaria, flu, cold, colorectal cancer, liver problems and inflammation. *G. parviflora* possesses several pharmacological properties such as antibacterial, antifungal, antioxidant and antidiabetic [43]. *Reinwardtia indica* (Lineaceae) is a medicinal plant in the Himalayan region. It is effectively used in folk medicines for the treatment of various health complications. *R. indica* extracts can be used as potent natural antioxidant having antifungal and antibacterial action [44]. *Solanum xanthocarpum* (Solanaceae) has been used for treatment of many infectious and degenerative diseases in traditional medicine and possess anti-oxidant and anti-cancerous properties [45]. Common mullein (*Verbascum thapsus* L.) is a medicinal plant readily found in roadsides, meadows and pasture lands and has been used to treat pulmonary problems, inflammatory diseases, asthma, spasmodic coughs, diarrhoea and migraine headaches [46]. *Valeriana jatamansi* (Valerianaceae), also called as Indian Valerian is an herb useful in ayurveda. It is used as an analeptic, antispasmodic, carminative, sedative, stimulant and stomachic [47]. *Taraxacum officinale* (G.H. Weber ex Wiggers), commonly known as dandelion, is a herbaceous plant which has immense medicinal value and contains hepatoprotective, antioxidant and anti-cancerous properties [48]. *Rubia cordifolia* (Rubiaceae) is a perennial botanical drug climbing vine. *R. cordifolia* has multiple pharmacological activities, such as neuroprotective, anti-tumor, antibacterial, anti-inflammatory, anti-oxidant, and immunosuppressive effects [49]. Besides the above mentioned species there are number of different plant species also listed which have multiple medicinal and therapeutic values associated (Table 1, 2, 3 and 4).

Due to the introduction of various alien species in the region the trees are also under threat due to insect infestation. During nature walks conducted in the area it was observed that the acorns of *Q. leucotrichophora* are heavily affected by insect infestation. The density of the broad-leaved forest should be improved by artificial regeneration of Oak as natural regeneration has proved to be slow or impossible. The condition of the forest is such that fellings should be entirely silvicultural to improve the existing crop and not to get revenue. Oak tree is a keystone species in the region without which the complex web of the ecosystem will get disturbed. The Oak forests are source of fuelwood, fodder and can be interconnected with rich biodiversity around. But due to increasing anthropogenic disturbances, Oak forests are today witnessing a steady decline and there are very few large patches of intact Oak forests and Deodar forests are left in the Himalayan region today. Also it was noticed that some Oak trees in the region are under attack of different species of fungi [50].

The baseline data on botanical records plays a crucial role in evaluating threats, prioritizing conservation efforts for species and effectively managing resources sustainably. The medicinal plants found in Landour, Mussoorie carry immense medicinal potential, making it vital to prioritize their conservation and sustainable utilization. Apart from the different plant species identified in the present article there may be many different unidentified plants also in the region which must be identified for their future conservation and medicinal properties. Overexploitation, deforestation, and urbanization pose threats to these valuable ecosystems and the tourist destinations in the Himalayas are at risk for ecological degradation as a result of the influx of substantial number of visitors and linked developmental actions. Therefore, during this early stage of tourism, it is vital to establish a natural wealth benchmark to facilitate future monitoring and conservation efforts in the area. The reforestation efforts have been lacking among local communities, hence, there is a need to not only focus on regeneration activities, but also provide alternative sources to alleviate the pressure on flora. Such measures are necessary to safeguard the enigmatic complexity of the region's floral diversity and ensure its preservation for future generations.

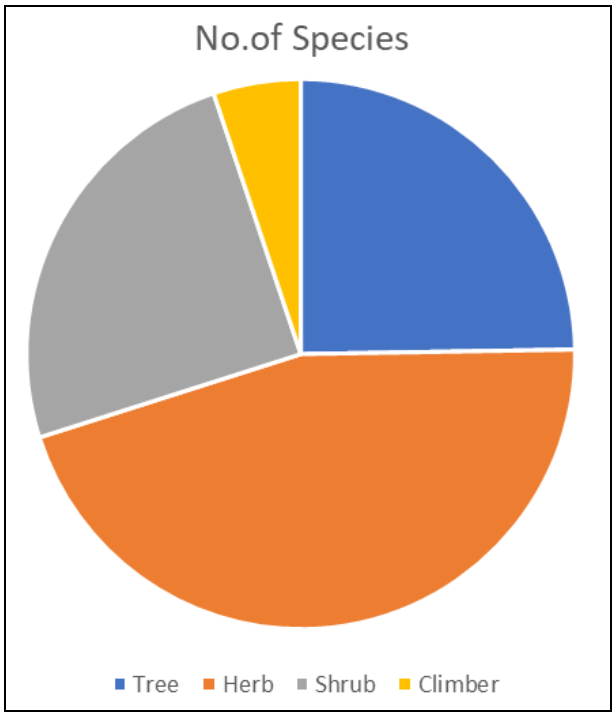

Fig 1: Plant habit wise distribution of different plant species in the hillside of Landour, Mussoorie

Table 1: List of trees in the hillside of Landour, Mussoorie along with their medicinal properties and IUCN status

