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A comprehensive review on some ethnomedicinal plants of Topneel region of Doda District of J&K, India

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Abstract

Present paper reveals the documentation of some ethnomedicinal plants of Topneel region of Doda District of J & K, India. In total, 26 ethnomedicinal plant species belonging to 24 genera and 18 families were documented which are useful for the treatment of various diseases by locals. *Abelmoschus esculentus* (L.) Moench, *Adiantum cappilus-veneris* (L.), *Ajuga bracteosa* Wall ex Benth., *Amelanchier ovalis* (Medik), *Allium cepa* (L.), *Allium sativum* (L.), *Artemisia annua* (L.), *Artemisia arboretum* (L.), *Beta vulgaris* (L.), *Berberis vulgaris* (L.), *Cannabis sativa* (L.), *Capparis decidua* (Edgew.), *Calendula officinalis* (L.), *Cedrus deodara* (Roxb. ex D. Don) G. Don, *Chenopodium vulgare* (Gueldenst.), *Coriandrum sativum* (L.), *Convolvulus arvensis* (L.), *Crataegus songarica* (L.), *Cucumis sativus* (L.), *Diospyros lotus* (L.), *Eriobotrya japonica* (Thunb) Lindl., *Foeniculum vulgare* (Mill), *Hordeum vulgare* (L.), *Melia azedarach* (L.), *Malva sylvestris* (L.) and *Mentha piperita* (Mallow) were the dominating species with medicinal value. Different parts of the plants such as root, stem, leaves, bark, seeds, flowers and fruits are mainly used for medicinal purpose. These species of plants are used to cure various ailments by the locals such as skin rashes, allergies, liver illness, bleeding, toothache, gum problems, itching, urinary tract infection, acne, fever, constipation, diarrhea, ulcers, jaundice, cough, asthma, respiratory disorders, diabetes, gastrointestinal disorders and also as antiseptic. Exploration survey conducted in the research region has also shown that people in the area gather and sell these therapeutic species through local middlemen or contractors in order to make a living. However, the region's local farmers would have better employment opportunities and incomes, thanks to scientific farming and proper post-harvest management.

1. Introduction

Ethnobotany is a unique field of natural science that studies medicine, religion, culture, agricultural tools, household items, and a variety of other topics. According to Singh and Shrivastava (2007), ethnobotany is now considered a sub-branch of economic botany that focuses on the utilization of plants, their potential for absorption into another culture, and indirect engagement with the plants through their by products. Plants have been utilized for medicinal purposes since ancient times. Even today, many significant medications used in contemporary medicine are derived from plants. According to the WHO, more than 80-85% of the world's population in under-developed countries mostly depends on the plant-based medications to cover their fundamental healthcare conditions.

Historically, ethanobotanical study consisted mostly on a survey of the plants utilized by villages. A Botanist identified the plants and documented their usage. An Anthropologist was sometimes present

to translate the disease's description, but a physician was rarely accessible to identify. Medicinal plants provide cost-effective alternatives to pharmaceutical treatments, as they may be cultivated at home or obtained in local supermarkets. Herbs may be purchased without a prescription from health food stores, pharmacies, and online, and they usually have fewer negative effects. There is less data on the use of plants as traditional medicines in the Doda District's interior areas. Plants have long been utilized by rural and elderly people to heal a variety of ailments. Rural populations in this region now have access to modern healthcare facilities, but many people still choose traditional herbal medicines since they are more readily available, cost-efficient, and effective.

The general definition of ethnomedicine is the use of plants by humans as medicine; nevertheless, ethanobotanical medicine would be a better term to describe these applications (Fransworth, 1994). Worldwide, the estimated number of plant species that are known is 2, 00,000. The WHO has enumerated 21,000 plant species with potential medical benefits worldwide. Traditional healers in India employ over 2,500 different plant species for therapeutic purposes (Chandel *et al.*, 1996). Numerous researchers have examined the various ways in which the indigenous people of plains or hilly regions utilize various plant parts (Jain, 1991).

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The wealth of folklore and ethnobotany in our nation is immense. The native communities have their own unique customs, rituals, diets, and extensive understanding of traditional medicine (Upadhye, 1986). Indigenous knowledge of using medicinal plants' natural resources without compromising the environment's resilience is seen to be a crucial indicator of the sustainable conservation of plant biodiversity (Krishna, 1998; Kaur *et al.*, 2023c). Many medicinal plants are on the verge of extinction due to fuel wood collecting and fires, as well as genetic variety loss. Identification of different plant species and indigenous knowledge of their therapeutic properties are crucial for making the most use of herbal plant resources (Kaur and Vashistha, 2014). In recent years, medicinal plants have had a significant global impact. The natural vegetation and traditional culture of India are rapidly diminishing due to a variety of human activities like deforestation, rapid industrialization, urbanization, and other developmental activities (Bhattacharjee, 2001). The current work's goal is to provide knowledge and documentation on the therapeutic plants that the indigenous people of the various communities use.

Present study shows that in the lack of contemporary medical facilities, residents in the region rely on the local plants for therapeutic purposes. Based upon the first reconnaissance observations and group talks, where the emphasis was on identifying the competent resource individuals, it was discovered that expertise on the therapeutic applications of plants appears to be limited to elder people (over the age of 40). The younger generation is unaware of the immense therapeutic resources present in their surroundings and is more focused on market resources. All of the resource people uncovered were in between the ages of 40 and 55, and they were all knowledgeable with the medical plants that grew in their neighbourhood.

