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Article

Ethnobotanical survey of medicinal plants of Haridwar Forest Division, Uttarakhand, India

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Abstract: A reservoir of vegetation, wildlife, and medicinal plant abundance is represented by the Haridwar forest divisions. This study deals with the results of ethnobotanical survey of medicinal plants conducted in the Haridwar forest division during the period of December 2016 and March 2019. The information on folk medicinal use of plants were gathered by interviewing with local healers and Vaidya's who have long been advising the folk medicines for medication of various disorders. The important folk medicinal data of 33 medicinal plants species belonging to 22 families and 33 genera practiced by tribal and local people of the study area has been recorded by the survey team of the Institute. Fabaceae followed by the Lamiacea and Asteraceae were the dominant families. The species diversity showed maximum exploration of Trees, Herbs followed by Shrubs and Climbers. Leaves, seed and root were the most prevalently used part in study followed by the stem bark, fruit, flower, stem and fruit pulp. During the study it was observed that the traditional practices of Gujjars of Uttarakhand have close relation with forests and have strong dependency on the same for food, medicine, timber and fodder etc. The information recorded for the treatment in different ailments has been presented in the paper in the pie charts and tabular form. In the recorded information most of the plants along with Plant name, Family name, Voucher Specimen No., Local Name/Unani name, Part Used, Diseases/Condition and Habitat/ICBN status so as to enrich the existing knowledge on ethnopharmacology. Many of the medications used today have their roots in traditional knowledge of medicinal plants and indigenous uses of plant material, and there are still a plethora of potentially useful pharmaceutical chemicals to be found. In this regard, more in-depth field research could aid in the discovery of novel plant species utilized in indigenous medical systems to improve patient needs. With this aim this study was conducted to explore and trace the ethnobotanical potential of flora of the Haridwar forest division so that it could prove to be immensely advantageous for both the development of new medications to treat dreadful and catastrophic illnesses as well as for the study and preservation of cultural and social variety.

Keywords: ethnobotany; Gujjars community; Haridwar; survey; Shiwalik forest circle

1. Introduction

Since drug-resistant strains of recognized pathogens and with the constantly emerging new diseases, ethno-botanical leads are crucial for the discovery of novel active chemicals from natural sources, especially from plants. There are still a lot of possible medicinal compounds that have not yet been found, but traditional knowledge of medicinal plants and indigenous use of plant material have served as the foundation for many medications used today [1]. On the other hand, there is a chance that this priceless resource will be lost, endangering numerous indigenous cultures in addition

to the therapeutic plants themselves. However, the industry's attention, curiosity, and fascination to explore previously uncharted and explored places have put pressure on biodiversity due to the growing demand for herbal goods.

Haridwar is the South Western district in the State of Uttarakhand and Northern state of India and located on the border of Uttar Pradesh. The Haridwar forest division is one of the important areas of Shiwalik forest Circle which has rich natural vegetation and wildlife. The division is situated in the North latitude of 29°41′ to 30°05′ and between East longitudes of 76°04′ to 78°15′ and the area of the division is 359.13 Sq km. It is bounded by Rajaji National Park and Lansdowne Forest Division in the North, Muzaffarnagar district in the South, Bijnor district in the East and Saharanpur district of UP in the West. The areas are comprised by natural forests, rich biodiversity and a treasure of medicinal plants.