Botanical name	Common name	Family	IUCN status	Medicinal properties
Abies pindrow	Himalayan Fir	Pinaceae	LC	Anti-inflammatory, Antioxidant [20]
Acer caesium	Candle shape maple	Sapindaceae	LC	--
Acer oblongum	Himalayan Maple	Sapindaceae		Antifungal, antitumor [21]
Aesculus indica	Indian Horse Chestnut or Pangar	Sapindaceae	LC	Treating skin disease, rheumatism [22]
Benthamidia capitata	Himalayan Dogwood	Cornaceae	LC	Antibacterial properties [23]
Carpinus viminea	Himalayan Hornbeam	Betulaceae		--
Cedrus deodara	Himalayan Cedar	Pinaceae	LC	Anti-inflammatory, analgesic,anti-cancer [24]
Cornus capitata	--	Cornaceae		--
Cornus macrophylla	Pagoda Dogwood	Cornaceae	LC	Analgesic, diuretic [25]
Cupressus sempervirens	Cypress	Cupressaceae	LC	Astringent, anti-seborrheic, antiaging [51]
Euonymus pendulus	Spindle tree	Celastraceae		Purgative, treatment of dyspepsia [52]
Ilex dipyrena	Himalayan Holly	Aquifoliaceae	LC	Analgesic, antipyretic [53]
Juglans regia	Walnut	Juglandiaceae		Gastroprotective, Antidiabetic, antarthritic [28]
Lyonia ovalifolia	Fetterbush	Ericaceae	LC	Analgesic,anti-inflammatory,antimicrobial [22]
Myrica esculenta	Himalayan Bayberry	Myricaceae		Astringent, antiseptic, carminative [54]
Pinus roxburghii	Chir Pine	Pinaceae	LC	Analgesic, anti-inflammatory [55]
Pinus wallichiana	Blue Pine	Pinaceae	LC	Antimicrobial, antioxidant [56]
Pyrus pashia		Rosaceae		Hypoglycemic, stomachic, astringent [57]
Quercus floribunda	Holly Oak	Fagaceae		Antipyretic, anti-inflammatory [58]
Quercus leucotrichophora	Banj Oak	Fagaceae		Used to cure gonorrhoea, asthma, haemorrhages, diarrhoea, and dysentery [59]
Rhododendron arboretum	Burans	Ericaceae	DD	Antinociceptive, treatment of diabetes and heart disease, antimicrobial [60]
Thuja occidentalis	Northern white cedar	Cupressaceae	LC	Hepatoprotective, Gastroprotective, antidiabetic [61]
Toona ciliata	Red Cedar, Toon	Meliaceae	LC	Aphrodiasc, antipyretic [62]
Ulmus sp.	Elm tree	Ulmaceae		

*LC = Least Count, DD = Data deficient

Table 2: List of shrubs in the hillside of Landour, Mussoorie along with their medicinal properties and IUCN status

Botanical name	Common name	Family	IUCN status	Medicinal properties
Berberis aristata	Indian Barberry	Berberidaceae	LC	Antipyretic, antidiabetic, astringent [63]
Berberis lycium	Indian Lycium	Berberidaceae		Aperient, Febrifuge, Diaphoretic [64]
Coriaria nepalaensis	Mansura	Coriariaceae		--
Cyathula tomentosa	Wooly patureweed	Amaranthaceae		--
Daphne sp.	Daphne	Thymeleaceae		Antimicrobial, Antioxidant [65]
Debregeasia longifolia	Rhea	Urticaceae		--
Debregeasia hypoleuca	Himalayan Rhea	Urticaceae		--
Deutzia staminea	Long Stamen Deutzia	Hydrangeaceae		--
Ageratina adenophora	Mexican Devil	Asteraceae		Antibacterial, antipyretic, antiviral [32], [33]
Hypercium oblongifolium	St. John's wort	Hypericaceae		Antispasmodic, antiseptic [36]
Indigofera gerardiana	Indigo	Fabaceae	LC	Treatment of gastrointestinal and abdominal pain [66]
Rosa moschata	Himalayan Wild Rose	Rosaceae		Antispasmodic and antidiarrheal [37]
Rubus ellipticus	Himalayan Raspberry	Rosaceae		Antidiurectic [35]
Strobilanthes atropurpureus	Deep blue Curved Bell	Rubiaceae		--
Viburnum cotonifolium	Indian wayfaring tree	Caprifoliaceae		Useful in haemorrhage, menorrhagia and metorrhagia. Fruits are edible [67]
Wikstroemia canescens	Himalayan Tie-Bush	Thymeleaceae		Anticancer, anti-inflammatory, antiaging [34]
Lonicera quinquelocularis	Translucent honeysuckle	Caprifoliaceae		Antipyretic, antioxidant [68]
Desmodium tilifolium	Creeping Tick Trefoil	Papilionaceae		Anti-arthirhitic, antioxidant [69]
Myrisine africana	Cape Myrtle	Myrisinaceae		Anti-inflammatory, antioxidant [38]
Rhus sp.		Anacardiaceae		--
Cotoneaster bacillaris	Purpleberry Cotoneaster	Rosaceae		Anti-inflammatory, antioxidant [70]
Jasminum humile	Yellow Jasmine	Oleaceae		Antiviral, antimicrobial [71]
Arundinaria falcata	Himalayan Weeping Bamboo	Poaceae		--
Lantana camara	Common lantana	Verbenaceae		Antimicrobial, insecticidal [72]

Table 3: List of herbs in the hillside of Landour, Mussoorie along with their medicinal properties and IUCN status

Botanical name	Common name	Family	IUCN status	Medicinal properties
Arisaema tortuosum	Whipcord Cobra lily	Araceae		Antimicrobial, antibacterial, antifungal [39, 40, 41]
Begonia picta	Begonia	Begoniaceae		Antibacterial, antioxidant [73]
Berginia ciliata	Hairy Berginia	Saxifragaceae	Vulnerable	Used for treatment of kidney stones [42]
Bonninghausenia albiflora	White Himalayan Rue	Rutaceae		Antiseptic [74]
Cauteleya spicata	Wild ginger	Acanthaceae		Antibacterial, antifungal [75]
Dicliptera bulbleuroides	Dicliptera	Acanthaceae		Treatment of eye diseases [76]
Erigeron belliloides	Himalayan Daisy	Asteraceae		--
Erigeron karvinskianus	Daisy fleabane	Asteraceae		Antimicrobial, Antifungal [77]
Fragaria indica	Mock strawberry	Rosaceae		Antidiabetic, Antioxidant [78]
Fragaria nubicola	Himalayan strawberry	Rosaceae		
Galinsoga parviflora	Quick weed	Asteraceae		Anti-inflammatory, hepatoprotective [43]
Geranium wallichianum	Wild geranium	Griniaceae		Antiarthiritc [79]
Gerbera gossypina	Gerbera	Asteraceae		--
Girardinia heterophylla	Himalayan nettle	Urticaceae		Antihyperglycemic, Antidiabetic [80]
Hedychium spicatum	Spiked Ginger Lily	Zingiberaceae		Antimicrobial, anti-inflammatory [81]

