



# A Review on Phytochemistry and Pharmacological Properties of Selected Valuable Medicinal Plants Found in the Cold Deserts of Himachal Pradesh

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## KEYWORDS

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## ABSTRACT:

In India, most of the traditional medicinal herbs are sourced from the Himalayan area. In field research conducted in the frigid deserts of Himachal Pradesh, India, around 113 medicinally valuable plants were identified. The habitat, functions, and chemical components of the 22 most significant medicinal plant species were emphasized in this article. Out of the 22 species of plants, 11 are classified as threatened, including *Aconitum heterophyllum*, *Arnebia euchroma*, *Betula utilis*, *Dactylorhiza hatagirea*, *Ephedra gerardiana*, *Hippophae rhamnoides*, *Hyssopus officinalis*, *Hyoscyamus niger*, *Jurinea dolomiaea*, *Picrorhiza kurroo*, and *Rhododendron campanulatum*. These therapeutic plants are becoming rare because of habitat modification, limited distribution, overgrazing, and overharvesting. Sustainable ways to conserve natural resources include adding a section to the Wildlife Protection Act about the preservation of rare and endangered medicinal plants, encouraging community-based conservation, establishing nature reserves as an in-situ conservation site, developing medicinal plant nurseries as an ex-situ method, and promoting community-based conservation.

## Introduction

The tribal habitats of Himachal Pradesh hold a wealth of knowledge and insights into the diverse wildlife and flora of the region. Traditional wisdom is believed to have been accumulated through years of careful observation and experimentation. Previously, the northern Lahaul and Kinnaur region of Himachal Pradesh was perceived as a cold desert. Among all the states in India, Himachal Pradesh stands as the northernmost state, situated in the North Western Himalayan region, boasting a rich heritage of folklore and artistic culture. With a mix of socio-economic and cultural backgrounds among the various tribal communities like Gaddis, Gujjars, Kinners, Juds, Lahaulis, Pangwals, and Swangalas, this state serves as a vast repository of plants with valuable medicinal properties. These plants have been preserved and utilized for generations, contributing significantly to the field of ethnobotany (Sood et al., 2001). The Lahaul-Spiti and Kinnaur districts in Himachal Pradesh are

known for being predominantly tribal areas, offering opportunities for herbal utilization and a rich diversity of plant life. Referred to as Lahaulas and Spitians, these tribal communities have resided in the Lahaul-Spiti region for generations, inhabiting what is considered a cold desert environment throughout the year. The Gaddis, Swangla, Bhot, and other tribes in Lahaul-Spiti sustain their basic needs by utilizing indigenous plants, showcasing a deep-rooted tradition of incorporating native flora into their daily lives. Their historical practice of leveraging plant resources underscores their profound connection to, awareness of, and dependence on the diverse botanical landscape in the area. Due to ongoing changes and developments in human civilization, the wild plants have been used for a variety of purposes for ages (Sood et al., 2001).

The region of Kinnaur in the Himalayan highlands of Himachal Pradesh is home to the Kinner tribal communities, also known as the "Kinner Society," who



predominantly rely on traditional herbal remedies for treating a range of illnesses and health concerns. This reliance on traditional medicine is due to the lack of medical facilities in the area caused by heavy snowfall during specific seasons, making access to modern healthcare services challenging. The indigenous inhabitants of this region hold a wealth of traditional knowledge in utilizing plant-based products and components as natural remedies within their folk medicine practices (Rawat & Kharwal, 2011). This study looks at studies on the traditional therapeutic applications of a few selected herbs from the Himachal Pradesh tribal communities of Kinnaur and Lahaul-Spiti. These groups use these plants to treat a variety of illnesses that are common in these areas. Biological diversity is found in huge hotspots throughout the Indian Himalayan Region (IHR) (Myers., 2000). It stretches over 2,800 kilometers in length, 220–300 km in width, and climbs to heights of between 800–2500 meters (Anonymous., 1992). Within the flora, there are around thousands of species of angiosperms (40% endemic), 44 endemic gymnosperm species, 600 endemic pteridophyte species, 1737 endemic bryophyte species, 1,159 endemic lichen species, and 6,900 endemic fungal species. In 1996, Singh and Hajra, and in 1998, Samant et al. There are roughly 1,748 species of medicinal plants among them, and each one has a unique set of qualities. 675 species of edible wild plants (Samant and Dhar, 1997), 118 species of edible wild plants, and traditional and modern therapeutic applications (Samant et al., 1998).

There are 279 kinds of fodder, 155 holy plants (Samant and Pant 2003), 121 rare-endangered plants (Nayar and Sastry 1987, 1988, 1990), and species of medicinal plants that generate essential oils. Several investigations on therapeutic plants have been conducted at the IHR (Samant et al., 1998; Rai et al., 2000; Jain, 1991). However, these studies are irregular and primarily inventory-oriented, particularly in Himachal Pradesh. These include Gauhan (1988, 1989, 1990, 1996, 1999); Jain (1991); Samant et al. (1998, 2001); Badola (2001); Sood et al. (2001); Badola and Pal (2003); Bhattacharya and Uniyal (1982); Gammie (1898); Kapahi (1990); Rau (1960); Samant and Pant (2006); Kala (2006). Aswal and Mehrotra, 1994; Sharma and Singh, 1996; Sharma and Dhaliwal, 1997, 1999; Sharma and Dhaliwal, 1997a, 1997b; Singh and Rawat, 2000; Kaur and Sharma, 2004)

are among the scholars who have made references to physiological applications of plants in floristic notes, biodiversity research, and ethnobotanical observations of plants in floristic notes. Himalayan species are also the basis of the Tibetan medical system (69% of the material was obtained by destructive harvesting, showing a major threat to medicinal plants. Samant et al. (1998) and Anonymous (1997) calculated that at least 90% of therapeutic plant species are taken from the wild (Dhar et al., 2000). In the Himalayan region, increased human pressure has been identified as the main reason of the decline in the quantity and accessibility of medicinal plants (Samant et al., 1998). Himachal Pradesh's abundant natural supply of therapeutic herbs is severely threatened by rising demand, a resurgence of interest in traditional ethnopharmacy throughout the world, and the trend leaning towards using natural substances in healthcare (Samant et al., 1998). This study combines available data with findings from recent field surveys to offer the knowledge required to enable additional action.

According to (Ghahremaninejad and Hoseini.,2015), medicinal plants are considered nature's gift to humanity and are essential to conventional medical systems. Different regions of India are home to several scientifically validated indigenous medical systems, including the Ayurvedic, Yoga, Naturopathy, Unani, Siddha, and Homoeopathic (AYUSH) systems. The Vedas, which are important sources of information on medicinal plants and how to use them to heal a variety of ailments, are the cornerstone of Indian traditional knowledge. The increased awareness of organic, non-toxic components that are readily available at reasonable prices and have no negative effects are driving a steady increase in interest in traditional treatments in industrialized and poor nations (Raina et al., 2023). As per (Chaudhary et al.,2023), 80% of individuals in developing countries practice traditional medicine, with plants constituting around 85% of these cures. Natural variety, ethnic diversity, and rich traditions are the three elements that an area needs to have a rich ethnobotanical history, and India has all three. The word "ethnobotany," first used by (John William Hershberger.,1895), refers to a subfield of ethnobiology that includes the investigation of human-plant interactions and relationships (Ghahremaninejad., 2021). The field of traditional medicine has a long history in India, where folkloric traditions and traditional properties of natural



components with medicinal significance are well documented in *Materia Medica* (Pandey et al., 2013). The scriptures of the Rig-Veda, Charak Samhita, Sushrut Samhita, Atharvaveda, Ayurveda, and even epics like the Ramayana reference the therapeutic properties of many plants from the Himalayas (Thakur et al., 2023). Only 45,000 different plant species may be found in India, with many of them having the potential to be used medicinally (Grover et al., 2002). Of these, only 3,000 have official medical records, although practitioners employ over 6,000 of them (Seth and Sharma., 2004). A significant proportion of Indians live in isolated areas, with 70% of them being near woods. In these areas, people rely on various plant components for sustenance, medical treatment, and other daily necessities (Bussmann et al., 2009). The Himalaya is the largest and highest mountain range in the world, extending over 2400 kilometers in length and 300 kilometers in width, and exhibiting a vast range of climate conditions (Rana et al., 2019). The Himalayan state of Himachal Pradesh (HP), which is located between 32° 22'40 and 33° 12'40 N and 75° 47'55 and 79° 04'22 E, is home to over 3300 different plant species, making it a rich source of medicinal plants (Rana and Rawat., 2017). At elevation range of 247 meters to 7000 meters above sea level, the state is primarily mountainous and is blessed with a large diversity of flora because to its varied topography, climate, and height. In the state's temperate forests, Shiwalikhills, alpine and sub-alpine meadows, more than a thousand plant species have been identified (Puri et al., 2019). As per (Ghahremaninejad et al., 2021), the majority of people living in Himachal Pradesh belong to several ethnic and civilizational groups, each with their own unique old customs. Drawing on the information provided by the local ethnic community, several investigators and researchers from various regions in Himachal Pradesh have documented the medicinal and ethnobotanical uses of various plant species. Remote and indigenous communities generally rely on natural medicinal plants because contemporary medical services are not available in these areas, especially at high altitudes. Sadly, the loss of forests, grazing by animals, and researched harvesting have put medicinal plants in danger. Because the preservation of indigenous knowledge necessitates both the protection of biological resources and their right use, it emphasizes the urgent need for their preservation. The Chhota Bhangal region

of Kangra district, Himachal Pradesh, lacks comprehensive records on the status and use of medicinal plants, despite several research on the subject conducted throughout India. The Himachal Pradesh interior region of Chhota Bhangal is home to a large collection of high-altitude medicinal plants. The people living in Chhota Bhangal are indigenous to the region and have been utilizing these medicinal plants for centuries to cure a wide range of minor and severe illnesses, including cancer, diabetes, arthritis, coughing, and fever. Traditional knowledge is usually transmitted from one generation to the following. however, when an ancient medical practitioner passes away without teaching others about traditional herbal cures, there might be a problem (Ahmad et al., 2014). In addition, one major worry is the incorrect gathering of therapeutic herbs. Younger generations today underestimate their traditional values as a result of industrialization and the advancement of new therapies, which has accelerated the loss of traditional wisdom. If adequate documentation is not kept up to date, many crucial concepts related to drug development might be forgotten. In light of this, the Chhota Bhangal region was chosen due to its abundance of medicinal plants, but it has not yet been well investigated in terms of ethnobotanical research. Therefore, the goal of the current study was to record the ethnobotanical knowledge of medicinal plants that the inhabitants of the Chhota Bhangal region of the Himalayas have historically used.