2. Materials and Methods

For survey, Topneel region of Doda District of J & K was selected. Doda District, the gateway of Jammu and Kashmir State is bounded to the south by Chamba District, to the east by Kishtwar District, to the west by Ramban District, and to the north by Udhampur District. It has a boundary with Himachal Pradesh State to the east. Jammu is one of the three administrative divisions within Jammu and Kashmir, the northern most state in India. It consists of 10 Districts of Jammu that includes Jammu, Kathua, Doda, Reasi, Kishtwar, Poonch, Ramban, Udhampur, Rajouri, and Samba. For survey, Topneel region of Doda District of Jammu and Kashmir was selected. The study was conducted in the Galadhar and Panchayat Topneel of District Doda, Jammu and Kashmir (UT), India. Doda is one of the four hilly districts of Jammu division in Union Territory of Jammu and Kashmir, India. Doda District is located at 32°50' N to 33°23' N latitude and 75°20' E TO 76°13' E longitude. It was given the name Doda after the Opium plant, which is called as "Doddi" in the local language.

The present investigation was the result of field surveys of the medicinal plants of Topneel region of Doda District (J & K). Present findings are an outcome of survey of Doda District undertaken during March 2021 to August 2021. While conducting the surveys, information on the potential properties of medicinal plants was gathered from the local people. For this local knowledgeable person, experienced community members were interviewed for the identification of medicinal plants of study area. Small visits were made and photographs of medicinal plants were taken and identified with the help of related floras like Flora of Jammu and Plants of

Neighborhood (Sharma and Kachroo, 1982) and Flora of Udhampur (Swami and Gupta, 1998). Information includes the local names, part(s) used, altitudinal distribution, habitat, *etc.* Extensive field surveys were undertaken to collect the detailed information about the ethnomedicinal plants in proposed study area at Topneel region of District Doda of UT Jammu and Kashmir.

Topneel is bounded to the north by Dhandal and Gurmul block, to the west by Rajghar block, to the east by Kastigarh block, and to the south by Assar block. Topneel is close to Udhampur, Anantnag, Dalhousie, and Jammu. Topneel is one of the villages in the Assar block. This place was given the name "Topneel" because it is present on the top hilly region. The Jammu and Kashmir Union Territory is a huge and vital source of floral variety, including plants with medicinal benefits and characteristics. The research was conducted in District Doda (Topneel region) of J & K, India. Field surveys were conducted in a number of villages in District Doda (J & K), including Dashnan and Bagorain (Dhar).

The knowledge was acquired through interviews and group discussions with locals, elders, and healers (Hakim). This technique yielded a wealth of information, as well as a slew of inquiries on the veracity of the material acquired. Following that, all of the information was jotted down in a notebook, including their local names, traditional usage, and so on. All acquired specimens and documentation were cross-checked with previously published legitimate data in order to obtain the correct information about them.

3. Results

In the present work a total of 26 plant species were studied which have medicinal value and they are used traditionally. The results are summarized as below:

3.1 *Abelmoschus esculentus* (L.) Moench

The plant is often referred to as ladies fingers or ochro in several English-speaking nations. It is valued for its edible green seed pods which are an excellent source of mineral, vitamins, antioxidant and fiber. Okra pods are used for many different things, including food, astringents, appetite stimulants, and aphrodisiacs. Okra pods have also been suggested as a treatment for gonorrhoea, diarrhoea, and urinary issues. Extracts of immature okra pods have also been shown to have moisturizing and diuretic characteristics, while the seeds of this plant have been claimed to feature anticancer and fungicidal qualities. It has several biological actions, such as anti-inflammatory, antidiabetic, antioxidant, antibacterial, immunomodulatory, anticancer, and neuropharmacological properties. Furthermore, the plant contains lipid-lowering, trypsin inhibitory, hemagglutinating, antiadhesive, and antifatigue properties. The fruit and seeds are well accepted by both animals and humans (Elkhalifa *et al.*, 2021). Okra's profile of bioactive ingredients is well-documented; it includes amino acids, niacin, carotene, folic acid, vitamin C, riboflavin, thiamine, and polyphenolic compounds (Roy *et al.*, 2014; Jain *et al.*, 2012; Gemedé *et al.*, 2015; Petropolous *et al.*, 2018). Okra seeds are rich in proteins with high lysine content, polyphenolic chemicals (mostly flavonol derivatives and oligomeric catechins), and oils generated from the plant that are high in oleic, palmitic, and linoleic acids (Adelakum *et al.*, 2009; Arapitsas, 2008; Adelkaum *et al.*, 2011; Hu *et al.*, 2014).

3.2 *Adiantum capillus-veneris* (L.)

Also know as southern maidenhair fern or black maidenhair fern, is a species of fern from the family Pteridaceae. Native Americans

utilize this plant medicinally; the Mahuna people use it internally to treat rheumatism. In traditional medicines of Iran, frond infusion of the plant is used for Jaundice therapy. Important phytochemicals such as phospholipids, carotenoids, phenolic acids, flavonoids, terpenoids, phytosterols, and triacylglycerols are abundant in plants. It has features including antibacterial, antispasmodic, wound healing, antinociceptive, antidiarrheal, antigonitrogenic, nephroprotective, antiurolithiatic, antioxidant, anti-inflammatory, and analgesic. It also has attributes including wound healing and hearing loss (Zeb, 2023).