Impatiens scabrida	Yellow Balsam	Balsaminaceae		--
Impatiens sulcata	Himalayan Balsam	Balsaminaceae		Antibacterial, Antifungal [82]
Iris sp.	Himalayan Iris	Iridaceae		--
Isodon coesta	Isodon	Lamiaceae		Used in the treatment of fever and gastrointestinal disorders [83]
Oenothera rosea	Evening primrose	Onagraceae		Anti-inflammatory, antidiabetic [84]
Oxalis corniculata	Creeping Wood Sorrel	Oxalidaceae		Antibacterial, Antifungal [85]
Oxyria digyna	Mountain Sorrel	Polygonaceae		Used for treatment of gastrointestinal disorders [86]
Strobilanthes alatus	Strobilanthes	Acanthaceae		--
Reinwardtia indica	Yellow Flax	Linaceae		Antioxidant, Antimicrobial [87]
Roscoea pururea	Roscoe's Lily	Zingiberaceae		Antidiabetic, Antioxidant [88]
Rumex hastatus	Arrowleaf Dock	Polygonaceae		Carminative, Diurectic [89]
Rumex nepalensis	Nepal Dock	Polygonaceae		Anti-inflammatory, wound-healing [90]
Rumex obtusifolius	Dock Leaf	Polygonaceae		Anti-inflammatory, Antioxidant [91]
Sagerita oppositifolia	Opposite leaved Sagerita	Rhamnaceae		--
Salvia lanata	Salvia	Lamiaceae		Anti-inflammatory, Antioxidant [92]
Scutellaria scandens	Climbing Skullcap	Lamiaceae		Anti-inflammatory, Antimicrobial [93]
Silene conoidea	Weed Campion	Caryophyllaceae		Anticancer, Antibacterial [94]
Solanum xanthocarpum	Yellow Fruit Nightshade	Solanaceae		Anticancer, Antioxidant [45]
Taraxicum officinale	Dandelion	Asteraceae		Diurectic, hepatoprotective, Immunoprotective [48]
Tinantia erecta	False Day Flower	Commelinaceae		--
Trifolium repens	White Clover	Papilionaceae		Anti-inflammatory, analgesic, antiseptic [95]
Trifolium pratense	Red Clover	Papilionaceae		Expectorant, Opiatic [96]
Verbascum thapsus	Candlewick Plant	Scrophulariaceae		Anti-inflammatory, used in the treatment of migraine, cough and diarrhoea [46].
Viola canescans	Violet	Violaceae		Anticancerous, antipyretic [97]
Viola serpens	Violet	Violaceae		Antipyretic, diphoretic, diurectic [98]
Veronica persica	Speedwell	Scrophulariaceae		Antimicrobial, Antioxidant [99]
Inula cappa	Sheep's ear	Asteraceae		Anti-inflammatory and immunomodulatory [100]
Artemisia vulgaris	Mugwort	Asteraceae		Analgesic, hepatoprotective [101]
Valeriana jatamansi	Indian Valerian	Caprifoliaceae	Vulnerable	Antispasmodic, sedative, stimulant [47]

Table 4: List of climbers in the hillside of Landour, Mussoorie along with their medicinal properties and IUCN status

Botanical name	Common name	Family	IUCN status	Medicinal properties
Rubia cordifolia	Indian madder	Rubiaceae		Neuro protective, anti- tumor [49]
Hedera helix	Common Ivy	Araliaceae		--
Hedera nepalensis	Ivy	Araliaceae		--
Vitis himalayana	Himalayan Woodbine	Vitaceae		--
Smilax sp.		Smilacaceae		Antidiabetic [102]

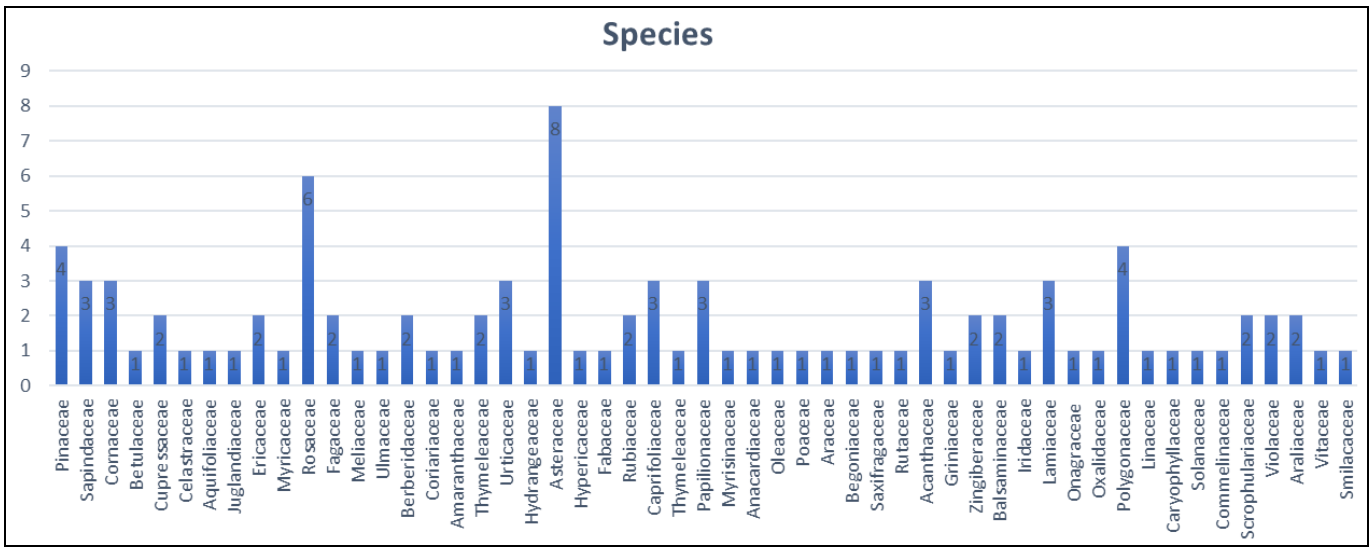

Fig 2: Analysis of family wise distribution of different plant species found in the study area