In the form of fuel, food, fodder, vitamins, raw materials for industries, medicines, and most importantly, a source of extra money, wild or naturalized plants have been a source of social security for millions of people worldwide since ancient times (Cunningham et.,2001; Silveira.,2018; Karous.,2021). About 65–80% of people in underdeveloped nations, according to the World Health Organization, depend on therapeutic plants are used to make herbal treatments (WHO, 2011). In the Indian herbal business, plants from the Western Himalayas account for over 90% of the species employed (Singh et al.,2011). With around 1,748 recorded species of medicinal plants, the Indian Himalayan area was well-known for its floristic variety (Samant et al.,1998). which were applied in pharmacological research, clinical therapeutic investigations, chemistry, and pharmacognosy (Patwardhan et al.,2000;2004). The state of Himachal Pradesh, located in northeastern India, is





These plant species are marketed to different pharmaceutical firms and dealers by means of commercial extraction from the region. Of the 22 plant species chosen for a thorough description, 11 are classified as endangered species.

### 2.1 *Aconitum heterophyllum* [Ranunculaceae]

This plant has simple or branching stem that grows up to 1 meter tall, and it's a tuberous plant. The lower leaves are widely ovate, cordate, or about five lobed, with lower leaves measuring 5 to 10 cm in length and strongly serrated top leaves that are lanceolate. Greenish blue flowers with purple veins are arranged in racemes. Petaloid sepals; the top one resembles a helmet. Numbering five, the follicles are hairy. This plant grows from 3000 to 4000 meters above sea level, primarily in the moist parts of the cold deserts. Cough, diarrhea, aphrodisiac, and tonic properties are all associated with this herb. Atisine (0.4%), dehydroatisine, heteratisine, and hetisine are among the non-toxic, amorphous alkaloids found in the roots. Tannic acid, pectin, starch, and aconitic acid are also present. A relatively inactive substance in terms of physiology is atisine. The medication is commonly administered as a pure white bitter powder. The species is often considered non-poisonous since atisine is significantly less harmful in tiny quantities than aconites (Chauhan et al., 2006).



Figure 2 : Plant *Aconitum heterophyllum*

### 2.2 *Berberis aristata* DC. [Berberidaceae]

Approximately 2 to 5 meters tall, this deciduous shrub is prickly and has light, coarse, wrinkled bay. Its plants are shadowed, elliptic and obovate, fascicled in the axils of solitary or branching spine, fibrous, and may have a sharply toothed edge. Longer than the leaves, golden flowers with sturdy pedicles arranged in compound racemes. Ovoid, grey-white when immature, azure when ready. Plants may usually found at elevations between 2700 and 3500 meters in dry slope habitats. For many years, source bay, wood, and various extracts have been used in medicine used for skin conditions, menorrhagia, diarrhea, thorniness, and ocular sections. When used as a wash to unhealthy ulcers, a decoction of the rot bark is supposed to help and encourages cocainization in their methodology. Juveniles can consume ripe fruits, and they are also administered to them as a gentle laxative. Anorexia, diarrhea, amenorrhea, enlargement of the spleen, intestinal catarrh, dyspepsia, and malarial selections are among the conditions for which berberine is used as a salt, such as berberine hydrochloride and berberine sulfate. Berberis infusion has antimicrobial properties (Kritikar et al., 1987). The main alkaloid, berberine, is also present in fat, resin, tannin, oxycanthine, and umbellatine. Fruits are rich in tannins, citric acid, and malic acid. An abundance of alkaloids can be found in the root bark. The main alkaloid, berberine, is easily extracted from the roots as its salts, namely hydrochloride (2.23%) and sulphate (3%) (Anonyms ., 1988a)



Figure 3: Plant *Berberis aristata*



### 2.3 *Betula utilis* D. Don. [Betulaceae]

It is a small tree that grows to a height of 10 meters. Bark may be reddish-white, papery, white, or brownish. Older shoots become glabrescent, whereas younger shoots become pubescent. The oblong leaves have a rounded base, a subcordate or cuneate form, with edges that are double serrated to subserrate. In catkins are the male flowers, fruiting scales made of wood. nuts are oval-shaped and elliptic. It is located between 3000 and 4000 meters above sea level in a rocky environment. The bark is considered to be caustic, pungent, hot, tonic, and alexiteric in Ayurveda, it is beneficial for conditions including leprosy, bronchitis, blood and ear disorders, and convulsions. According to the Yunani system, bark relieves earaches. The bark infusion is applied topically on poisoned wounds and otorrhea. Additionally, it is used as an antiseptic carminative for several infections, bysteria, toxemia, anemia, cough, obesity, and urinogenital disorders. On the inside, it treats unseen wounds and is an effective veterinary medication. The exterior bark of the plant contains leucocyanadin, while the inner bark contains polymeric anthocyanidins, along



Figure 4 : Plant *Betula Utilis*

### 2.5 *Dactylorhiza hatagirea* [Orchidaceae]

This robust, The glabrous terrestrial plant is 20 to 25 cm long and palmately split into two or five similar processes in tubers. The leaves range from oblong-lanceolate to rectangular. Pink or purple blossoms are displayed on thick flower spikes. It grows best in grassy,

with betulin, lupeol, olenolic acid, and acetylene olenolic acid).(Singh et al.,2012)

### 2.4 *Corydalis govaniana* Wall. [Fumariaceae]

This perennial plant is upright or tubular, growing to a height of 20-30 cm (Figure 6). Catelinae often have two opposing or subopposite, simple dentate leaves, whereas radicales typically have one to several, two-pinnate leaves with a petiole that is as long as or longer than the lamina. More than the radical leaves, racemes 10–30 flowered and 5–10 cm length with separated bracts and yellow flowers. The capsule has an oval shape. Around 2700–3200 meters above sea level, it is mostly found in marshy regions and glacier moraines. Tonic, diuretic, alterative, and antiperiodic properties are associated with this root. It is given for for cutaneous, scrofulous, and syphilitic erections. In the treatment of eye conditions, yellow juice is used (Chauhan et al.,2006). Protopine and stylopine are found in the plant. Isoquinoline is one of the alkaloids that it contains. Other compounds found in the plant include alpha-alloctropine, ophiocarpine, protopine, canadine, berberine, Adlumine, and corypalmine (Anonyms.,1998b).



Figure 5: Plant *Corydalis govaniana*

damp meadows between 4000 and 4500 meters above sea level. The roots are used as an aphrodisiac, nervine tonic, and in farinaceous cooking. For prolonged fever, diarrhea, and dysentery, mucilage jelly is beneficial and healthy. A concoction of salep and sugar is a wonderful beverage for those who are ill. According to the Unani



medical tradition, it is used to cure seminal debility, persistent diarrhea, and general weakness in women who are too weak to give birth. It is utilized, is thought to be astringent, nourishing, and calming in afferent neuropathy cases that result in paralysis (Chauhan et al., 1984). Starch, sugar, alumen, a considerable amount of mucilage, a little amount of volatile oil, and ash are all found in the roots which is primarily made up of potassium and lime. The root is strained and crushed in water to extract starch. The Russian Pharmacopoeia states that salep powder should not given more than 14% moisture content and 3% ash value and has a white or yellowish tint.

(Chauhan et al.,2006).

### 2.6 *Ephedra gerardiana* Wall ex Stapf. [Ephideraceae]

A branching woody root of this stiff tree gives rise to several upright, closely grouped, thin, smooth, green, jointed branches, low-growing tree, which reaches a height of 30 to 60 cm. The branches' joints are covered in scales. Single or 2.3 ovoid 6-8 mm male cones; 4-8

flowers with spherically fused bracts and 5-8 anthers with fused filaments. Female cones usually live alone. Fruits are 7–10 mm in diameter, with 1-2 seeds encased in thick, delectable crimson bracts. In the drier regions of the icy deserts, it can be found at elevations ranging from 2700 to 4500 meters. Hay fever, asthma, and allergic rashes are all treated with dried twigs. The stems and roots are decocted to alleviate rheumatism, irritation of mucous membranes and asthma episodes are treated using nasal spray made from the medication. Ephedrine and pseudo-ephedrine are two of the alkaloid compounds found in plants. There is a range of 0.28% to 2.79% total alkaloid concentration in Indian ephedra. Rainfall has an adverse outcome on the alkaloids, which declines from May-August before progressively increasing to its maximum amount in October to November. The main alkaloid, ephedrine, acts pharmacologically like adrenaline does. The ideal time to gather the green twigs is when the plants are four years old and in bloom, as the alkaloid content rises with plant age (Anonyms et al.,1989).