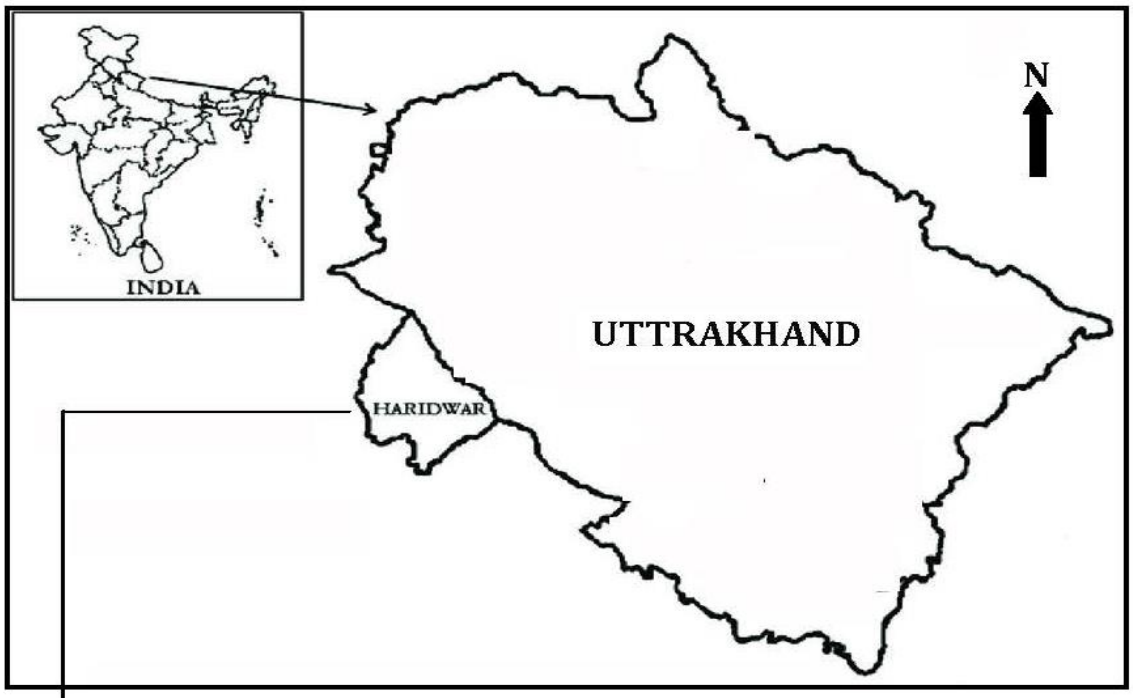
In Haridwar many of the areas are inhabited by Gujjars a nomadic tribal community of the study area and settled in different places of the forest division. The tribal community living close to nature acquired good knowledge about medicinal use of wild flora in which most of them are not known to the outside world. This rich knowledge of traditional system should be scientifically screened and to be brought in to the benefit of humanity for the treatment of many diseases and conditions. It has been reported that many of the floras of this region has been used in the traditional medicines [2–25]. In addition to the available published reports on medicinal plants and traditional herbal medicines this, study also recorded new folk medicinal uses which can be taken to the clinical research in the future. Out of 130 taxa of medicinal plants collected and identified from the study area 32 are intensively used in folk medicines by Gujjars for the treatment of various ailments. However, there is more scope for exploration of tribal dominated areas to record more and more information on medicinal and other uses of plants prevalent among this community. The study adds to our current understanding of the ethnomedicinal flora in this region of the Shiwalik Forest Circle.