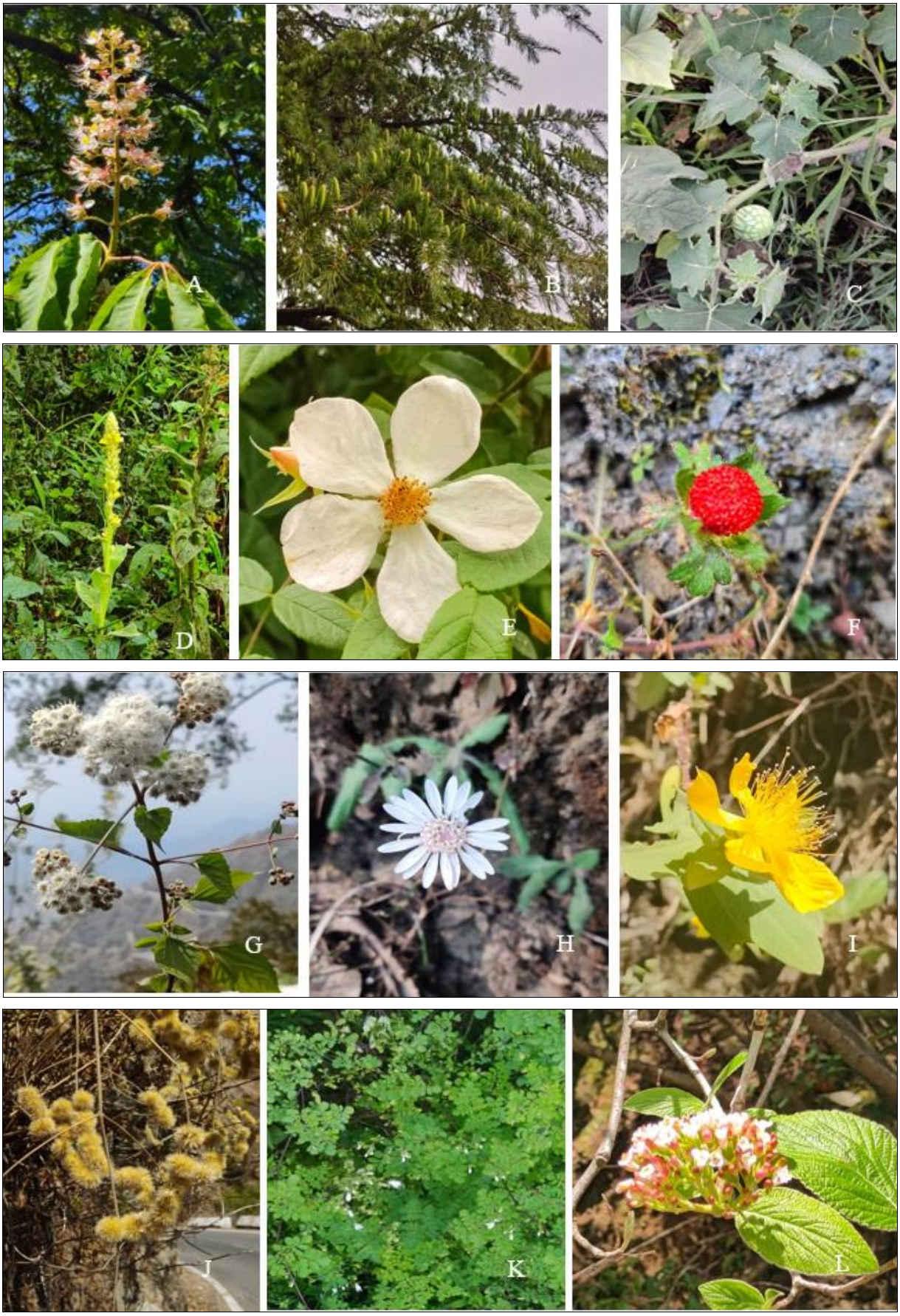
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Fig 3: (A) *Aesculus indica* (B) *Cedrus deodara* (C) *Solanum xanthocarpum* (D) *Verbascum thapsus* (E) *Rosa moschata* (F) *Fragaria indica* (G) *Ageratina adenophora* (H) *Gerbera gossypina* (I) *Hypercium oblongifolium* (J) *Cyathula tomentosa* (K) *Bonninghausenia albiflora* (L) *Viburnum cotonifolium* (M) *Veronica persica* (N) *Euonymus pendulus* (O) *Rubus ellipticus* (P) *Begonia picta* (Q)*Rumex hastatus* (R) *Coriaria nepalaensis* (S) *Taraxicum officinale* (T) *Arisaema tortuosum* (U) *Rubia cordifolia* (V) *Dicliptera bulbleuroides* (W) *Viola canescans* (X) *Salvia cana* (Y) *Berginia ciliata* (Z) *Impatiens sulcata* (a) *Daphne* sp. (b) *Erigeron karvinskianus* Photographs: Chandrima Debi

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References

1. Nautiyal S, Rajan KS, Shibasaki R. Environmental conservation vs compensation: Explorations from the Uttaranchal Himalaya. Environmental Informatics Archives. 2004;2:24-35.
2. Hooker JD, Thomson T. Introductory essay to the Flora Indica. London: W Pamplin; 1855.
3. Royle JF. Illustrations of the Botany and other branches of the natural history of the Himalayan Mountains and the Flora of Cashmir. London; c1833-40.
4. Allen GO. A few additions to the list of Mussoorie plants by James Marten in Vol. XIX.p. 475. Journal of the Bombay Natural History Society. 1919;26(2):695-696.
5. Stewart RR. The ferns of Mussoorie and Dehradun. Calcutta: Royal Botanical Garden; 1942. 159 pp.