3.3 *Ajuga bracteosa* (Wall ex. Benth)

It is herbaceous plant, found in the sub-Himalayan region of Kashmir to Nepal, with dispersed branches. In Ayurveda, the herb is suggested for the treatment of amenorrhea, gout, and rheumatism. The entire plant produces five chemicals, including bracteonin-a (a novel clerodane diterpenoid), 14, 15-dihydroajugapitin, 14-hydro-15-hydroxyajugapitin, β -sitosterol, and stigmaterol. Plant is found to have antifeedant action against *Spodoptera littoralis* larvae, antiplasmodial and cancer chemopreventive activities. It has been also shown to inhibit butyrylcholinesterase, lipoxigenase, and acetylcholinesterase activity. Various phytochemical investigations on *Ajuga* species have revealed that diterpenes, sterol glycosides, iridoids, phytoecdy flavonoids, phenylethanoid glycosides, and steroids are the genus's primary secondary metabolites (Manguro *et al.*, 2006; Ono *et al.*, 2011; Atay *et al.*, 2016).

3.4 *Allium sativum* (L.)

It belongs to the genus Onion and is a kind of bulbous flowering plant. Due to its strong flavor, garlic is used as a flavoring or condiment all over the world. A clinical research found that consuming garlic produces only a small reduction in blood pressure. Among the ethnomedicine's prospective uses for garlic are applications against the snakebite, diabetes, hypertension, wounds, pneumonia, scabies, pain, hair loss, influenza, respiratory disorders, female infertility, heart diseases, cough, paralysis, haemorrhoids, asthma, malaria, *etc.*, which are mainly attributed to its aphrodisiac, antidiabetic, diuretic, antiatherosclerotic, cardioprotective, antihypertensive, antimicrobial, anticancer, and sedative properties. Garlic bulbs are reported to contain many bioactive compounds, many of which are sulfur-containing, *viz.*, thiosulfonates (allicin), sulphides (diallyl disulfide), vinylidithiins, ajoenes (E-ajoene and Z-ajoene), diallyl trisulfide and so on, constituting up to 82% of the total sulphur content in garlic. The primary toxic chemicals are: S-methyl cysteine sulfoxide, allicin, and S-propylcysteine sulfoxide, with allicin being the most abundant cysteine sulfoxide. Allicin, PCSO, and MCSO, when acted on by different enzymes, generate compounds such as methyl methane-thiosulfonate, and other allyl methane thiosulfonates (Tudu *et al.*, 2022; Tiwari *et al.*, 2023).

3.5 *Allium cepa* (L.)

Also known as common onion, or bulb onion is a vegetable which is most widely cultivated species of the genus *Allium*. Onion contains quercetin, a plant pigment that amazing antioxidant properties; which helps in reducing the oxidative stress. Onions' various bioactive components, including polysaccharides, organosulfur compounds, phenolic compounds, and saponins, are primarily responsible for their health advantages (Marrelli *et al.*, 2019; Teshika *et al.*, 2019). The health benefits of onions and their bioactive compounds; which include antibacterial, antioxidant, anti-inflammatory, antiobesity,

anticancer, antidiabetic, neuroprotective, hepatopancreatic, reproductive, respiratory, cardiovascular and immunomodulatory properties have been demonstrated by a growing body of research in recent times (Colina coca *et al.*, 2017; Loredana *et al.*, 2019; Jini and Sharmila, 2020). A wide range of useful phytochemicals, including as polysaccharides, phenolic compounds, organosulfur compounds, and saponins, are abundant in onions (Lee *et al.*, 2017; Ren *et al.*, 2017; Viera *et al.*, 2017; Ma YL *et al.*, 2018; Moreno-Rojas *et al.*, 2018; Zamri and Hamid., 2019; Lanzotti *et al.*, 2012; Dahlawi *et al.*, 2020). The main bioactive substances found in onions are phenolic substances including quercetin glucosides, rutin, quercetin, and as well as sulfur-containing substances such onionin A and cysteine sulfoxides.

3.6 *Amelanchier ovalis* (Medik)

Commonly known as the snowy mespilus, juneberry, irga, or shadberry. Its pome fruits are edible. It contains a number of health-promoting chemicals, which may be included to functional foods and dietary supplements. These berries include pectin, protein, minerals, insoluble and soluble fibre, vitamins, and a range of carbohydrates such as glucose, sorbitol and fructose. The chemical makeup of these berries is influenced by storage conditions, environmental factors, genotype, and maturity. It is rich in polyphenols. The skin of berries is high in phenolic acid and anthocyanin (Lachowicz *et al.*, 2020).

3.7 *Artemisia abrotanum* (L.)

Sometimes known as the southernwood or boys' love, is a blooming plant from the sunflower family. This plant is used to extract a yellow dye from its branches, which is then used on wool. In eastern and northern traditional medicine, aerial portion of plant is utilized in jaundice treatment. The principal bioactive antioxidant phenolic chemicals in this species include caffeic acid, gallic acid, gentisic acid, epicatechin, ferulic acid, isoquercitrin, quercetol, vanillic acid, catechin, sinapic acid, rutin, quercetin, luteolin, chlorogenic acid, kaempferol, and apigenin (Mamatova *et al.*, 2019; Batiha *et al.*, 2020; Minda *et al.*, 2022). They have primarily been successfully employed in traditional European medicine to treat liver disorders, pediatric parasite infections, and as antipyretics.