2. Methodology

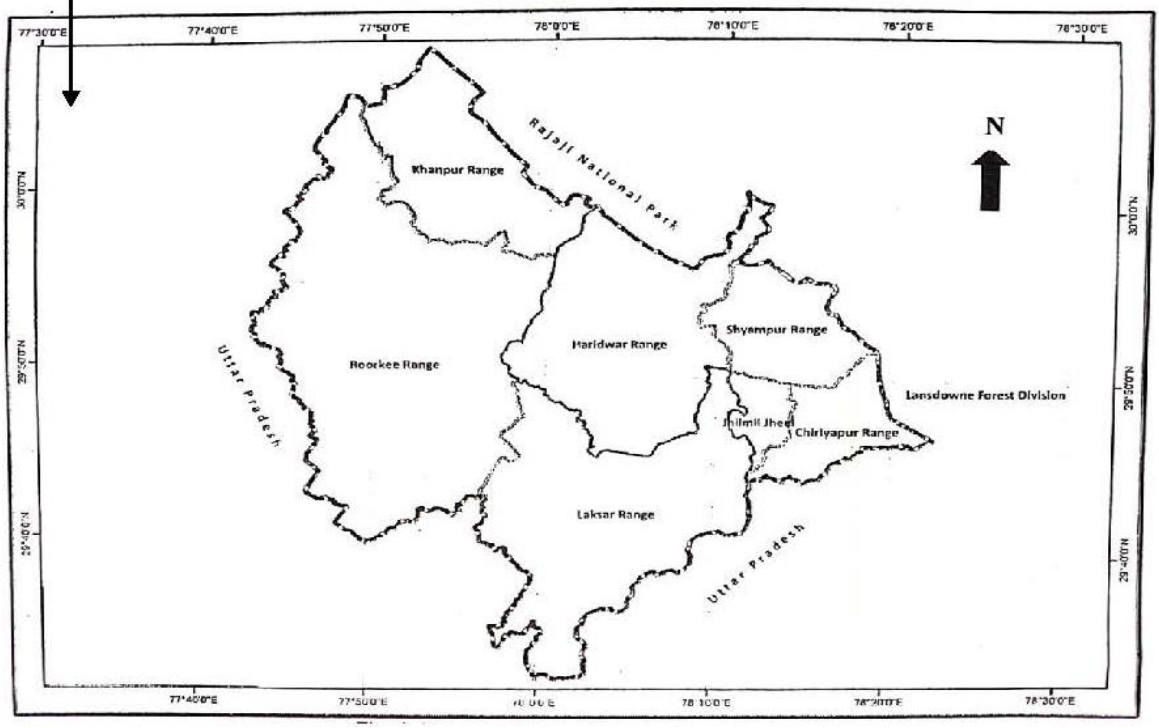
The study area was surveyed in December 2016 and March 2019 with a view to study the medicinal plants of the area and also to record folk-wisdom of tribal's. The sampling was randomly laid in six ranges namely Shyampur, Khanpur, Chiriyapur, Laksar, Haridwar, Roorkee and Jhimil Jheel. The important forest areas visited during field studies included, Haridwar, Shyampur, Pilipadao, Mithiberry Rasoolpur, Pilichoki, Haripur, Khanpur, Budhwa Shaheed, Chiriyapur, Kotawali, Rasiyabad, Pathri Bahadrabar, Roorkee, Tibri and Laksar (**Figure 1**).

The information on folk medicinal uses of plants were obtained by first hand data, collected through interviewing local healers, who accompanied the survey team to the field or the tribal's who have long been prescribing the folk medicines for treatment of various diseases (**Figure 2**). The study has uncovered several fascinating ancient healing techniques used by the indigenous people of forest area of Haridwar. Plant specimens were collected and identified by the senior author with the help of pertinent floras [5,26–31]. While most of the time, botanical specimens were recognized and verified at the Botanical Survey of India in Dehradun. All voucher specimens were

prepared and deposited in the herbarium of the Survey of Medicinal Plants Unit, Regional Research Institute of Unani medicine, Aligarh (UP), India.



(a)



(b)

Figure 1. (a) Map showing the area of study in Haridwar District, Uttrakhand, India; **(b)** Haridwar Forest Division, Uttrakhand.

Figure 2. Ethnobotanical survey photographs of the study area of the Haridwar Forest Division.

3. Results and discussion

Traditional phyto-therapy is a skill performed chiefly by limited older people whose empirical knowledge is respected by everyone in the village and tribal settlements. This study presents some traditional and contemporary knowledge about the medicinal use of plants used by the Gujjar people in the forest around Haridwar. With the assistance of certain floras from the study region, medicinal plants were gathered and identified used in folk medicines by Gujjars for the treatment of various ailments. The data on plants species collected has been presented in table. Plant species in the table have been arranged in alphabetical order with their botanical name, voucher specimen number, local name/Unani name (if available), part used followed by disease/condition. A total of 33 plant species belongs to the 22 families were collected during the survey program from the study area (**Table 1**). The highest number of the ethnomedicinal plants were reported from Fabaceae, followed by the Lamiacea, Asteraceae, Apocynaceae and Rutaceae while rest of the families contributed one species each (**Figure 3**). This represents the prevalence of the family in the particular rea. It has been observed that different part of the plant viz. root, fruit, leaves, flowers, seeds, fruit pulp, aerial part, stem, stem bark and inflorescence are used as the ethnomedicine in the study. Among the numerous plant part explored leaf