6. Raizada MB. Supplement to Duthie's Flora of the Upper Gangetic Plain and of the adjacent Siwalik and sub-Himalayan tracts. Dehradun: Bisen Singh, Mahendra Pal Singh; c1976.
7. Raizada MB, Saxena HO. Flora of Mussoorie. Dehradun: Bishen Singh Mahendra Pal Singh; c1978. p. 648.
8. Fletcher GN. The fabulous Flemings of Kathmandu; c1964.
9. Stewart RR. Missionaries and Clergymen as Botanists in India and Pakistan. *Taxon*. 1982;31(1):61.
10. Alter S. Field guide: Robert L. Fleming Sr. Nature Trail. Woodstock Publication; c2010.
11. Srivastav M, Kumar A, Hussain T. Diversity of angiospermic plants in Dhanaulti Region, Uttarakhand: an emerging tourist destination in Western Himalaya. Check list. 2015;11(4):1702.
12. Kumar A, Mitra M, Singh G, Rawat GS. An inventory of the flora of Binog Wildlife Sanctuary, Mussoorie, Garhwal Himalaya. Indian Journal of Fundamental and Applied Life Sciences. 2012;2(1):281-299.
13. Sharma AK, Kumar S, Kumar NK. Diversity of Ethno-medicinal Plant: A Study in Pithoragarh District of Uttarakhand. Agricultural Reviews. 2023;44(4):568-572.
14. Palni U. Himalayan Medicinal Plants: Potential and Prospects. Nainital: Gyanodaya Prakashan; c2001. p. 117-124.
15. Singh MP, Srivastava JL, Pandey SN. Indigenous Medicinal Plants, Social Forestry and Tribals. Daya Publishing House, 2007, 515.
16. Singh G, Rawat GS. Ethnomedicinal survey of Kedarnath wildlife sanctuary in Western Himalaya, India. Indian Journal of Fundamental and Applied Life Sciences. 2011;1:35-46.
17. Champion HG, Seth SK. A revised survey of the forest types of India. New Delhi: Government of India Press; c1968. p. 404.
18. Hall WT. Working plan for the Landour, Cantonment forests; c1938-52.
19. Ved DK, Kinhal GA, Rajkumar K, Prabha Karan V, Ghate U, Vijayashankar R, *et al*. Conservation assessment and Management Prioritization for the medicinal plants of Jammu and Kashmir, Himachal Pradesh and Uttaranchal. Proceedings of the regional workshop held at Shimla. Bangalore: Foundation for Revitalisation of Local Health Traditions; c2003. p. 26.
20. Kumar D, Kumar S. A Complete Monograph on Abies pindrow. Indian Journal of Pharmaceutical Sciences. 2017; Centre for Advanced Research in Indian System of Medicine, Sastra University.
21. Bi W, Gao Y, Shen J, He C, Liu H, Peng Y, *et al*. Traditional uses, phytochemistry, and pharmacology of the genus Acer (Maple): A review. Journal of Ethnopharmacology. 2016;189:31-60.
22. Manandhar NP. Plants and People of Nepal. Oregon: Timber Press; c2002.
23. Mishra AP, Saklani S, Stankovic MS, Tiwari P, Jakovljevic D, Mihailovic V, *et al*. Himalayan dogwood (*Cornus capitata* Wall ex. Roxb., Cornaceae): Nutritional and bioactive properties. Oxidation Communications. 2020;40:168-177.
24. Chaudhary A, Ahmad S, Mazumder A. Cedrus deodara (Roxb.) Loud.: A Review on its Ethnobotany, Phytochemical and Pharmacological Profile. Polymer Journal. 2011;3:12-17.
25. Akbar M, Ali U, Khalil T, Iqbal MS, Amin A, Naeem R, *et al*. Cornus macrophylla, the Antibacterial Activity of Organic Leaf Extracts and the Characterization of the More Lipophilic Components by GC/MS. Molecules. 2020;25(10):2395.
26. Khan WM, Shah SZ, Khan MS, Akhtar N. Evaluation of indigenous knowledge of medicinal plants from Tall Dardyal Hills, Khyber Pakhtunkhwa, Pakistan. Journal of Herbal Medicine. 2020;20:100314.
27. Sharma NK, Bhattarai M, Shah S, Gyawali P, Baral K, Banstola H. *Lyonia ovalifolia* (Angeri) poisoning: A case report. Clinical Case Reports. 2022;10(7)
28. Bhat AA, Shakeel A, Rafiq S, Farooq I, Khan A, Khan M, *et al*. Antispasmodic, bronchodilator and blood pressure-lowering properties of *Hypericum oblongifolium*: Possible mechanism of action. Phytotherapy Research. 2010;24(7):1027-1032.
29. Taib M, Rezzak Y, Bouyazza L, Lyoussi B. Medicinal Uses, Phytochemistry, and Pharmacological Activities of *Quercus* Species. Evidence-Based Complementary and Alternative Medicine. 2020;Article ID 1920683:20 pages.
30. Kumar V, Suri S, Prasad R. Bioactive compounds, health benefits and utilization of *Rhododendron*: A comprehensive review. Agriculture & Food Security, 2019, 8(6).
31. Bukhari SMF, Ali G, Abbas SR, Anjum Z, Ahmed N, Munir A, *et al*. Ethnobotanical and biochemical study of *Berberis lycium* Royle collected from different areas of Azad Jammu and Kashmir. Evidence-Based Complementary and Alternative Medicine. 2021;Article ID 9916305:9 pages.
32. André R, Catarro J, Freitas D, Pacheco R, Oliveira MC, Serralheiro M. Action of euptox A from *Ageratina adenophora* juice on human cell lines: A top-down study using FTIR spectroscopy and protein profiling. Toxicology *in vitro*. 2019;57:217–225.
33. Poudel R, Neupane NP, Muker IH, Alok S, Verma A. An updated review on invasive nature, phytochemical evaluation, and pharmacological activity of *Ageratina adenophora*. International Journal of Pharmaceutical Sciences Research. 2020;11(6):2510–2520.
34. Huan DQ, Hop NQ, The SN. *Wikstroemia*: A Review on its Phytochemistry and Pharmacology. Current Pharmaceutical Biotechnology; c2023. DOI: 10.2174/1389201024666230606122116.
35. Lamichhane A, Lamichhane G, Devkota HP. Yellow Himalayan Raspberry (*Rubus ellipticus* Sm.): Ethnomedicinal, Nutraceutical, and Pharmacological Aspects. Molecules. 2023;28(16):6071.
36. Khan A, Khan M, Subhan F, Gilani A. Antispasmodic, Bronchodilator and Blood Pressure Lowering Properties of *Hypericum oblongifolium* - Possible Mechanism of Action. Phytotherapy Research. 2010;24(7):1027-1032.
37. Ali N, Alam H, Khan A. Antispasmodic and antidiarrheal activity of the fruit of *Rosa moschata* (J). BMC Complementary and Alternative Medicine. 2014;14:485.
38. Fibrich B, Gao X, Puri A, Banga AK, Lall N. *In vitro* antioxidant, anti-inflammatory and skin permeation of *Myrsine africana* and its isolated compound Myrsinoside B. Frontiers in Pharmacology. 2020;10:1410.
39. Ali H, Yaqoob U. Traditional uses, phytochemistry, pharmacology and toxicity of *Arisaema* (Areaceae): a review. Bulletin of the National Research Centre. 2021;45:47.
40. Pragada PM, Rao DS, Malleboyina V. Study of some