Figure 6: Plant *Dactylorhiza hatagirea*



Figure 7: Plant *Ephedra gerardiana*

### 2.7 *Hippophae rhamnoides* Linn. [Elaeagnaceae]

Its leaves are smaller, narrower, and covered in rusty or silvery scales underneath, rather than star-shaped hairs, setting it apart from *Hippophae salicifolia*. Typically, these dwarf, highly thorny shrubs have many branches, Young, scaly twigs and an older, waxy-covered shoot. The leaves can be either green on top or silvery-scaly on both sides. They are oblong blunt and can measure up to

4 cm by 2-4 mm width. Red or orange fruits, 6 mm in length. At an elevation of 2700-3200 meters, it may be found along the banks of chilly desert rivers. In addition to being used to make jelly and syrup, fruits are also used to treat cancers, prevent sunburn, and treat pulmonary issues. It is also used in various cosmetic preparations and as an emollient to prevent wrinkles in the skin around the eyes. Harman and harmol are alkaloids that are



obtained from the plant. Additionally discovered are polyphenols, isorhamnetin, and quercetin. The leaves contain flavones, while the berries produced isorhamnitol. From its bark, serotonin has been isolated. Sugars, alkaloids, terpenoids, and steroids are found in plants. Vitamin C is abundant in fruits. Fatty oil is extracted from seeds (Chauhan et al.,2006).

### 2.8 *Hyoscyamus niger* Linn. [Cannabaceae]

It is a tall, viscous, erect plant that may be pubescent or hairy oblong-ovate basal leaves with coarsely sinuate petiole and tothing; sessile, oblong cauline leaves with irregular lobed or pinnated surfaces. Lower blooms are solitary on the branch forks, while purple-veined, lurid-green flowers with a tall, single-sided spike grow in the axils of leaf-like bracts. At an elevation of 3000–3600 m, it is primarily found in open areas and at the sides of roads. The effects of hyoscyamus are mydriatic, narcotic, and anodyne. Primarily used as a sedative for nervous

arousals, dental pain, and irritable ailments like whooping cough and asthma, it replaces opium when the latter is not permitted. This plant is used in traditional medicine to treat diabetes together with other substances. Alkaloids overall in the different sections of the plant are as follows: 0.16% in the roots, 0.045-0.08% in the leaves, 0.07-0.010 % in the overgrowing tips, and 0.06-0.10 % in the seeds. Hyoscyamine, hyoscyne, and scopolamine are the main alkaloids found in the different plant components. There are additional residues of scopoline and tropine. At the end of the vegetative phase, atropine is exclusively found in the roots of biennial plants. More byoscyamine is found in mature leaves compared to gyoscyne, whereas hyoscyne is comparatively more abundant in young leaves. The seeds taste somewhat bitter and have almost no smell. They have an oil that is amber in color (25–30%), including 6.5% palmitic, 1.6% stearic, 35.2% oleic, and 56.4% linoleic (Anonyms.,1959).



Figure 8: Plant *Hippophae rhamnoides*



Figure 9: Plant *Hyoscyamus niger*

### 2.9 *Hyssopus officinalis* Linn. [Lamiaceae]

The plant is woody, fragrant, and can grow upright or erect to a height of 30 to 60 cm. The base of the stems had several branches. There are entire, sessile, oblong, linear, or lanceolate leaves. There are terminal or axillary spikes. Lots of flower whorls in the shape of a funnel. Corolla is purple and blue undertones. At an elevation of 3000–3600 meters, it is primarily found on dry hillsides. Plants are employed as stimulants, carminatives, and

pharmaceuticals. Tea made from the plant is reported to be effective when infusion is used for neurological disorders, toothaches, lung, digestive, uterine, and urinary problems. The method used to get rid of the round worms is leaf juice. Crushed herbs are administered as vulneraries and resolvents. Immersed in heated water, it serves as a fomentation for cuts, sprains, and rheumatism in the muscles, as well as a means of removing darkness caused by blows. It may be used



topically to throat irritations and hoarseness, as well as topically to treat bronchial asthma and chronic bronchitis. Hyssop oil is used in some degree in fragrances with a spicy scent and as a flavoring component in bitters and tonics. One percent essential oil was extracted from the plant. The components that make up this volatile oil include minor quantities of primary and secondary alcohols, bicyclic sesquiterpenes, carinen-type sesquiterpene alcohols, beta-pinene, L-pinene, camphene, 1-pinocamphene, and aldehyde. The herb also includes xanthophylls, fat, sugar, choline, tannis, and carotin in addition to the volatile oil. The tops include bitter principal marubion, sugar, gums, ursolic acid, and flavonoid glunosides (hesperidin, diosmen).

#### 2.10 *Juniperus communis* Linn. [Cupressaceae]

Shrub, rather upright, with three whorls of leaves that are pointy, linear or boat-shaped, and spread almost perpendicularly from the branchlets. Flowers have axillary dioecy. The fruit is blue-black, glaucous, and subglobose. The number of seeds is 1-3. It is found at elevations of 3000–4000 meters in dry regions. Asthma, stomatitis, hemicrania, chronic bronchitis, and spleen

and liver diseases can all benefit from juniper's aphrodisiac and styptic properties. Juniper oil has been used to treat mucous discharges including gonorrhoea, leucorrhoea, and many skin diseases. It also has carminative, stimulant, and several types of dropsies properties. These effects can be obtained either on its own or in conjunction with other diuretics. The production of essential oil from Indian juniper is as low as 0.25%. Additionally, it has 10% resin, an unidentified bitter ingredient, juniperine, and organic acids. Berries of the juniper plant have a colorless or pale greenish yellow oil, but when exposed, it thickens quickly, becomes yellow, and finally turns reddish brown while reacting acidically. The fruits have volatile oil along with organic acids (formic, acetic, malic, oxalic, and glycolic), fixed oil, protides, gum, wax, pectins, fermentable sugars (33%), resin (8%), and juniperin (a mixture of sugar and tannin, 0.36%). They are a great source of ascorbic acid, with 35 mg/100g. With lesser amounts of camphene, cadinene, juniper camphor, Junene, and terpinenol also present, D-a-pinene is the primary component of the oil. (Anonyms et al.,1980).



Figure 10: Plant *Hyssopus officinales*



Figure 11: Plant *Juniperus communis*

#### 2.11 *Jurinea dolomiaea* Boiss [Asteraceae]

This perennial plant is relatively prostrate, with a thick, domed cluster that grows up to 10 cm in diameter in the center, quite large purple flower heads with a rosette of spreading, longer leaves with purple veins in the middle. Up to 4 cm long, short stalks, involucre-like flower heads

with hairy, lanceolate outer bracts and a narrower, longer, papery inner bract that is dark crimson. A robust taproot gives rise to oblong, blunt leaves that are stalked, pinnately lobed, with serrated or shallowly lobed lobes and a white, woolly underside. The leaves radiate outward for 30 centimeters. It grows between 4000-5000 meters



above sea level on open alpine slopes or meadows. The main component of dhoop industry is the aromatic roots. The roots are used in fever after delivery and are thought to be stimulants. Skin outbreaks are treated with bruised roots. Rheumatism and gout benefit from the use of aromatic oil derived from roots. Aromatic resin is included in it (Radha et al.,2021; Raut et al.,2012).

### 2.12 *Mentha longifolia* (L.) Hudson [Lamiaceae]

Standing 30-90 cm tall, this herb has a pronounced hoary-tomentose flavor and can be upright or diffuse. The leaves have short petioles, about 3-8 cm in length. They are lanceolate, circular or cordate at the base, pubescent or hoary-tomentose above, ovate to oblong, strongly toothed, and hoary-tomentose below 2-4-5-8-0 cm long, thin, ash-colored spikes. Flowers that pedicelled quickly had hoary pedicels and whorls that

were often continuous but sometimes disrupted. Outside, the corolla is hairy and lilac. It may be found between 2700 and 4000 meters above sea level in damp areas of the cold desert region. It is believed that this plant has carminative, antiseptic, and stimulating properties. Since they are astringent, the leaves are used to treat rheumatic discomfort. Fever, headaches, and heat apoplexy are treated with a plant decoction. To flavor confections, the plant is utilized as an alternative to imported peppermint oil. In the United States, this oil is used to flavor powder and as a snuff to relieve headaches. An effective diuretic and emollient is a politice applied to the renal area and lumber. It's used as a liniment inside. The plant's essential oil comprises diosphenolene, pipertenone, disophenol, piperitone oxide, and piperitine oxide. (Raut et al.,2012;Kumar et al.,2009)



Figure 12: Plant *Jurinea dolomiaea*



Figure 13: Plant *Mentha longifolia*

### 2.13 *Taraxacum officinale* Wigg. [Asteraceae]

It has a robust rootstock and is a perennial herb. Lobes pointing downward, seldom oblanceolate and entire; All of the leaves are radical, sessile, linear, oblanceolate, or entire to lyrate pinnatifid. On long, trailing scapes, yellow heads, about 1.0–3.0 cm in diameter. Pappus is white with hair. At an elevation of 2700-3700 meters, it is found in marshy and damp places. Root has laxative, tonic, anti-rheumatic, diuretic, and aperient properties. This plant is used as a bitter for upset stomachs and appetite loss. It contains a little amount of insulin. This medication helps to increase gall secretion and is

effective in treating long-term liver and kidney problems. It has been used to treat obliquerea, muscular rheumatism, gallstones, cholecystitis, jaundice, and atonic dyspepsia with constipation. In addition to saponin, the medication also includes the phytosterols tartaracasterol and homotaraxasterol, as well as the bitter crystalline principles taraxacin and taraxacerine. Choline, cellulose, lettuce, roltaraxacin, and alcohol may all be found in the milky sap. Vitamin C is present in the leaves, and xanthophylls are present in the flowers while the root produces inulin, tannin, and a little amount of ethereal oil. Additionally, pectose, enzymes, fatty acids