is the most important part that has been explored maximally followed by the seed and root as the ethnomedicine. While leaf pulp, fruit pulp, inflorescence and aerial part occupy the least position in consuming as the medicine (**Figure 4**). In addition to this most of the plant's species used by the Gujjar community belongs to the tree form followed by the herbs, shrubs, climbers and least from the creeper (**Figure 5**). It has also been envisaged from the study that most of the plants explored as ethnomedicine by the gujjar community were common and only a very few endangered plant species such as *Asparagus adscendens* Roxb., *Oroxylum indicum* (L.) Kurz., *Litsea glutinosa* (Lour.) C.B., were explored as the ethnomedicinal use (**Figure 6**). A total of 33 plant species documented were used for curing or alleviating different diseases and conditions viz. Cough, Boil, Cut and wounds, Pimples, Lactation, Epilepsy, Dhobie itch, Constipation, Dysentery, Family planning, Bone fracture, Irregular menses, Jaundice, Hydrocele, improve hearing, Backache, Ringworm, Spermatorrhoea, conception, Diabetes and many complaints of domestic animals (**Figure 7)**.

The usual methods of application of folk medicines are as decoction, paste, powder, juice and pills. These are taken internally or applied externally. The data on folk medicinal uses have been compared with recent available literature [2,25,32–41] and found that most of the folk medicinal plants (*Abrus precatorius* L., *Achyranthes aspera* L., *Aegle marmelos* (L.) Correa, *Aloe vera* (L.) Burm. f., *Asparagus adscendens* Roxb., *Barleria prionitis* L., *Caesalpinia bonduc* (L.) Roxb., *Glycosmis pentaphylla* (Retz.) DC., *Helictere sisora* L., *Ocimum tenuiflorum* L., *Rauvolfia serpentine* (L.) Benth. ex Kurz., *Tinospora sinensis* (Lour.) Merr., *Vitex negundo* L. and *Withania somnifera* (L.) Dunal) are duly reported in the literature, however, their mode of application, ingredients and parts used are different. Furthermore, many phyto-therapeutic applications coincide with those of other part of Uttarakhand [42–52]. Therefore, the present study represents contemporary folk uses of medicinal plants of the area investigated. It would be worthwhile to subject all these folk drugs to scientific testing in the context of claims reported herein. In the course of fieldwork, it was observed that this ancestral knowledge of medicinal plants is in danger of being lost because of the lack of interest of younger generation in traditional system. It was, therefore, considered important that this valuable knowledge regarding folk medicinal uses of plants be recorded before these time-tested uses of herbal drugs are lost forever.

Table 1. Ethno-pharmacological uses of plants collected from Haridwar Forest Division, Uttarakhand India.

S.N.	Botanical name Voucher Specimen No:	Family	Local name/ Unani name	Part Used	Diseases/Condition	Habitat/ IUCN Status
1.	*Abrus precatorius* L. SMPUA 10277	Fabaceae	Lallari/ Ghunghchi	Root	Cough	Climber/ Common
2.	*Acacia catechu* (L.f.) Willd. SMPUA 10585	Mimosaceae	Khair/Kaith	Stem bark	Stomatitis	Tree/ Common
3.	*Achyranthes aspera* L. SMPUA 10238	Amaranthaceae	Parkanda/ Chirchita	Root	Boil	Herb/ Common
4.	*Aegle marmelos* (L.) Correa SMPUA 10290	Rutaceae	Bel/Belgiri	Fruit pulp	Expel out placenta (In Buffaloes)	Tree/ Common
5.	*Ageratum conyzoides* (L.) L. SMPUA 10295	Asteraceae	Sarenda	Leaf	Cut and wounds	Herb/ Common

Table 1. (*Continued*).