ethnomedicinal plants for treatment of dysentery of North Coastal Andhra Pradesh, India. International Journal of Biosciences. 2012;2:18-24.
41. Nile SH, Park SW. HPTLC analysis, antioxidant, anti-inflammatory and antiproliferative activities of *Arisaema tortuosum* tuber extract. Pharmaceutical Biology. 2014;52(2):221-227.
42. Ahmad M, Butt MA, Zhang G, Sultana S, Tariq A, Zafar M. *Bergenia ciliata*: A comprehensive review of its traditional uses, phytochemistry, pharmacology and safety. Biomedicine & Pharmacotherapy. 2018;97:708-721.
43. Ripanda A, Luanda A, Sule KS, Mtabazi GS, Makangara JJ. *Galinsoga parviflora* (Cav.): A comprehensive review on ethnomedicinal, phytochemical and pharmacological studies. Heliyon, 2023, 9(2)
44. Upadhyay P, Mishra SK, Mishra AK, Kumar P, Pandey N, Tiwari KN, *et al*. Evaluation of antioxidant and antimicrobial potential of a novel Himalayan plant *Reinwardtia indica* Dumort: Scientifically unexplored. Microbial Pathogenesis. 2019;127:326-334.
45. Kumar S, Pandey AK. Medicinal attributes of *Solanum xanthocarpum* fruit consumed by several tribal communities as food: an *in vitro* antioxidant, anticancer and anti-HIV perspective. BMC Complementary and Alternative Medicine. 2014;14:112.
46. Turker AU, Gurel E. Common mullein (*Verbascum thapsus* L.): recent advances in research. Phytotherapy Research. 2005;19(9):733-739.
47. Mathela CS, Tiwari M, Sammal SS, Chanotiya CS. *Valeriana wallichii* DC, a new chemotype from north-western Himalaya. Journal of Essential Oil Research. 2005;17(6):672-675.
48. Napoli D, Zucchetti P. A comprehensive review of the benefits of *Taraxacum officinale* on human health. Bulletin of the National Research Centre. 2021;45:110.
49. Wen M, Chen Q, Chen W, Yang J, Zhou X, Zhang C, *et al*. A comprehensive review of *Rubia cordifolia* L.: Traditional uses, phytochemistry, pharmacological activities, and clinical applications. Frontiers in Pharmacology. 2022;13:965390.
50. Debi C. Wild mushrooms in the hillside of Landour, Mussoorie. International Journal of Environment, Agriculture and Biotechnology. 2022;7(6):27-32.
51. Hubbard F. Three centuries of harpsichord making. Harvard University Press; c1965. p. 201.
52. Gaur RD, Purohit VP, Silas RA. *Euonymus tingens* Wall, (Celastraceae), a tree of multi-economic folk utility in Raath region (Garhwal Himalaya). Nelumbo. 2015;28(1-4):146-148.
53. Ali A, Khalil AAK, Khuda F, Nazir N, Ullah R, Bari A, *et al*. Phytochemical and biological screening of leaf, bark and fruit extracts from *Ilex dipyrena* Wall. Life. 2021;11(8):837.
54. Kabra A, Martins N, Sharma R, Kabra R, Baghel US. *Myrica esculenta* Buch.-Ham. ex D. Don: A natural source for health promotion and disease prevention. Plants (Basel). 2019;8(6):149.
55. Kaushik D, Kumar A, Kaushik P, Rana AC. Analgesic and anti-inflammatory activity of *Pinus roxburghii* Sarg. Advances in Pharmacological Sciences. 2012;245431.
56. Sinha D. A review on ethnobotanical, phytochemical and pharmacological profile of *Pinus wallichiana* A.B. Jacks. Pharmacognosy Journal. 2019;11(4):624-631.