3.8 *Artemisia annua* (L.)

Also known as sweet wormwood or sweet annie. An extract of the plant is a medication used to treat Malaria, it has antimalarial properties. Artemisinin, a sesquiterpene lactone endoperoxide derived from *A. annua* known as "qinghaosu," is used to prevent as well as in the treatment of malaria and cancer. Several analogues, including arteminic acid, arteether, artesunic acid, and artemether, may be semi-synthesised and are highly effective against malaria caused by multidrug-resistant *Plasmodium falciparum* (Abolaji *et al.*, 2013; Jain *et al.*, 2000). Plant's leaves and flowers artemisinin is contained in it (Mokhber *et al.*, 2014).

3.9 *Berberish vulgaris* (L.)

A shrub in the genus *Berberis* is also referred to as common barberry. It yields berries that are edible but quite acidic; these berries are rich in vitamin C. All parts of this plant have been proven to have therapeutic properties, such as antimicrobial, sedative, antioxidant, antimalarial, anti-inflammatory, anticholinergic, cholagogic, antipyretic, and anti-leishmaniasis. The two most prevalent

substances present in various *Berberis* species are berberine and berbamine. Phytochemical examination of several species in this genus showed the presence of phenolic compounds, triterpenes, tannins, and sterols (Dezfuli *et al.*, 2014).

3.10 *Beta vulgaris* (L.)

It is a species of flowering plants in the family Amaranthaceae, also known as beetroot or garden beet. Traditional medicine has utilized beetroot and leaf preparations to treat a broad range of illnesses. It contains carbohydrates, vitamins, fatty acids, proteins, and fibres making it a good source of food for humans and a healthy source of feed for animals; phenolic acids (syngic acid, caffeic acid and ferulic acid), betalains (vulgaxanthin I and II, betanin, and isobetanin) and flavonoids (such as rutin, quercetin, and myricetin). The plant also contains sucrose, which makes its root excellent for the industrial manufacturing of sugar and used as second source for the production of raw sugar (Kingsley and Afimoh, 2020).

3.11 *Cannabis sativa* (L.)

It is an annual herbaceous blooming plant with worldwide distribution due to its extensive cultivation. This plant has been thoroughly studied, and over 750 compounds have been found. It has been extensively grown for its uses in industry, decoration, nourishment, medicine, and leisure. This plant is classed based on the quantity of Δ^9 -tetrahydrocannabinol (THC), a major phytocannabinoid. Plants are often classified and managed as industrial hemp, if the dried flower contains less than 0.3% THC (this figure varies by country), or as a narcotic, if it surpasses this level (Siracusa *et al.*, 2023).

3.12 *Capparis decidua* (Edgew)

Also known as karira or kerda, very useful plant in its marginal habitat. The spicy fruits are used to make veggie curries and exquisite pickles. It may also be used as a vegetable by diabetics. Sonaina *et al.* (2020) reported that *C. deciduas* had numerous pharmacological properties, including antidiabetic, antibacterial, anthelmintic, antiatherosclerotic, antifungal, antinociceptive, antirheumatic, hypolipidemic, analgesic, antitumor, antioxidant, anti-inflammatory and hepatoprotective activity. The caper plant's remarkable bioactivities can be related to the presence of a diverse spectrum of the phytochemicals, which are alkaloids (stachydrine, capparisinine, isocodoncarpine, and capparisine), phenolics, flavonoids, sterols, and fatty acids (Arora *et al.*, 2013).

3.13 *Calendula officinalis* (L.)

The Asteraceae family of daisies includes the common marigold, sometimes known as the pot marigold. Its leaves can be made into poultices which are used in scratches and shallow cuts to heal faster and to prevent infection. The genus' primary phytoconstituents include triterpene alcohols, saponins, flavonoids, carotenoids, and polysaccharides. A few species in this genus have medicinal value, which has been traditionally used to treat various ulcers, skin tumours, swellings, dermatological lesions and nervous disorders, along with that nearly 200 cosmetic formulations such as creams, lotions, soaps and shampoos are prepared from this plant.

3.14 *Cedrus deodara* (Roxb. ex D. Don) G. Don

It is a species of cedar native to the western Himalayas. The interior wood is fragrant and used to manufacture incense. Cedar oil is commonly used for its fragrant characteristics. It is a well-known

medicinal tree that has long been used to cure a range of ailments, including asthma, sprains, bone fractures, rheumatism, ulcers, boils, and leprosy. Phytochemical analysis revealed 105 chemical compounds from various parts of the plant, the majority of which are classified as terpenoids and flavonoids. Crude extracts, isolated components, fractions, and essential oils of tree exhibited some major pharmacological properties including anti-inflammatory, anticancer, antiarthritic, neuroprotective, antifungal, antidiabetic, antibacterial, antiurolithiatic and antiasthmatic (Bisht *et al.*, 2021).

3.15 *Chenopodium vulgare* (Gueldenst)

Goosefoot is a genus of flowering herbaceous plants that can grow anywhere in the world, either as an annual or perennial. It belongs to the Amaranthaceae family. It is used medicinally as a laxative, an anthelmintic against round and hook worms, and a blood purifier in spleen enlargement, hepatic diseases, burns and intestinal ulcers. The plant's crude and separated compounds have antifungal, antipruritic, and hypotensive properties, making it useful in traditional medicine. The plant is incredibly nutritious, with high protein, vitamin C, vitamin A, iron, calcium, phosphorus, and potassium levels. It has been revealed that flavonoids, saponin, phenolic amide, chinoalbicin, apocortinoid, cinnamic acid amide, xyloside, lignans, and phenols are the active phytochemicals (Agrawal and Shamkuwar, 2014).