S.N.	Botanical name Voucher Specimen No:	Family	Local name/ Unani name	Part Used	Diseases/Condition	Habitat/ IUCN Status
6.	*Aloe vera* (L.) Burm. f. SMPUA 10330	Liliaceae	Gheekawar/ Sibrezard	Leaf pulp	Pimples	Herb/ Common
7.	*Asparagus adscendens* Roxb. SMPUA 10261	Asparagaceae	Satawar/ Satawar	Root	Lactation	Climber/ Endangered
8.	*Barleria prionitis* L. SMPUA 10228	Acanthaceae	Kalabansa	Aerial parts	Cough	Shrub/ Common
9.	*Butea monosperma* (Lam.) Taub. SMPUA 10311	Fabaceae	Tesu/Palas	Flowers	Anuria (In Cattle)	Tree/ Common
10.	*Caesalpinia bonduc* (L.) Roxb. SMPUA 10236	Fabaceae/	Karjua/ Karanjwa	Seeds	Epilepsy	Shrub/ Common
11.	*Clerodendrum cordatum* D. Don SMPUA 10226	Lamiacaeae	Kadu	Leaf	Kill lice (In cattle)	Shrub/ Common
12.	*Cuscuta reflexa* Roxb. SMPUA 10241	Covovulaceae	Amarbel/ Kasoos	Stems	Boil	Climber/ Common
13.	*Diospyros cordifolia* Roxb. SMPUA 10245	Ebanaceae	Kendu	Fruits	Dhobie itch	Tree/ Common
14.	*Glycosmis pentaphylla* (Retz.) DC. SMPUA 10308	Rutaceae	Pilru	Fruits	Constipation	Shrub/ Common
15.	*Helicteres isora* L. SMPUA 10213	Sterculiaceace	Kapasi/ Marorphali	Fruits	Dysentery	Shrub/ Common
16.	*Holarrhena pubescens* Wall. ex G. Don SMPUA 10239	Apocynaceae	Kura/ Teewaj	Stem bark	Gastric trouble (In cattle)	Tree/ Common
17.	*Lawsonia inermis* L. SMPUA 10312	Lythraceae	Desimehndi/ Hina	Leaves	Family planning	Small tree/ Common
18.	*Leucas cephalotes* (Roth) Spreng. SMPUA 10233	Lamiaceae	Gummad/ Gumma	Inflorescence	Fever	Herb/ Common
19.	*Litsea glutinosa* (Lour.) C.B. Rob. SMPUA 10246	Lauraceae	Chandna/ Maidalakri	Stem bark	Bone fracture	Tree/ Endangered
20.	*Mimosa pudica* L. SMPUA 10331	Fabaceae	Lajwanti/ Lajjalu	Seeds	Irregular menses	Herb/ Common
21.	*Ocimum tenuiflorum* L. SMPUA 10306	Lamiaceae	Tulsa	Leaves	Jaundice	Herb/ Common
22.	*Oroxylum indicum* (L.) Kurz. SMPUA 10306	Bignoniaceae	Ullu	Seeds	Hydrocele	Tree/ Endangered
23.	*Oxalis corniculate* L SMPUA 10302	Oxalidaceae	Chukha	Leaf	Improve hearing	Creeper/ Common
24.	*Rauwolfia serpentine* (L.) Benth. ex Kurz. SMPUA 10295	Apocynaceae	Sarpgandha/ Asrol	Root	Fever	Climbing shrub/ Cultivated
25.	*Senna occidentalis* (L.) Link SMPUA 10229	Fabaceae	Chakunda/ Kasondi	Leaf	Boil	Herb/ Common
26.	*Sida cordata* (Burm.f.) Borss.Waalk. SMPUA 10268	Malvaceae	Kharenti	Seeds	Backache	Herb/ Common
27.	*Tagetes patula* L. /SMPUA 10305	Asteraceae	Genda	Leaf	Ringworm	Herb/ Common
28.	*Tinospora sinensis* (Lour.) Merr. SMPUA 10280	Menispermacea e	Gilo/ Gilo	Stem	Fever, Poliomyelitis	Climber/ Common
29.	*Trichosanthes tricuspidata* Lour. SMPUA 10329	Cucurbitaceae	Kanchan	Seeds	Cold in cases of cattle	Climber/ Common

Table 1. (*Continued*).