(including p-hydroxyphenylacetic and melissic acids), stigmasterol, sampsin, potassium, and vitamins are said to be present in plants. (Raut et al.,2012; Kumar et al.,2009; Radha et al.,2019)

#### 2.14 *Thymus linearis* Benth. [Lamiaceae]

This plant has a woody base, is hairy, aromatic, prostrate, and densely branched. Its length ranges from 10 to 25 cm. Subsessile, lanceolate or oblong-ovate, with prominent gland dots on both sides are the leaves. Compact capitate spikes of polygamous flowers are seen. Male flowers are big. The calyx has hairs on the exterior and glands dotted inside the mouth. Corollas come either white or purple. It is located at a height of 3000–4500 meters in stony parts of the clod desert zones. This plant has stimulant, characteristics that are antiseptic, expectorant, carminative, anthelmintic, and anti-spasmodic leaves and oral shoots are used to treat

menstrual cystitis, epilepsy, whooping cough, and reduce urine production. It is used to treat skin breakouts and itching by infusing the leaves. The juice of these leaves is said to have emetic properties and is used in billousness. These seeds have antifebrile and anthemintic properties. It is a well-liked treatment for colds, coughs, and gastrointestinal issues in the hills. The volatile oil identified as "oil of wild thyme" is extracted from the leaves and floral tops, it yields 0.27 percent from fresh plants and 0.60 percent from dried ones. There is chymol in the oil. Three plant compounds, namely luteolin 7-glucoside, apigenin, and scutellarin heteroisede, have been identified. It is stated that urisolic acid may be extracted from the tips and leaves of eucalyptus plants in 0.75% of cases. Ascorbic acid is abundant in its nectar.(Nautiyal et al.,2002;Raut et al.,2012;Kandari et al.,2012)



Figure 14: Plant *Taraxacum officinale*



Figure 15: Plant *Thymus linearis*

#### 2.15 *Tagetes minuta* Linn. [Asteraceae]

This scented annual plant grows to a height of 1-2 meters. The leaves are pinnatisect, 7–15 cm long, and the segments are linear or lanceolate, 11–19 cm long, and 4 cm or longer. The achenes are black, while the flower heads are light yellow, thin, tubular, and arranged in corymbose clusters. It may be found at a height of 2700–3500 meters close to waste areas and on dry embankments. The herb's oil exhibits favorable juvenile hormone action and synergistic effects. The whole herb's ethanolic preparations have antiviral effectiveness against the virus that causes Ranikhet illnesses. The roots

exhibit nematoid activity. The blossoms serve as aperients, diuretics, asthmaticants, and diaphoretics. Their volatile oil possesses calming, hypotensive, spasmolytic, bronchodilatory, and anti-inflammatory qualities. From the plant, many compounds have been isolated, including aromadendrenem tagetone, phenylethyl alcohol, ocimens, salicyladehyde, phenylacetaldehyde, eudesmil, linalyacetate, limonene, linalool, and an unidentified carbonyl molecule.(Agarwal et al.,1997;Radha et al.,2021;Negi et al.,2005)



### 2.16 *Rhododendron campanulatum* Linn. [Ericaceae]

It is a little shrub with elliptic or ovate-oblong leaves that are 10 to 15 cm long. The leaves are crimson underside and entirely hairless above. The flowers are pinkish-purple, 2-3 cm long, and arranged in a loose terminal cluster. Teeth are oval, calyx is 1-2 mm long, and obtuse glabrous. Bell-shaped corolla, 2-3 cm long; 5 notched lobes. There are ten stamens in each. The ovary has a lot of hairs. The length of a capsule is 1.5–3 cm. longitudinally wrinkled, curved, and cylindrical. It is found between 3000 and 4500 meters above sea level on

rocky slopes and woodland regions. Syphilis, sciatica, hemicranias, colds, and chronic rheumatism are all treated with leaves. Edible flowers produce a strong, fragrant oil. There is a poisonous material found in leaves that has many of the chemical and pharmacological characteristics of andromedotoxin. Additionally, it has been stated that they contain a bitter yellowish brown resin called quercetin, campanulin, ursolic acid, a-amyrin, friedelin, epifriedelinol, and ericolin. They also include the pigments quercetin and myricetin (Kumar et al.,2012;Panth et al.,2017).



Figure 16: Plant *Tagetes minuta*



Figure 17: Plant *Rhododendron campanulatum*

### 2.17 *Rheum australe* D. Don [Polygonaceae]

The perennial plant features a robust stem with greenish brown streaks, small, dark reddish-purple flowers in densely branching clusters on rounded leaves that are carried in an inflorescence that is 20–30 cm long and greatly enlarges when it bears fruit. leaves with a heart-shaped base, a very robust leaf stem, and a rounded to broadly ovate blade with hair underneath. Nutlets with a heart-shaped base, notched apex, and slender, purple wings. At an elevation of 3000–4000 meters, it primarily occurs on the open slopes of cold desert areas. Rhizomes/roots have purgative, tonic, astringent, stomachic, and aperient properties. Root powder is applied to wounds to promote rapid healing and is used to clean teeth. Root is utilized as a natural remedy for stomach issues, cuts, wounds, and muscle swells, as well as tonsillitis and the mumps. It is a powerful anti-inflammatory medication. The root contains chyrophanic

acid, emodin, starch, rhein, anthraquinone derivatives, essential oil, calcium oxalate, and a resinous material. There is oxalic acid in the leaves. The total amounts of oxalic acid found in the stems and leaves are 0.81 and 0.65 percent, respectively. The leaves and flowers contain rutin (0.32%) (Koirala et al.,2015; Anonyms,1980).

### 2.18 *Prunella vulgaris* Linn. [Lamiaceae]

It is an upright or rising, 10–30 cm high, hairy to glabrous plant. At the base, stems often creep and root. The leaves are whole, toothed, ovate or oblong, and petiolate. Larger, bisexual flowers are dimorphic, while smaller, upright, cylindrical terminal spikes are packed with six female flowers in a whorl. Calyx had a purple tint. The corolla is purplish-violet to violet. At an elevation of 3500–4000 meters, it is primarily found on damp, shaded hillsides. Astringent, carminative, antispasmodic,



expectorant, anti-rheumatic, tonic, antiseptic, and stimulant, this plant is used to treat fever and coughing. As an infusion, it is also used to treat internal bleeding piles and is beneficial in the treatment of hemorrhages, diarrhea, sore throats, and ulcerated mouths. It can be

used as a syrup to treat interior injuries and as a headache remedy. The plant produces an essential oil and bitter components. The primary components of the oil are d-camphor and d-fenchone, with minor amounts of penchyl alcohol (Verma et al.,2012; Kunwar et al.,2003).



Figure 18: Plant *Rheum australe*



Figure 19: Plant *Prunella vulgaris*

### 2.19 *Picrorhiza kurrooa* Royle ex Benth [Scrophulariaceae]

The corolla of this tiny plant is much smaller, measuring 8 mm, with five lobes in the middle, and the stamens are significantly longer. The blooms are pale or purple-blue. The flowering stems are usually longer than the leaves, measuring 5 to 15 cm in length, almost entirely coarsely sawtoothed, spatulate to narrow elliptic, narrow to a winged stem, and basal. It is mainly found on stony mountain slopes at elevations between 4000 and 4500 meters. The plant is said to have the following properties: it is an appetizer, blood purifier, blood pressure reducer, cardiac expectorant, febrifuge, and cure for leprosy, constipation, stomach problems, asthma, colds, and coughs. The rhizome has been found to contain the dark resinous glucoside picorhizin and its aglycone, picorhizetin. Furthermore, taken from the medication were vanilic acid, kutkiol occurring as acetate, kutkisterol, a non-bitter compound called kurrin, and the glycoside bitter ingredient kutkin. Some reports from the rhizomes have included Kutkin, apocynin alkanol alkane, and beta-sitosterol (Thakur et al.,2018; Radha et al.,2021).

### 2.20 *Asparagus racemosus* [Asparagaceae]

The woody, climbing perennial *Asparagus racemosus* is indigenous to India and the Himalayas. It is a member of the Asparagaceae family, which also contains popular plants like asparagus. *Asparagus racemosus* grows in both climbing and crawling forms, with its wiry, thin stems reaching lengths of several meters. It is a climber with trailing branches that may grow to a maximum length of 1-2 meters. Although *Asparagus racemosus* may grow to a height of around 1-2 meters when fully grown, its size can vary. Because of their flexibility and thinness, the stems can spread out and climb over the ground. Cladodes are tiny, needle-like leaves that have been altered into scales. In reality, these cladodes are modified stems that carry out photosynthesis. Along the stems, they are grouped together or in clusters. Arranged in short, spiky clusters known as racemes, *Asparagus racemosus* produces fragrant, tiny, white or pinkish flowers. The crimson berries with black seeds that result from these summertime blooms are produced. Because it helps improve women's reproductive health in particular, *asparagus racemosus* is highly valued in Ayurveda. As a plant for female reproductive system rejuvenation, it is known as a rasayana. It helps with menstruation diseases



such irregular periods and cramping, balances menstrual cycles, and promotes fertility. It aids in the regulation of female hormones, especially estrogen. It promotes appropriate levels of estrogen, which are essential for preserving reproductive health and reducing menopausal symptoms. It is good for digestive issues due to its

calming and cooling qualities. It encourages good digestion and helps the formation of digestive juices. It can assist in reducing stomach irritation, ulcers, and acidity. Shatavari falls under the category of adaptogens, supporting the body's ability to adjust to both mental and physical stress (Nair et al.,2013; Raut et al.,2012).