3.16 *Coriandrum sativum* (L.)

It is a genus of herbs in the family Apiaceae. Coriander, a versatile herb utilized in both culinary and medicinal practices, has a rich history of treating ailments such as blepharitis, headaches, aphthous stomatitis, scabies, laryngitis, and palpitations. Recent studies have unveiled its extensive therapeutic potential, demonstrating properties such as anticonvulsant, anxiolytic, antimigraine, neuroprotective, analgesic, hypolipidemic, hypoglycemic, diuretic, hypotensive, anticancerous, and antioxidant activities. Coriander contains a diverse array of bioactive phytochemicals, including terpenoids, isocoumarins, phenylpropenes, phytosterols, and fatty acids (Sobhani *et al.*, 2022).

3.17 *Convolvulus arvensis* (L.)

It is filed bindweed that is rhizomatous and belongs to the morning glory family Convolvulaceae. Fever and constipation are treated using a powdered form of its roots. It was found to be abundant in terpenoids, anthocyanidins, flavonoids, amino acids, phenylpropanoids, steroids, lipids, anthraquinones, lignans, coumarins, saponins, alkaloids, resins, tannins, and fatty acids. It has been found that convolvulus has therapeutic qualities, including the capacity to lessen or completely eradicate the signs of serious illnesses including fever, gastrointestinal irritation, hair loss, sleeplessness, memory loss, urogenital disorders, heart disease, gaseous distended intestine, animal stings, congestion, and organ haemorrhages acids (Salamatullah., 2022).

3.18 *Crataegus songarica* (L.)

This plant is an Asian species of hawthorn with black fruits which are sometime used medicinally. Hawthorn fruits contain large concentrations of phenolic compounds, which are utilized as medical treatments with a range of biological activities such as antitumour, diuretic, cardiotoxic, antiatherosclerotic, hypotensive, antispasmodic, and anti-inflammation. The primary active ingredients of the *Crataegus* species include bioflavonoids, polyphenols, triterpenoids,

flavonoid glycosides, antioxidants, oligomeric procyanidins, organic acids, vitamins, tannins, and certain phenolic acids. Because they contain significant levels of phenolics and certain well-known antioxidant compounds, the fruits of several *Crataegus* species can be considered a good source of antioxidants notably, hyperoside, isoquercetin, chlorogenic acid, epicatechin, rutin, quercetin, and protocatechuic acids (Alirezalu *et al.*, 2020).

3.19 *Cucumis sativus* (L.)

A common creeping vine plant in the Cucurbitaceae family is the cucumber. Seeds are used to eliminate parasitic worms. The skin is nourished with fresh fruit juice; it calms the skin irritations and reduces edoema. Cucumber can also help you relax and alleviate the pain from sunburn. The fruit contains refrigerant, haemostatic, and tonic characteristics and it can be used to treat thermoplegia, hyperdipsia, and other ailments. The seeds are used to avoid constipation since they have a cooling impact on the body. Cucumber includes several bioactive compounds, including cucumerin A and B, cucurbitacins, vitexin, cucumegastigmanes I and II, orientin, apigenin 7-O-(63 -O-p-coumaroyl)glucoside), and isoscoparin 23 -O-(64 - (E)-p-coumaroyl) glucoside, among others (Mukherjee *et al.*, 2013).

3.20 *Diospyros lotus* (L.)

It has common name date plum and is widely cultivated species of genus *Diospyros*. Its fruits are edible and high in malic acid, sugar, and vitamins. They can be used fresh or frozen, although they are commonly dried. Date plum is planted in many countries for its delicious fruits, which have excellent nutritional and medicinal properties. Fruit consumption is recommended for its therapeutic advantages on human health, which include anticancerous, sedative, antidiarrheal, antidiabetic, antiseptic, dry cough reliever, laxative, and stress regulator (Hassan *et al.*, 2022).

3.21 *Eriobotrya japonica* (Thunb) Lindl.

It is commonly known as loquat with a huge evergreen shrub or tree that is commercially farmed for its orange fruit and tea leaves. The loquat has a high sugar, acid, and pectin content. Its leaves produce 164 compounds, including organic acids, sesquiterpene glycosides, phenylpropanoids, flavonoids, triterpenes, megastigmane derivatives, and 169 volatile oils. It is still unknown whether more than half of these substances have pharmacological activity. The most significant bioactive substances in terms of pharmacological effect are flavonoids and triterpenes which have anti-inflammatory, antidiabetic, and anticancer characteristics (Zhu *et al.*, 2022).

3.22 *Foeniculum vulgare* (Mill)

Fennel is a blooming plant from the carrot family. It's a hardy perennial plant with yellow blooms and feathery foliage. Florence fennel is one of three major plants used in the production of absinthe, an alcoholic beverage that originated in Europe. Numerous essential molecules have been found through phytochemical research, including volatile compounds, phenolic compounds, flavonoids, fatty acids, and amino acids. Antiviral, anti-inflammatory, antimicrobial, antinociceptive, antipyretic, antispasmodic, cardiovascular, antimutagenic, antitumor, hepatoprotective, hypolipidemic, hypoglycemic, chemomodulatory, and memory-enhancing properties are just a few of the many *in vitro* and *in vivo* pharmacological qualities that demonstrate its efficacy. This herb has become well-known as a superb source of traditional medicine (Badgujar *et al.*, 2014).