S.N.	Botanical name Voucher Specimen No:	Family	Local name/ Unani name	Part Used	Diseases/Condition	Habitat/ IUCN Status
30.	*Tridax procumbens* L. SMPUA 10234	Asteraceae	Ghavpatta	Leaf	Bleeding from cut	Herb/ Common
31.	*Vitex negundo* L. SMPUA 10234	Lamiaceae	Mala/ Sambhalu	Leaf	Spermatorrhoea	Tree/ Common
32.	*Withania somnifera* (L.) Dunal SMPUA 10810	Solanaceae	Aswagandha/ Asgandh	Root	Conception	Shrub/ Cultivated
33.	*Ziziphus mauritiana* Lamk. SMPUA 10230	Rhamanaceae	Ber/ Ber	Fruit	Diabetes	Tree/ Common

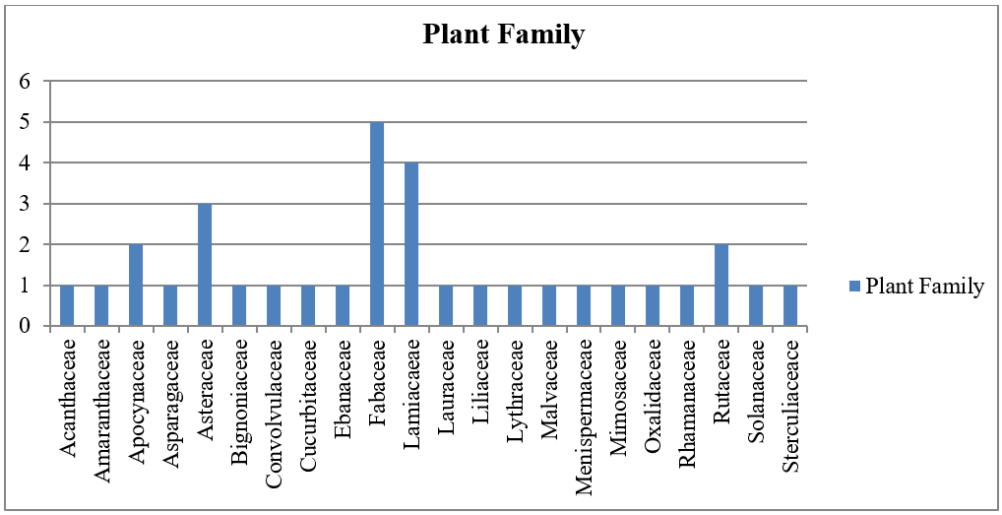


Figure 3. Family of the plant used as Ethno medicine by the Gujjar Community of Haridwar Forest division of Uttarakhand.