57. Janbaz KH, Zaeem AM, Saqib F, Imran I, Zia-Ul-Haq M, Abid RM. Scientific basis for use of *Pyrus pashia* Buch.-Ham. ex D. Don. Fruit in gastrointestinal, respiratory and cardiovascular ailments. PLoS One, 2015, 10(3)
58. Ahmad FM, Zafar A, Ahmed M, Akhtar N, Hasan MMU, Abdel-Maksoude MA, *et al*. *Quercus floribunda* Lindl. Ex A. Camus; a tremendous remedy against inflammation and associated symptoms. *Fitoterapia*. 2023;170:105628.
59. Taib M, Rezzak Y, Bouyazza L, Lyoussi B. Medicinal uses, phytochemistry, and pharmacological activities of *Quercus* species. Evidence-Based Complementary and Alternative Medicine; c2020. p. 11-20.
60. Kumar V, Suri S, Prasad R. Bioactive compounds, health benefits and utilization of *Rhododendron*: a comprehensive review. Agriculture & Food Security. 2019;8:6.
61. Caruntu S, Ciceu A, Olah NK, Don I, Hermenean A, Cotoraci C. *Thuja occidentalis* L. (Cupressaceae): Ethnobotany, phytochemistry and biological activity. Molecules. 2020;25(22):5416.
62. Divakar, Ratan P. Phytopharmacology of *Toona ciliata*: A review. International Research Journal of Pharmacy. 2017;8(5):30-35.
63. Rathi B, Sahu J, Koul S, Kosha RL. Detailed pharmacognostical studies on *Berberis aristata* DC plant. Ancient Science of Life. 2013;32(4):234-240.
64. Fiaz Bukhari SM, Ali G, Abbas SR, Anjum Z, Ahmed N, Munir A, *et al*. Ethnobotanical and biochemical study of *Berberis lycium* Royle collected from different areas of Azad Jammu and Kashmir. Evidence-Based Complementary and Alternative Medicine. 2021;9916305.
65. Upadhyay G, Koranga S, Pandey D, Tewari LM, Tewari G, Lodhiyal V, *et al*. Investigation on the phytochemical analysis and biological activity of *Daphne papyracea* Wall. Ex Steud. leaf extracts from Kumaun Himalaya. Letters in Applied NanoBioScience. 2023;12(40):109.
66. Zeb MA, Khan SU. *In-vitro* anti-inflammatory activity of *Indigofera heterantha* roots. Pharmacy & Pharmacology International Journal. 2018;6(4):307-308.
67. Singh KJ, Thakur AK. Medicinal plants of the Shimla hills, Himachal Pradesh: A survey. International Journal of Herbal Medicine. 2014;2(2):118-127.
68. Khan D, Khan HU, Khan F, Khan S, Badshah S, Khan AS, *et al*. New cholinesterase inhibitory constituents from *Lonicera quinquelocularis*. PLoS One, 2014, 9(4)
69. Singh V, Singh R, Singh MP, Katrolia A. Therapeutic role of *Desmodium* species on its isolated flavonoids. Current Molecular Medicine. 2024;24(1):74-84.
70. Krzemińska B, Dybowski MP, Klimek K, Typek R, Miazga-Karska M, Dos Santos Szewczyk K. The anti-acne potential and chemical composition of two cultivated *Cotoneaster* species. Natural Product Research. 2022;36(6):1585-1589.
71. Mansour KA, El-Neketi M, Lahloub MF, Elbermawi A. Nanoemulsions of *Jasminum humile* L. and *Jasminum grandiflorum* L. Essential Oils: An Approach to Enhance Their Cytotoxic and Antiviral Effects. *Molecules*. 2022;27(11):3639.
72. Chavan SR, Nikam ST. Investigation of *Lantana camara* verbenaceae leaves for larvicidal activity. Bulletin of Haffkine Institute. 10(1):21-22.
73. Shrestha N, Itani R, Khanal DP. Pharmacognostic, phytochemical, antioxidant and antibacterial activity studies on *Begonia picta*. World Journal of