Figure 20: Plant *Piccorhiza korrooa*



Figure 21: Plant *Asparagus racemosus*

### 2.21 *Bacopa monnieri* [Plantaginaceae]

The perennial plant *Bacopa monnieri* is tiny and creeps. *Bacopa monnieri* usually reaches a height of 10–30 cm. Its prostrate stems root at the nodes and spread horizontally to create thick mats. The succulent leaves are oblong and measure between one and two centimeters in length. They are frequently rather meaty and are positioned in opposition to one another along the stem. *Bacopa monnieri* has tiny, white blooms with five petals. In the leaf axils, they are either borne singly or in little clusters. The fruits are tiny, seed-containing capsule-shaped structures. The herb *Bacopa monnieri* is well known for supporting memory and improving cognitive function. In ancient medical systems like Ayurveda, it is commonly utilized as a brain tonic. It is thought that the active ingredients in *Bacopa monnieri*, especially bacosides, facilitate nerve impulse transmission, increase synaptic connectivity, and encourage the regeneration and repair of neurons. Enhancement in learning capacity, memory retention, and general cognitive function can result from these effects. Anxiolytic qualities of *Bacopa monnieri* contribute to a decrease in tension and anxiety. It is

believed to alter neurotransmitters that are involved in mood regulation, such as dopamine and serotonin. Better mental and emotional well-being can be achieved by *Bacopa monnieri* by lowering stress hormone levels and encouraging relaxation. *Bacopa monnieri's* antioxidant activity aids in the scavenging of free radicals and the reduction of cellular damage in the brain, which may postpone the development or advancement of diseases such as Parkinson's and Alzheimer's. Antioxidants found in abundance in *Bacopa monnieri*, such as flavonoids and phenolics, support the body's defense against oxidative stress in all areas. *Bacopa monnieri* improves cellular health and lowers the risk of chronic illnesses linked to oxidative damage by counteracting free radicals. A frequent element in many chronic illnesses is inflammation. Because of its anti-inflammatory qualities, *Bacopa monnieri* supports immunological function and lowers inflammation indicators. For ailments including arthritis, inflammatory bowel illnesses, and cardiovascular health, this may be advantageous. (Aguiar et al.,2013; Kumar et al.,2012)

### 2.22 *Rhododendron arboreum* [Ericaceae]



The 4,000+ species that make up the large Ericaceae family are split among about 126 genera. *Rhododendron arboreum* is one of the several species of Ericaceae that thrive on acidic soils with little nutrient availability. Their relationship with mycorrhizal fungi, which aid in the uptake of nutrients, especially phosphorus, facilitates this adaptation. The Ericaceae family of plants has a diverse array of morphological characteristics. Though some species might be tiny trees or herbaceous perennials, they are usually evergreen or deciduous shrubs. Flowers are usually bell- or urn-shaped and are sometimes borne in bunches. Leaves are normally leathery or needle-like. The Ericaceae family has a number of plants that are highly valuable economically. Cranberries (*Vaccinium macrocarpon*) and blueberries (*Vaccinium spp.*) are two examples of commercially grown Ericaceae species that are prized for their consumable fruits. These berries support regional economies through commerce and agriculture in addition to being nutrient-dense. In various environments, plants of the Ericaceae family fulfill vital ecological roles. They offer a range of animals, such as birds and mammals, food and habitat. Many Ericaceae plants have thick foliage, which helps retain moisture and support soil

structure, especially in heathlands and peatlands. Certain plants, like *Rhododendron arboreum*, are also home to pollinators like butterflies and bees. At a height of up to 20 meters, *Rhododendron arboreum* is a huge evergreen shrub or small tree. Its elliptical, leathery leaves, which have a woolly or silky underside and a shiny top surface, reduce water loss in its alpine environment. The bell-shaped blooms, which range in color from vivid red to pink and even white, produce thick clusters that bloom magnificently in the spring. *Rhododendron arboreum* serves a variety of ecological roles in its native environment. Birds and small animals can find cover from the dense foliage, and pollinators—which are necessary for the reproduction of many plant species in the ecosystem are drawn to the blooms. In the alpine woods where it thrives, the litter left by falling leaves enhances soil fertility and nitrogen cycling. It has been used to cure inflammation, fevers, and digestive issues, albeit due to possible toxicity in some plant parts, care is suggested. *Rhododendron arboreum* is widely distributed across the Himalayas and other regions, however conservation efforts are confronted with obstacles (Panth et al.,2017; Sharma et al.,2013)



Figure 22: Plant *Baccopa monniera*



Figure 23: Plant *Rhododendron arboreum*

### 2.23 *Aconitum ferox* [Ranunculaceae]

The perennial herbaceous shrub *Aconitum ferox* is well-known for its remarkably beautiful hood-shaped petals, which are often blue or purple and resemble a monk's cowl. This gives rise to the popular name "monkshood." In the mountainous Himalayan area, the plant grows well in the alpine and subalpine regions. With strong, tuberous

roots that store alkaloids, *Aconitum ferox* may reach heights of one to two meters. Its deep lobed leaves and upright stems increase its aesthetic appeal. This species is usually found in high altitude meadows and at the borders of forests, preferring wet, well-drained soils. Aconitine, pseudoaconitine, and bikaconitine are among the main bioactive components of *Aconitum ferox*



that contribute to its high toxicity. The plant is both an effective therapeutic herb and a harmful toxin due to these alkaloids' strong effects on the nervous system. The herb can be used to treat inflammatory diseases like arthritis and gout because of its anti-inflammatory properties. When all other therapies have failed, *Aconitum ferox* is used to lower high fevers. It has been used to treat several cardiac and respiratory conditions at extremely low dosages. The alkaloids are helpful in treating some cardiac problems under close monitoring since they have the ability to affect heart rate and contraction strength. Due to its extreme toxicity, incorrect usage of *Aconitum ferox* can result in fatalities or serious poisoning. Aconite poisoning can cause cardiac arrhythmias, which can be deadly, numbness, tingling, vomiting, and diarrhea. Due to the extreme toxicity of the plant, even touching it unprotected can result in skin irritation and systemic poisoning if absorbed through wounds or abrasions. (Koirala et al.,2015;Adhikari et al.,2013)

## 2.24 *Rauvolfia serpentina* [Apocynaceae]

It is a small, evergreen, permanent plant that usually reaches a height of 60 to 90 cm. Around the stem of the plant, whorls of three to four long, oval leaves are organized. It bears tiny, glossy, black-purple seeds after producing white, pink, or red baby blooms. With their therapeutic qualities, the thick, lengthy, but woody roots were the most valued ingredient in the plant. *Rauvolfia serpentina's* large content of alkaloids is mainly responsible for its pharmacological traits. Reserpine, ajmaline, serpentine, and a substance called are the most important of them. Specifically, because of its strong effects on the neurological and cardiovascular systems, serpine has been deeply studied and used in modern medicine. The most well-known use of *Rauvolfia serpentina* is probably in the treatment of hypertension. Reserpine, an alkaloid, is a natural treatment for hypertension because it lowers blood pressure by acting on the central nervous system. It has been utilized for this purpose in both conventional and contemporary medicine. *Rauvolfia serpentina* has sedative qualities that make it helpful in treating anxiety, sleeplessness, and other mental health issues. It has a soothing impact on the body and mind, reducing tension and encouraging sound sleep. The herb known as "snakeroot" got its name because it was once used to treat snake bites. Though this

usage is more ancient and less prevalent now, it was thought to neutralize venom and relax the nervous system. Constipation and diarrhea are among the digestive problems that *Rauvolfia serpentina* has been used to treat. Certain compounds found in its roots may help to regulate the digestive system. Many of the traditional applications of *Rauvolfia serpentina* have been confirmed by modern research, especially in the area of treating hypertension. One of the earliest medications used in therapeutic settings to treat high blood pressure and certain mental illnesses was serpine, an alkaloid that was isolated from *Rauvolfia serpentina*. Through the central nervous system's catecholamine and serotonin depletion, it lowers blood pressure and has sedative effects (Wang et al.,2019; Dewan et al.,2018).

## 2.25 *Withania somnifera* [Solanaceae]

*Withania somnifera* is a tiny woody shrub that reaches a height of 35 to 75 cm. It has red, berry-like fruits, yellow-green blossoms, and elliptic, green leaves with small hairs. When the berries on the plant ripen in the fall, the roots of the plant are collected and used mainly for medical use. It is a robust crop in its surroundings because it grows well on rocky, dry soils and needs little water. *Withania somnifera's* extensive medicinal plants makeup is thought to contribute to its medicinal efficacy. Alkaloids (such withanine and somniferine), steroidal lactones (like withanolides and withaferins), saponins, and sitoindosides are the main active ingredients. These substances support the adaptogenic, anti-inflammatory, antioxidant, and neuroprotective benefits of *Withania somnifera*. As a well-known adaptogen, *Withania somnifera* lowers cortisol levels in the body to help it cope with stress. Its effectiveness at lowering stress and anxiety and enhancing mental health overall has been shown in clinical research. The plant is well known for improving cognitive and memory abilities. Due to its neuroprotective properties, research suggests that *Withania somnifera* can enhance cognitive function and lessen the signs of moderate cognitive impairment. There are notable analgesic and analgesic effects of *Withania somnifera*. It has shown effective in lowering inflammation and related discomfort when used to treat ailments like arthritis. By boosting the body's protective structures, withania somnifera improves the body's immune system. Preventing and recovering from diseases is very advantageous. One of the with an oxide



in the plant *Withania somnifera*, also called withaferin A, may have anti-cancer effects by causing cancer cells to undergo apoptosis and preventing them from growing,

according to preliminary study. (Chandershekhar et al.,2012; Kuboyama et al.,2017)