3.23 *Hordeum vulgare* (L.)

A common cereal grain farmed throughout the world in temperate climates is barley, a member of the grass family. Seeds were used to utilize to create wine which is consumed for warmth in cooler climates. Plant is used in various pharmacological activities as it contains the compound such as methyl ester, hexadecanoic acid, 9,12-octadecanoic acid (Z, Z)-, methyl ester, lup-20(29)-en-3-one, n-hexadecanoic acid, lup-20(29)-en-3-one, campesterol, 9,12-octadecadienoic acid (Z, Z), γ -sitosterol and squalene (Farooqi *et al.*, 2024).

3.24 *Melia azedarach* (L.)

Often called the bead tree, chinberry tree, or pride of India, this deciduous species belongs to the Meliaceae family of trees. Its leaves contain an extract that has anti-inflammatory and antibacterial qualities. It is also a good source of flavonoids, alkaloids, phenols, terpenes, carotenoids, and saponins - natural substances that have antioxidant qualities. Furthermore, preparations from several portions of this medicinal plant have been demonstrated to have toxicological and pharmacological properties. Many bioactive substances found in leaves include terpenoids, saponins, limonoids, flavonoids, steroids, alkaloids, fatty acids, carbohydrates, and tannins. Research has demonstrated that these substances have insecticidal, antibacterial, antifungal, and antiparasitic qualities (Dias *et al.*, 2022).

3.25 *Mentha piperita* (L.)

It is sometimes referred to as *Mentha balsamea* wild, a hybrid mint native to Europe and the Middle East that is a mix between spearmint and watermint. Its eaves are consumed because of their antidiabetic, antifungal, and antioxidant properties. Plants generate nonnutritive molecules called phytochemical, which contain beneficial and disease-preventing components. Over 900 phytochemical have been recognized as dietary components, with many more to be found today. Plants may produce a variety of bioactive molecules, including alkaloids flavonoids, carotenoids, tannin, and phenolic compounds (Abuajah *et al.*, 2015).

3.26 *Malva sylvestris* (Mallow)

It is a species of the family Malvaceae. To cure gum issues and toothaches, seed powder is applied. Its phytochemical studies revealed that the leaves and flowers are the most often used parts of the plant, including a range of bioactive compounds such as coumarins, flavonoids, terpenoids, mucilages, phenol derivatives, saponins, sterols, alkaloids and tannins. These chemicals have many pharmacological actions, which include antibacterial, anti-inflammatory, hepatoprotective, laxative and antioxidant properties (Batiha *et al.*, 2023).

4. Discussion

Present investigation provides a comprehensive detail on the ecological diversity and ethnomedicinal uses of the plants used by the locals of Topneel region. A total of 26 plant species from 24 genera and 18 families were identified from the current study. Most species were herbs, followed by shrubs, trees, climbers and grasses. Herbs were identified as the dominant species in this area. Results revealed that the people of Topneel region of District Doda still uses these plants traditionally to treat a variety of disorders. The valley's floral richness is important in traditional medicine because of its

many applications among rural cultures. Locals are well-versed in the usage of plants to treat a variety of diseases. To augment their earnings, people who gather medicinal plants from forested areas usually sell them to nearby merchants, contractors, or practitioners. Table 1 presents information on key plant species of ethanobotanical relevance. The medicinal plants commonly present in this area and used traditionally are as *Abelmoschus esculentus* (L.) Moench, *Adiantum cappilus-veneris* (L.), *Ajuga bracteosa* Wall ex Benth., *Allium sativum* (L.), *Allium cepa* (L.), *Amelanchier ovalis* (Medik),

Artemisia annua (L.), *Artemisia arboretum* (L.), *Beta vulgaris* (L.), *Berberis vulgaris* (L.), *Cannabis sativa* (L.), *Capparis decidua* (Edgew), *Calendula officinalis* (L.), *Cedrus deodara* (Roxb. ex D. Don) G. Don, *Chenopodium vulgare* (Gueldenst), *Coriandrum sativum* (L.), *Convolvulus arvensis* (L.), *Crataegus songarica* (L.), *Cucumis sativus* (L.), *Diospyros lotus* (L.), *Eribotrya japonica* (Thunb) Lindl., *Foeniculum vulgare* (Mill), *Hordeum vulgare* (L.), *Melia azedarach* (L.), *Malva sylvestris* (L.) and *Mentha piperita* (Mallow).