Pharmaceutical Research. 2016;5(1):979-997.
74. Gaur RD. Flora of the District Garhwal, North West Himalaya (with Ethnobotanical Notes). Srinagar, Garhwal: TransMedia; c1999.
75. Semwal S, Sharma P, Kumar M, Sharma RK. Chemical constituents from rhizomes of *Cautleya spicata* (Sm.) Baker (Zingiberaceae). Natural Product Research. 2015;29(21):2030-2032.
76. Riaz T, Abbasi MA, Rehman A, Shazadi T, Shahid M. Assessment of *Fumaria indica*, *Dicliptera bupleuroides* and *Curcuma zedoaria* for their antimicrobial and hemolytic effects. Pakistan Journal of Pharmaceutical Sciences. 2019;32(2):697-702.
77. Belho NA, Solo P, Therese G, Yanthan S, Sophia KP, Chongliu K. Phytochemical screening and antimicrobial activity of *Erigeron karvinskianus* DC. Journal of Medicinal Plants Studies. 2022;10(5):39-50.
78. Huneif MA, Alqahtani SM, Abdulwahab A, Almedhesh SA, Mahnashi MH, Riaz M, *et al*. α-Glucosidase, α-Amylase and Antioxidant Evaluations of Isolated Bioactives from Wild Strawberry. Molecules. 2022;27(11):3444.
79. Abbasi BA, Iqbal J, Mahmood T, Ahmad R, Kanwal S, Afridi S. Plant-mediated synthesis of nickel oxide nanoparticles (NiO) via *Geranium wallichianum*: Characterization and different biological applications. Materials Research Express. 2019;6(8):0850a7.
80. Dhungyal B, Sharma C, Jha DK. Antihyperglycemic effect of leaves and inflorescences of *Girardinia heterophylla* on Streptozotocin-nicotinamide induced type-II diabetic male albino Wistar rats. Journal of Pharmacognosy and Phytochemistry. 2019;8(2):1423-1426.
81. Rawat S, Jugran AK, Bhatt ID, Rawal RS. *Hedychium spicatum*: a systematic review on traditional uses, phytochemistry, pharmacology and future prospectus. Journal of Pharmacy and Pharmacology. 2018;70(6):687-712.
82. Singh P, Singh R, Sati N, Sati OP. Antioxidant, antibacterial and antifungal activity of *Impatiens sulcata* Wallich in Roxb. extracts. International Journal of Life Sciences Scientific Research. 2016;2(6):671-677.
83. Sharma S, Kumari A, Dhatwalia J, Guleria I, Sharma A, Arya V, Kumar A. Effect of solvents extraction on chemical profile and biological potential of *Isodon coetsa* seeds. Indian Journal of Ecology. 2022;49:1113-1121.
84. Munir R, Semmar N, Farman M, Ahmad NS. An updated review on pharmacological activities and phytochemical constituents of Evening primrose (*genus Oenothera*). Asian Pacific Journal of Tropical Biomedicine. 2017;7(11):1046-1054.
85. Rehman A, Rehman A, Ahmad I. Antibacterial, antifungal, and insecticidal potentials of *Oxalis corniculata* and its isolated compounds. International Journal of Analytical Chemistry. 2015;842468.
86. Wali R, Khan MF, Mahmood A, Mahmood M, Qureshi R, Ahmad KS. Ethnomedicinal appraisal of plants used for the treatment of gastrointestinal complaints by tribal communities living in Diamir district, Western Himalayas, Pakistan. PLOS One, 2022, 17(6)
87. Upadhyay P, Mishra SK, Mishra AK, Kumar P, Pandey N, Tiwari KN, Tilak R, Purohit S, Dubey GP. Evaluation of antioxidant and antimicrobial potential of a novel Himalayan plant *Reinwardtia indica* Dumort: Scientifically unexplored. Microbial Pathogenesis. 2019;127:326-334.
88. Misra A, Srivastava S, Verma S, Rawat AK. Nutritional evaluation, antioxidant studies and quantification of polyphenolics in *Roscoea purpurea* tubers. BMC Research Notes. 2015;8:324.
89. Ahmad S, Ullah F, Ayaz M. Antioxidant and anticholinesterase investigations of *Rumex hastatus* D. Don: Potential effectiveness in oxidative stress and neurological disorders. Biological Research. 2015;48:20.
90. Gonfa YH, Beshah F, Tadesse MG. Phytochemical investigation and potential pharmacologically active compounds of *Rumex nepalensis*: An appraisal. Beni-Suef University Journal of Basic and Applied Sciences. 2021;10:18.
91. Gustavo SW, Rodolfo S, Didomenico MM, Stremel AM, Iaschitzki FP, Lima VAP, *et al*. *Rumex obtusifolius* is a wild food plant with great nutritional value, high content of bioactive compounds and antioxidant activity. Emirates Journal of Food and Agriculture. 2019;31(4):315-320.
92. Lipi N, Kumar T, Lohumi P. Evaluation of *Salvia lanata* leaf extract for anti-inflammatory and antioxidant activity. Asian Journal of Pharmaceutical and Clinical Research; c2020. p. 113-117.
93. Zehravi M, Karthika C, Azad AK, Ahmad Z, Khan FS, Rahman MS, *et al*. A background search on the potential role of *Scutellaria* and its essential oils. Biomed Research International. 2022;7265445.
94. Chandra S, Rawat DS. Medicinal plants of the family Caryophyllaceae: A review of ethno-medicinal uses and pharmacological properties. Integrative Medicine Research. 2015;4(3):123-131.
95. Ahmad S, Zeb A. Phytochemical profile and pharmacological properties of *Trifolium repens*. Journal of Basic and Clinical Physiology and Pharmacology. 2021;32(1):20200015.
96. Nissan HP, Booth N, Yamamura HI, Farnsworth NR, Wang ZJ. A red clover (*Trifolium pratense*) phase II clinical extract possesses opiate activity. Journal of Ethnopharmacology. 2007;12(1):207-210.
97. Masood M, Arshad MS, Asif M, Chaudhari SK. *Viola canescens*: Herbal wealth to be conserved. Journal of Botany. 2014;10.1155/2014/345451.
98. Chandra D, Kohli G, Prasad KG, Bisht VDP, Punetha KS, Khetwal MK, *et al*. Phytochemical and ethnomedicinal uses of family Violaceae. Current Research in Chemistry. 2015;7:44.
99. Salehi B, Shetty SM, Kumar VAN, Živković J, Calina D, Oana Docea A, *et al*. *Veronica* plants: Drifting from farm to traditional healing, food application, and phyto-pharmacology. Molecules. 2019;24(13):2454.
100. Kalola J, Shah R, Patel A, Lahiri SK, Shah MB. Anti-inflammatory and immunomodulatory activities of *Inula cappa* roots (Compositae). Journal of Complementary and Integrative Medicine, 2017, 14(3).
101. Ekiert H, Pajor J, Klin P, Rzepiela A, Ślesak H, Szopa A. Significance of *Artemisia vulgaris* L. (common mugwort) in the history of medicine and its possible contemporary applications substantiated by phytochemical and pharmacological studies. Molecules. 2020;25(19):4415.
102. Gunn J, Che CT, Farnsworth N. Diabetes and natural products. In: Watson RR, Preedy VR, editors. Bioactive Food as Dietary Interventions for Diabetes. Academic Press; c2013. p. 381-394.
103. Fleming RL. Elementary Natural Science. Woodstock School, Mussoorie, Uttarakhand; c1944.