Figure 24: Plant *Acinotum ferox*

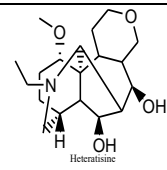
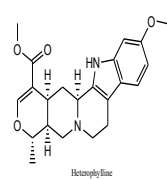


Figure 25: Plant *Rauwolfia serpentina*

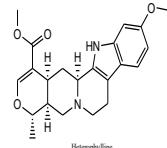
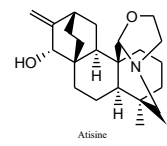
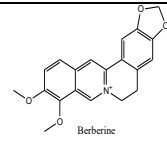
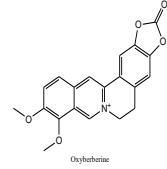
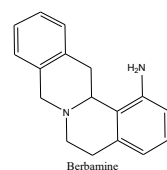
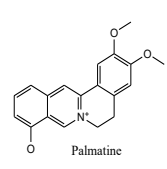
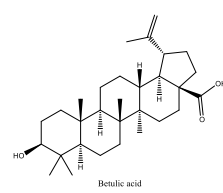
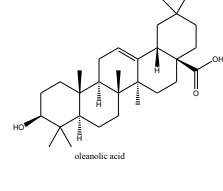


Figure 26: Plant *Withania somnifera*

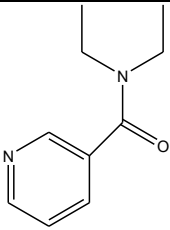
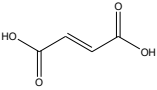
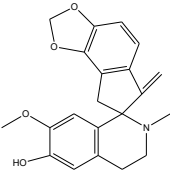
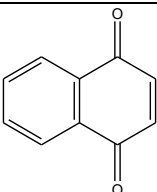
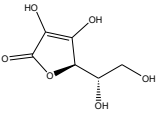
Table 1: Plants enlisted with Phytoconstituents:

Plant Name	Common Name	Phytoconstituents	Reported Activities	Structures	References
<i>Aconitum heterophyllum</i>	Atis or Ativisha	Atisine, Hetisine, Heteratisine, Hetidine, Atidine, Heterophyllisine, Dihydroatisine, Heterophylline, Heterophyllidine, Swatinine, 8-methyllycaconitine, 14demethyllycaconitine, Ndiethyllycaconitine-Naldehyde,	Nephroprotective, Antidiarrheal, Antimicrobial, Anti-inflammatory, Hypolipidemic, effects on CNS	 	(Wani et al.,2022)

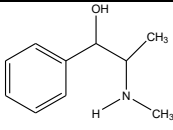
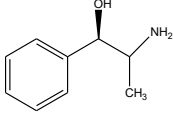
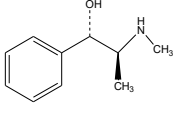
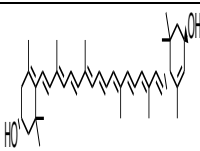
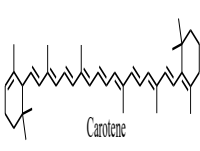
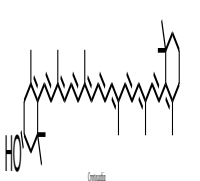
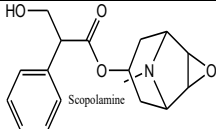


				 <p>Hetemphylline</p>  <p>Atisine</p>	
<i>Berberis aristata</i>	Daruhaldi	Berberine, Palamintine, K arachine, Palmatine chloride, tetrahydropalmatine, pseudopalmatine, oxyberberine, Taxilamine, oxacanthine, berbamine, aromoline	Cardiotonic, Anti PAF, Antidiarrheal, Antidiabetic, Antimicrobial, Anticancer, Ophthalmic, Hepatoprotective activities.	 <p>Berberine</p>  <p>Oxyberberine</p>  <p>Berbamine</p>  <p>Palmatine</p>	(D. Potdar et al., 2012)
<i>Betula Utilis</i>	Bhojpatra	Betulinic acid, Doxurubicin, lupeol, oleanolic acid, oleanolic acid-3-acetate, $\beta$ -sitosterol	Anti HIV activity, Antimicrobial activity, Antinflammatory activity, Antioxidant activity.	 <p>Betulic acid</p>  <p>oleanolic acid</p>	(Singh et al., 2012)

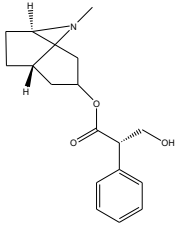
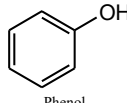
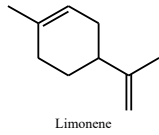
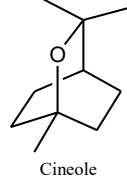
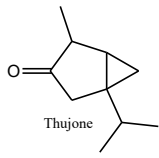
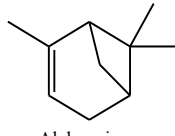
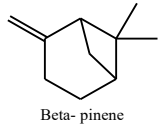


<p><i>Corydalis govaniiana</i></p>	<p>Maqshang</p>	<p>13-Epiyenusomine, Ochotensine, Protopine, corlumine, bicocculine, isochoridyne, Fumaric acid</p>	<p>AntiBacterial Infections, Astringent, Carminative, Anti Diuretic, Anti Oxidants Stereoidogenic.</p>	<p>             Coramine               Fumaric acid               Ochotensine         </p>	<p>(Mukhoupadhyay et al., 1987)</p>
<p><i>Dactylorhiza hatagirea</i></p>	<p>Salam Panja, Hath-Panja</p>	<p>Dactylorhin A, B, C, D, E, Reseveratrol, Naphthoquinone, Ascorbic acid, Milatarrin, Lesoglosin,</p>	<p>Antiinflammatory, antibacterial, Neuropharmacological, Anticancer, Antidiabetic, Antioxidant</p>	<p>             naphthoquinone               Ascorbic Acid         </p>	<p>(Wani et al., 2020)</p>

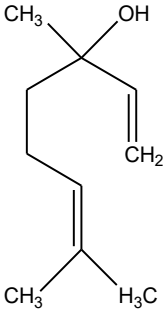
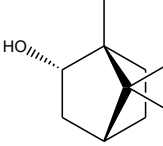
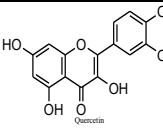
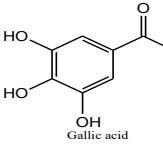
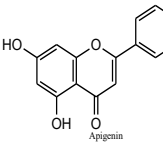
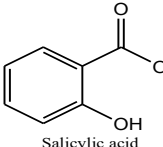


<p><i>Ephedra gerardiana</i></p>	<p>Somkalpa,Soma</p>	<p>Ephedrine,Pseudoephedrine,Nor ephedrine,methyl ephedrine.</p>	<p>Cardiotonic,Respiratory System,Antinflammatory,Antitumor,Renal System</p>	<p> Ephedrine</p> <p> Nor Ephedrine</p> <p> Pseudo Ephedrine</p>	<p>(Nazar et al.,2023)</p>
<p><i>Hippophae rhamnoids</i></p>	<p>Sibberian Pineapple, Sea berry</p>	<p>hydrocinnamic acid, lutein, zeaxanthin, β-cryptoxanthin, cis-β-carotene, and β-carotene, minerals, vitamins, fatty acids, carotenoids, and phenolic compounds</p>	<p>Antioxidants,Anticancer,Antihyperlipidemia,Antiobesity,Antipalletelet,Dermatological,Antiviral,Neuroprotective</p>	<p> Zeaxanthin</p> <p> Carotene</p> <p> Lycopodium</p>	<p>(Wang et al.,2022, Criste et al.,2020)</p>
<p><i>Hyoscyamus niger</i></p>	<p>Bajarbhang</p>	<p>Hyoscyamine, scopolamine,</p>	<p>Antispasmodic,Anaesthetic,Bowel syndrome,Parkinson's Disease,cramps</p>	<p> Scopolamine</p>	<p>(Alizadeh et al.,2014)</p>

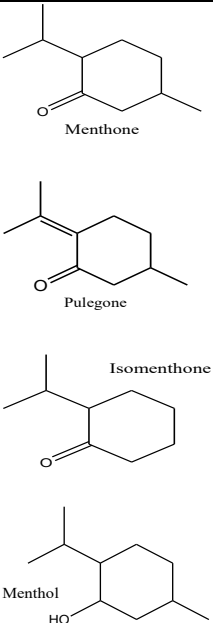
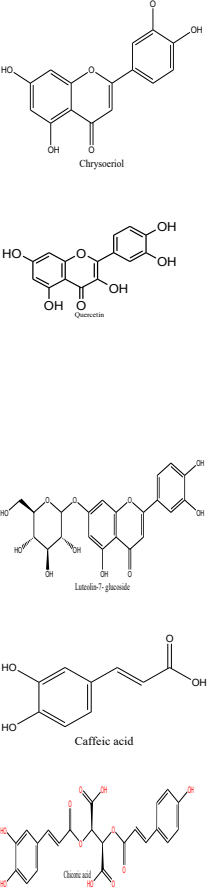


				 <p>Hyoscyamine</p>	
<i>Hyssopus officinalis</i>	Jufa	Thujone, phenol, pinocamphone, cineole, Limonene, germacrene D, pinocamphone $\beta$ – pinene	Antiseptic, CNS Stimulant, Antiepileptic, Cough suppressant, Larvicidal, Miorelaxation activities	 <p>Phenol</p>  <p>Limonene</p>  <p>Cineole</p>  <p>Thujone</p>	(Sharifi et al., 2022)
<i>Junniperus communis</i>	Aaraar, haubera, abhal	While oxygenated monoterpene hydrocarbons consist of terpinen-4-ol, myrcenol, $\beta$ -citronellol, linalool, $\alpha$ -pinene, $\beta$ -pinene, $\beta$ -myrcene, sabinene, and limonene, camphene hydrate, borneol,	Antioxidants, Neuroprotective, Antidiabetic, Hepatoprotective, Antifungal, Antifertility, Antiproliferative activities	 <p>Alpha-pinene</p>  <p>Beta-pinene</p>	(Raina et al., 2019)