Table 1: Ethnomedicinal plants reported from the present study

S. No.	Botanical name	Common name	Family	Part used	Uses
1.	<i>Abelmoschus esculentus</i> (L.) Moench	Bhindi	Malvaceae	Roots and Seeds	To cure sore throat, ulcers and to stabilize blood sugar level
2.	<i>Adiantum cappilus-veneris</i> (L.)	Gyou theer/Bumtuli	Pteridaceae	Leaves	Used for fever, wounds healing, antidiabetic
3.	<i>Ajuga bracteosa</i> Wall ex Benth.	Kauri booti	Lamiaceae	Leaves and Roots	Used for jaundice and stomach problems
4.	<i>Allium sativum</i> (L.)	Kashmiri Lehsun	Amaryllidaceae	Bulb	Chutney is good for treatment of diarrhea and dysentery
5.	<i>Allium cepa</i> (L.)	Pyaz/Ganda	Amaryllidaceae	Bulb	Used for acidity and diabetes
6.	<i>Amelanchier ovalis</i> (Medik)	Snowy mespilus	Rosaceae	Fruits and Leaves	Used for cold fever and constipation
7.	<i>Artemisia abrotum</i> (L.)	Southernwood/lover's love	Asteraceae	Leaves	It was to make tincher to cure jaundice
8.	<i>Artemisia annua</i> (L.)	Sweet wormwood/Sweet annie	Asteraceae	Leaves and Flower	Decoction of leaves is used as antihelmintic and also used to cure fever
9.	<i>Beta vulgaris</i> (L.)	Chukunder	Amaranthaceae	Seed and Leaves	Seed decoctions are used to treat the genital tumors while leaves were used to treat urinary tract infection
10.	<i>Berberis vulgaris</i> (L.)	Common barberry	Berberidaceae	Stem, Bark, Root and Fruits	Used to treat acnes, fever, liver illness and bleeding
11.	<i>Cannabis sativa</i> (L.)	Ganja/Bhang/Indian hemp	Cannabaceae	Leaves and Stem	Used to treat insomnia
12.	<i>Capparis decidua</i> (Edgew)	Karira/Karyal/Caper	Capparidaceae	Leaves, Flower, Root and Bark	Used to treat respiratory disorder and diabetes
13.	<i>Calendula officinalis</i> (L.)	Mary's gold/Marigold /Scotch marigold	Asteraceae	Flower	Flowers are crushed and used on pimples
14.	<i>Cedrus deodara</i> (Roxb. ex D. Don) G. Don	Deodar/Himalayan cedar	Pinaceae	Wood	To avoid allergies, resins are applied on the legs and feet after adequate preparation.
15.	<i>Chenopodium vulgare</i> (Gueldenst)	Bthwa/Bathua	Lamiaceae	Leaves	To treat skin related problems
16.	<i>Coriandrum sativum</i> (L.)	Dhaniya/Cilantro	Apiaceae	Leaves and Fruit	To treat digestive problems
17.	<i>Convolvulus arvensis</i> (L.)	Field Bindweed/ Morning glory	Convolvaceae	Whole Plant	The powder of the whole plant is used to treat fever and constipation
18.	<i>Crataegus songarica</i> (L.)	Hawthorn/Maybush	Rosaceae	Fruit	Fruit are eaten to overcome heart problems and in constipation

19.	<i>Cucumis sativus</i> (L.)	Khira/Loru	Cucurbitaceae	Seeds and Fruit	To remove parasitic worms from humans body, seeds are employed
20.	<i>Diospyros lotus</i> (L.)	Date plum/Amlook	Ebenaceae	Fruit	Fruits are taken as a treatment of diarrhea, anxiety, and cough
21.	<i>Eribotrya japonica</i> (Thunb) Lindl.	Loquat/Japanese plum	Rosaceae	Fruit and Leaves	Used to treat cough, diabetes and itching
22.	<i>Foeniculum vulgare</i> (Mill)	Fennel/Saunf	Apiaceae	Seed, Leaves and Stem	Used to improve the digestive as well as respiratory problems
23.	<i>Hordeum vulgare</i> (L.)	Barley/Jau	Poaceae	Seeds	Seeds are utilized in the treatment of diabetes as well as it reduces the risk of cardio-vascular diseases
24.	<i>Malva sylvestris</i> (L.)	Mallow/Tall mallow	Malvaceae	Seeds	To treat gum problems and toothache
25.	<i>Melia azedarach</i> (L.)	Chinaberry/Bakain/Bead tree	Meliaceae		Leaves extracts of leaves is used as antiseptic and anti-inflammatory properties
26.	<i>Mentha piperita</i> (Mallow)	Mint/Pudina	Laminacea	Leaves	Extract of leaves is used as antiseptic

Gupta *et al.* (2013) also reported ethnomedicinal plants of Paddar Valley of J & K. Its distinctive vegetation, which completely disappears on the eastern slopes, is dominated by a variety of commercially important plants that are vital to rural life. The region is situated in the dry temperate zone. The populace depends on plant resources for fuel, food, fodder, shelter, household goods, and traditional medical treatments for illnesses including cancer, gastrointestinal issues, and malaria. Knowledge of ethnobotany regarding medicinal plants might be helpful for drug development and community health care, as well as for the preservation of traditional cultures and biodiversity.

Shah *et al.* (2015) also discovered that in the Rajouri and Poonch districts of J & K, India, around 105 medicinal plant species were employed in the treatment of 40 non-communicable diseases, with 138 folk treatments reported from the tribal communities such as Bakkerwals and Gujjars, and that the leaves and other aerial portions of these traditional medicinal plant species were taken for food. Herbs were widely used in medicine, and the majority of these remedies were used to treat ailments in humans. Decoction was a common method of producing medicines, which further corroborated our findings.