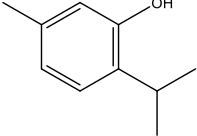
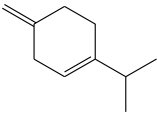
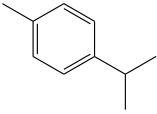
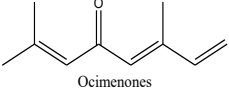
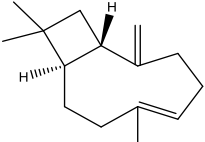
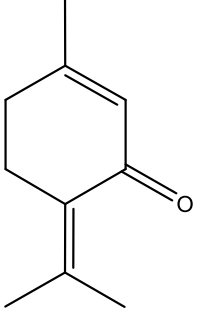


				 <p>Linalool</p>  <p>Borneol</p>	
<i>Jurinea dolomiaea</i>	Dhoop Lakkad	catechin, rutin, kaempferol, quercetin, gallic acid, salicylic acid, apigenin, myricetin,	Analgesics, antipyretic, antioxidants, antibacterial	 <p>Quercetin</p>  <p>Gallic acid</p>  <p>Apigenin</p>  <p>Salicylic acid</p>	(Nasir et al., 2014)

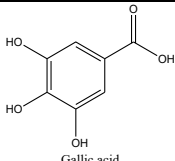
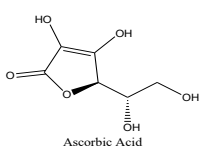
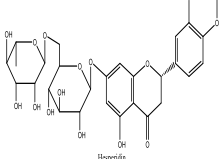
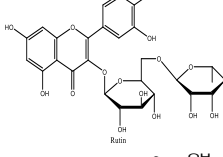
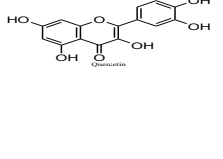
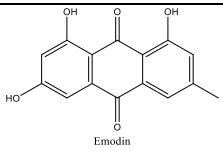
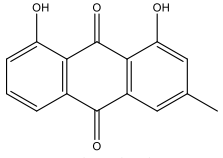
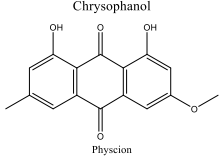
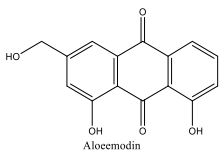
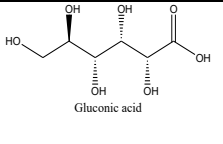


<p><i>Mentha longifolia</i></p>	<p>Mentha</p>	<p>Pulegone, menthone, isomenthone, menthol, 1,8-cineole, borneol, and piperitenone oxide</p>	<p>Gastrointestinal, respiratory disorders, Immune system, Skin organisms, Kidney failure, Antithrombotic activity</p>	 <p>Menthone</p> <p>Pulegone</p> <p>Isomenthone</p> <p>Menthol</p>	<p>(Mikaili et al., 2013)</p>
<p><i>Taraxacum officinale</i></p>	<p>Dandelion</p>	<p>quercetin, chrysoeriol, luteolin-7-glucoside, caffeic acid, chlorogenic acid, chicoric acid, taraxasterol, <math>\beta</math>-sitosterol, stigmasterol</p>	<p>diuretic, hepatoprotective, anticolitis, immunoprotective, antiviral, antifungal, antibacterial, antiarthritic, antidiabetic, antiobesity, antioxidant and anticancer activities</p>	 <p>Chrysoeriol</p> <p>Quercetin</p> <p>Luteolin-7-glucoside</p> <p>Caffeic acid</p> <p>Chicoric acid</p>	<p>(Napoli et al., 2021)</p>



<i>Thymus linearis</i>	Van Ajwain	thymol, terpinene, and p-cymene	antioxidant, analgesic, anti-inflammatory, antipyretic, antibacterial, anticancerogenic, and neuroprotective activities	 Thymol   Terpinene   P-cymene	(Thakur et al., 2023)
<i>Tagetes minuta</i>	Chil Chil, Western marigold	(Z)- and (E)-ocimenones, together with piperitone, piperitenone, limonene, tagetone, and caryophyllene	laxative, diuretic, flavouring, insect repellent, stimulant and snuff, coughs, stomach cramps and rheumatism	 Ocimenones   Caryophyllene   Piperitenone	(Wanjala et al., 2016)

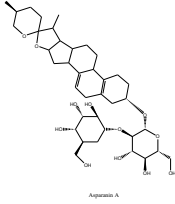
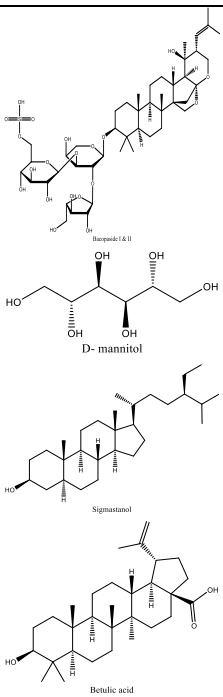
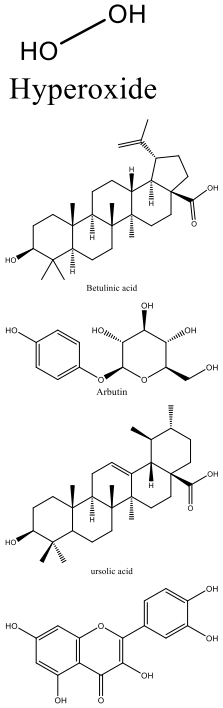


<p><i>Rhododendron campanulatum</i></p>	<p>Chimura, Gulabi Buransh</p>	<p>ascorbic acid, quercetin, gallic acid, and hesperidin, rutin, coumaric acid, coumaruline</p>	<p>anti-HIV, anti-inflammatory, and anti-nociceptive, chronic sciatica, and rheumatism activities</p>	<p>  Gallic acid   Ascorbic Acid   Hesperidin   Rutin   Quercetin                 </p>	<p>(Painuli et al.,2018)</p>
<p><i>Rheum australe</i></p>	<p>Himalyan Rhubarb</p>	<p>emodin, chrysophanol, physcion, aloemodin, rhein, piceatannol, resveratrol, eugenol, epicatechin, raphontigenin</p>	<p>Bronchiodialators, Analgesics, Bowel syndrome, Antiarthrititis, laxatives, Scabies, Skin diseases, Tonsillitis</p>	<p>  Emodin   Chrysophanol   Physcion   Aloemodin                 </p>	<p>(Pandith et al.,2018)</p>
		<p>Gluconic acid, Melonic acid, Citric acid, Caftaric acid, Gentisic acid, mDimethylbenzene, Pro</p>	<p>Antiviral, Antibacterial, Antitumour, antioxidants, Thyroiditis,</p>	<p>  Gluconic acid                 </p>	

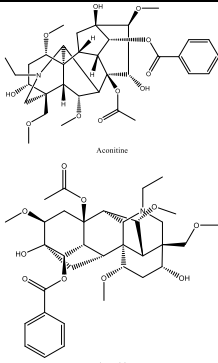
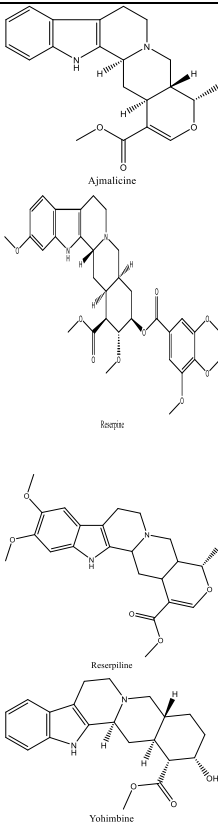


<i>Prunella vulgaris</i>	Self healing Plant	tocatechuic aldehyde, Chlorogenic acid		<p>Caffeic acid</p> <p>Gentisic acid</p> <p>Protocatechuic aldehyde</p> <p>Chlorogenic acid</p>	(Zaholdasba yev et al.,2023)
<i>Picrorhiza kurroa</i>	Kutki	eronicoside, minecoside, Picein androsincucurbitacin glycosides and 4-hydroxy-3-methoxy acetophenone, picroside I, kutkoside	Antimicrobial, antioxidant, antibacterial, antimutagenic, cardio-, hepato-, antimalarial, anti-diabetic, anti-inflammatory, anti-cancer, anti-ulcer, and nephro-protective properties	<p>Kutkoside</p> <p>Picroside I</p> <p>Mitoside</p>	(Masood et al.,2015)
<i>Asparagus racemosus</i>	Satamuli, Satavari	Sarasapogenin, Shataverin, Adscendin A, Asparanin A	Galactogogue, Antisecretory and antiulcer, Antitussive, Adaptogenic, Antiprotozoal, Gastrointestinal, Molluscicidal, Antihepatotoxic activities	<p>Sarasapogenin</p> <p>Shataverin</p>	(Alok et al.,2013)