According to Khanday and Singh (2017), earlier research on traditional medicinal plant species yielded similar results from the south Kashmir Himalayas, where the tribal community and some rural residents were discovered to be skilled at using these medicinal plants to treat a variety of health-related conditions, including headaches, mouth ulcers, spots, eye dilation, pain, dandruff, high blood pressure, asthma, back pain, high fever, coughing, constipation, and various skin-related infections. Kumar *et al.* (2017) found 45 medicinal plants from Ramnagar, Jammu and Kashmir, belonging to 31 families and 44 genera. The most significant plant for ethnomedicine was found to be herbs, with trees and shrubs coming in second. The vegetation in the area is diverse, ranging from alpine meadows on the highest slopes to subtropical flora. The goal of the current study was to

describe the ethnomedicinal uses of herbs that can be found in the area.

Dawa *et al.* (2018) reported on the condition of medicinal and aromatic plants in India's Jammu and Kashmir State. Medicinal and aromatic plants (MAPs) are sold both as raw materials and as finished products. The gathering and, more recently, marketing of (MAPs) have offered a significant source of money for mountain communities (Rodgers and Panwar, 1988). The sustainable usage of such plants is intimately linked to future potential for high elevations Himalayan. Mir *et al.* (2023) reported that 80 medicinal plants from 36 families were documented. Asteraceae was the most prevalent family in terms of taxa (11 species). Herbaceous taxa were the most prevalent life form, with leaves being the most widely utilized plant portion. Infusion was the primary method for extract preparation. Kashmiris utilize the most species (20%), while Gujjars use the fewest (16%).

Hussain *et al.* (2023) identified 80 medicinal plant species that have historically been utilized in the area to treat 17 illness types. The most often utilized plant components were roots and leaves, and medications were mostly administered orally in powdered form. The old people of Bhalessa possess valuable knowledge about medicinal plants, which has resulted in new information. These unique folkloric claims concerning the healing properties of medicinal plants deserve scientific proof. As a result, we advocate for targeted phytochemical research and thorough pharmacological validations of purported therapeutic benefits in the study region, notably for Himalayan endemic species. Kaur *et al.* (2023 a,b) also have reported gums, resin, tannins and dyes yielding plants from Kathua region of Jammu and Kashmir, which have different ethnomedicinal properties and used by local communities to cure various diseases.

The current study has identified 26 plant species that are utilized in this region for ethnomedicinal purposes. A key component of bioresource-based regional sustainable development can be the provision of baseline data for the sustainable usage of this plant

richness through the accurate taxonomic inventory of these medicinal plants and documenting of their traditional use. Understanding how to use these resources for basic healthcare will help raise awareness about the preservation and sustainable usage of these valuable plant resources. Moreover, the significance of this baseline data cannot be overstated, since it holds key leads for the future research and design of remedies. Because of this, the current study has mostly closed the knowledge gap by recording this important ethnomedicinal botany data from this Himalayan region. Raising awareness about the preservation and sustainable use of these priceless plant resources will be aided by knowing how to use them for primary healthcare. This baseline data is also important since it may provide crucial leads for the creation, advancement, and design of future treatments. Thus, the current study has, to a significant degree, addressed the knowledge vacuum by recording the valuable information of ethno medicinal plants of Topneel region of J & K.

During the survey, it was observed that almost every plant part was used such as leaves, fruits, roots, whole plant, seeds, flower, stem, bulb, tubers, aerial parts and roots, for treatments traditionally by the locals. The plant parts were used by them in different ways like by making their powder, paste, fresh juice, infusion, decoction and mixtures. These parts were traditionally used to treat different diseases like fever, cold, cough, allergies, constipation, cramps, heart disorders, respiratory diseases, etc. As these uses of the plants highlight their importance in daily life of the locals, conservation efforts should be made to preserve important medicinal plants the numbers of which are reducing day-by-day. The people of the region should be guided by administrative authorities of the area for the protection, preservation and proper utilization of the important plant resources in a sustainable way.

5. Conclusion

Overuse of these species has endangered some species that must travel kilometers to find, in addition to damaging the surrounding flora and causing the loss of scenic splendor. The primary drivers of the local flora were both direct (such as indiscriminate grazing and forest clearing for commercial and subsistence purposes) and indirect (such as population growth, poverty, and unclear land title). Because of inaccessibility, severe weather, and high altitudes, people must rely on wild flora for medical care. Cultivating these plants is not attracting much attention. Only a small percentage of these plants make it into people's home gardens, and some are restricted to growing in woods and grassy slopes. Because of these repercussions, there is an urgent requirement to safeguard of these natural riches before it is lost.

Moreover, research of this kind would be essential to the restoration, preservation, and planting of this special environment. The vegetation in the zone varied as much with altitude. The results of this study demonstrate that the growing season, which only lasted from April to September, was far too brief. Applying traditional knowledge to improve people's lives was hindered by the inaccessibility of the area, the absence of processing and suitable storage after harvest, the legal restrictions imposed by forest restrictions, the lack of a fixed price, and an inadequate market.

The region should be cultivated with an emphasis on rare availability and high value herbs, rather than the growth of unprofitable food crops, as well as a shift towards organized medicinal plant production

and sale. As a result, all efforts made by research and development organizations to conserve threatened herbal species and promote their cultivation *in situ* or *ex situ* would go a long way towards improving the socioeconomic status of this region while also preserving its traditional knowledge and resources. As a result, there is a need to properly review and document the accessible material in order to prepare it for future use. More research oriented and conservation based efforts should be focused on the area's resources so that in the near future, coming generation will get the benefits more than the present generation from these ethno- medicinal plant species, which are a wonderful gift to humanity.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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