				 <p>Aspermatin A</p>	
<i>Bacopa monnieri</i>	Brahmi	<p>jujubogeninbisdesmosides. Bacopasaponins E and F, bacopaside I and II, betulinic acid, D-mannitol, sigmastanol, <math>\beta</math>-sitosterol, and sigmasterol</p>	<p>Nervine Tonic, Antidepressants, Anxiolytic, In estrogen deficiency, bronchodilator, Anticancer, Analgesics activities</p>	 <p>Bacopaside I &amp; II</p> <p>D-mannitol</p> <p>Sigmasterol</p> <p>Betulinic acid</p>	(Firoz et al., 2022)
<i>Rhododendron arboreum</i>	Red Buransh	<p>Tarexanol, Hyperoxide, Betulinic acid, Quercetin, Arbutin, Ursolic acid, Rutin</p>	<p>anti-oxidant, antibacterial, hepatoprotective, Antidiarrhoeal activities</p>	 <p>Hyperoxide</p> <p>Betulinic acid</p> <p>Arbutin</p> <p>ursolic acid</p> <p>Quercetin</p>	(Pallavi., 2021)



<p><i>Aconitum ferox</i></p>	<p>Vastanabh, Bacchanag</p>	<p>Aconitine, Pseudoaconitine, Chasmaconitine, Indaconitine, Hypoaconitine, Mesoaconitine</p>	<p>CNS stimulants, CVS diseases, GIT diseases, Ophthalmics, Bronchodilators</p>	 <p>Aconitine Indaconitine</p>	<p>(Chatuphale et al., 2018)</p>
<p><i>Rauvolfia serpentina</i></p>	<p>Snakeroot</p>	<p>Ajamline, ajmalicine, Deserpedine, Inobinine, Reserpine, Reserpiline, Rescinamine, yohimbine, seentine</p>	<p>antifungal, antiinflammatory, antioxidant, antiproliferative, anticancerous, antidiuretic, antifibrillar, antiarrhythmic, anticholinergic, antidysentry, antidiarrhoeal antihypotensive, anticontractile, antidiuretic, sympathomimetic, and tranquillizing agent,</p>	 <p>Ajmalicine Reserpine Reserpiline Yohimbine</p>	<p>(Bhatnagar et al., 2013)</p>



<p><i>Withania somnifera</i></p>	<p>Indian ginseng</p>	<p>Viscosalactone B, Withasomniferol B and C, Somniwithanolide, Somniferanolide, Somniferin</p>	<p>cardioprotective, anticancer, antioxidant, antibacterial, antifungal, anti-inflammatory, hepatoprotective, anti-depressant, and hypoglycemic activities.</p>	<p>withasomniferol B</p> <p>viscosalactone b</p> <p>withasomniferol C</p> <p>Withafacin A</p>	<p>(Salim et al., 2020)</p>
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## 2. Summary & Future Perspectives

This study set out to detail the many uses of wild medicinal herbs in the mid-hills of the Solan area in India's Himachal Pradesh. 115 plant species, either from the same family or a different one, were recorded from the study region. Due to their strong belief in the traditional medical system, the rural people in the study region frequently favors using wild herbs. *Berberis aristata*, *Zanthalum armatum*, *Verbascum thapsus*, *Datura innoxia*, *Ocimum sanctum*, *Colebrookea oppositifolia*, *Mentha arvensis*, *Justicia adhatoda*, *Cynodon dactylon*, *Ficus auriculata*, *Cannabis sativa*, *Oxalis corniculata*, and *Verbascum aristata* are among the plant species that the study site's rural residents say are very effective in treating a variety of human ailments. Several of the plants used in ethnomedicine that are part of this research, including *Verbascum thapsus*, *Cannabis sativa*, *Cynodon dactylon*, *Ficus palmata*, *Urtica dioica*, and *Juglans regia*, have also been documented from various parts of India. Research, such as on *Juglans regia*, *Cynodon dactylon*, *Ficus palmata*, *Urtica dioica*,

*Verbascum thapsus*, and *Cannabis sativa* is not scarce?. Most of these formulations were prescribed for oral use. Recent years have seen reports of the gradual loss of traditional ethnobotanical knowledge about medicinal plants in society, mostly due to modernization, and the global extinction of some ethnobotanically significant medicinal plants as a result of habitat destruction, climate change, and overexploitation. In order to preserve traditional ethnobotanical knowledge and to protect endangered ethnomedicinal plants, research indicates that ethnobotanical knowledge and ethnomedicinal plants can be documented (Kumar et al., 2009; Verma et al., 2012). An abundance of therapeutic herbs that are essential to the native people from different regions of population may be found in the Himalayan woods (Kumar et al., 2021; Radha et al., 2021). Since traditional medicine is more affordable, has less side effects, and is ingrained in their lives and culture, it is preferred by tribal people in India, according to several research on the medicinal plants utilized by these groups. In distant parts of India, where medical facilities are few, several



medicinal plants serve as the only source of healthcare (Radha et al.,2019; Nautiyal et al.,2002). Around the world, different people and regions have different traditional applications for ethnomedicinal herbs (Negi et al., 2005; Garbyal et al.,2005). There is a danger of extinction since traditional knowledge of medicinal plants has declined among indigenous populations in recent decades. Traditional knowledge is being lost in India as a result of changes in indigenous populations' traditional lives brought about by recent economic improvements, exposure to the market economy, and infrastructural modernization (Kandari et al.,2012; Bhat et al.,2013; Spjut et al.,1975).

One effective way to discover new medications through ethnobotanical research is to use indigenous knowledge of traditional medicine. Several of the medicinal plants included in the present research site have also been the subject of prior investigations carried out in Himachali Pradesh's surrounding areas. Human remedies frequently make use of recently harvested plants or plant components. The most often utilized plant components to treat human illnesses include leaves, entire plants, stems, fruits, flowers, seeds, roots, and bark. The traditional ethnobotanical knowledge passed down from parents and grandfathers to those interviewed was invaluable. Research indicates that elders possess superior traditional knowledge of medicinal herbs compared to younger generations. Discoveries from ethnobotany may contribute to the advancement of indigenous knowledge and its application in fields such as phytochemistry, toxicology, phytopharmacology, taxonomy, anthropology, and medical science. These days, it is acknowledged that this kind of complementary medicine is essential to the advancement of communities (Bisht et al.,2018; Singh et al.,2020., Kumar et al.,2021). Recent research on the bioactivities of medicinal plants and phytoextracts has demonstrated their potential for use as a therapeutic intervention for a range of illnesses. The results presented in this study are preliminary and need more investigation. Pharmacological research on ethnomedicines would emphasize the connection between understanding of ethnomedicine and contemporary mainstream pharmacology (Kumar et al.,2021). There have been reports of a steady disappearance of indigenous knowledge on lesser-known plants. The numerous side effects of contemporary allopathic medications may lead to a rise in the use of

plant-based therapies, according to a recent research (Sivasankari et al.,2014; Yuan et al.,2016).

Inadequate control, legal safeguarding, selling and marketing of wild plant populations in general, and suitable methods for agricultural planting and harvesting are among the many things that local communities lack information about. In order to protect their resources and expertise, local communities also need support. Traditional knowledge of medicinal plants at the research site has to be documented immediately before it is lost from society, corresponding to the rural people of the study site who stated that modernity has made the younger generation less interested in such knowledge. Scientists, educators, researchers, and other pharmaceutical corporations may find the current study useful in the development of new medications. A small number of wild medicinal plant species, including *Zantholum armatum*, *Viola canescens*, and *Berberis aristata*, were discovered to be overused by rural residents, illicitly harvested, and highly valued in marketplaces. These plants are less common and require careful care and protection because of overexploitation carried out without scientific research. Ethnobotanical knowledge is under jeopardy due to the present, fast global shift in communities. A loss of plant variety in the region and harmful harvesting are the outcomes of overusing a number of wild species. Therefore, there is a need to educate the indigenous population about the preservation and long-term usage of medicinal plants.

### 3. Conclusion

Eleven of the twenty-two medicinal plant species found in the region—*Aconitum heterophyllum*, *Arnebia euchroma*, *Betula utilis*, *Dactylorhiza hatagirea*, *Ephedra gerardiana*, *Hippophae rhamnoides*, *Jurinea dolomiaea*, *Picrorhiza kurroo*, *Rhododendron campanulatum*—are classified as threatened species. The reason for the scarcity of these therapeutic herbs is because of habitat modification, restricted distribution, excessive grazing, and overharvesting. The species that are uprooted face a serious threat as their subterranean components—such as roots, bulbs, tubers, and rhizomes—are employed in medicine. Overcollection has made *Aconitum heterophyllum* and *Dactylorhiza hatagirea* endangered in the Himalayas. For many of these uncommon plant species, appropriate cultivation technology really must be created immediately in order



to enable large-scale production to meet local industry and population demands. Furthermore, because it is thought that cultivated types of medicinal plants are less effective than their wild cousins, both pharmaceutical businesses and the local population prefer to employ natural resources.

Most plant species' habitats, especially those in the Himalayan region's chilly deserts, have decreased because of environmental degradation brought on by uncontrolled tourism, excessive livestock grazing, dam and road building, and other human activities. The following improvements can be made to better conserve natural resources: fostering community-based conservation, creating nature reserves as a method of in-situ conservation, and including a component on plant conservation in the Wild Life Protection Act, particularly for rare and endangered medicinal plants, establishing medicinal plant nurseries and using tissue culture as an ex-situ method of conservation; and regularly educating locals, traders, and other relevant stakeholders on the process of collecting and processing medicinal plants. Additionally, there is a pressing need to lessen current pressures on medicinal plants, particularly those belonging to rare and endangered categories, by educating the locals about sustainable harvesting practices. Some medicinal plants require a certain environment, may it be soil type, temperature, rainfall or intrinsic microhabitat. This needs to be elucidated before harvesting practices are carried on. With the ever changing climate, pollination of plants is also affected for propagation which needs to be addressed. Only places with sufficient plant growth should be used for collection. Plants collected should be explored for artificial plant propagation techniques that can promise the continuous supply of threatened species. Once the vegetative activities have finished, plant pieces should be harvested in the fall. In the meanwhile, widespread development, establishment, and public promotion of appropriate cultivation technologies are required.

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