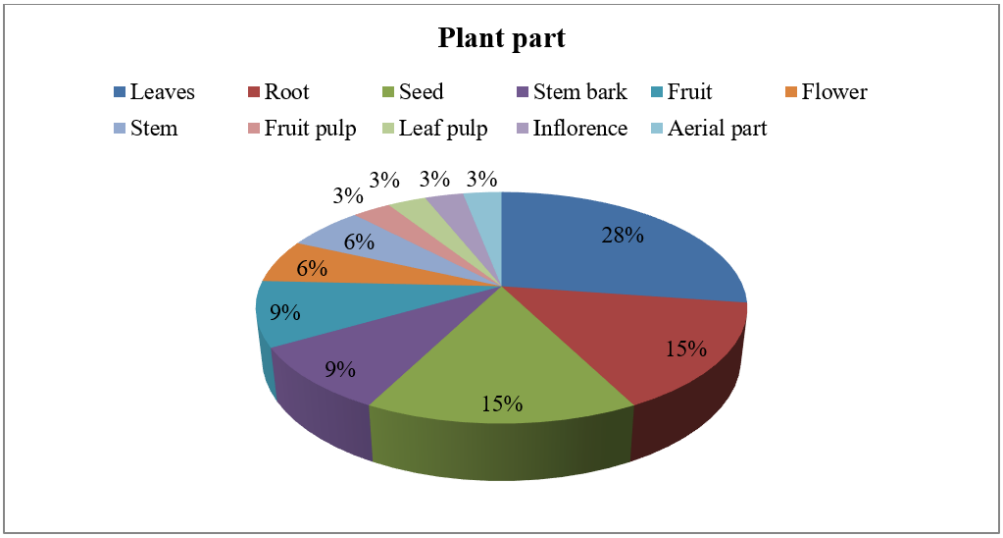


Figure 4. Plant parts were used as Ethno medicine by the Gujjar Community of Haridwar Forest division of Uttarakhand.

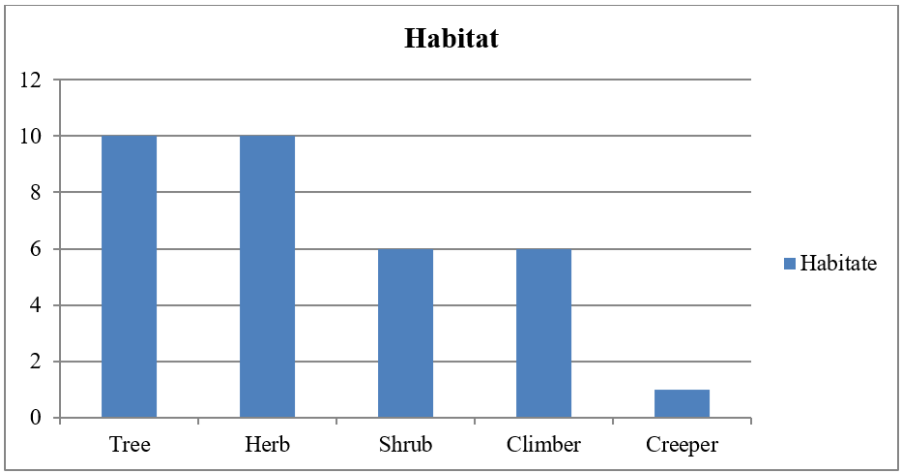


Figure 5. The life forms of different species used as Ethno medicine by the Gujjar Community of Haridwar Forest division of Uttarakhand.

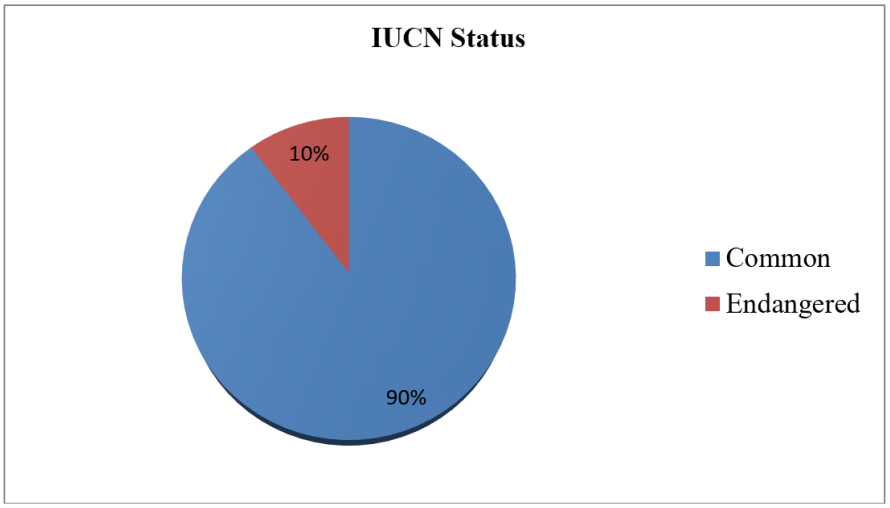


Figure 6. Status of the plant used as Ethno medicine by the Gujjar Community of Haridwar Forest division of Uttarakhand.

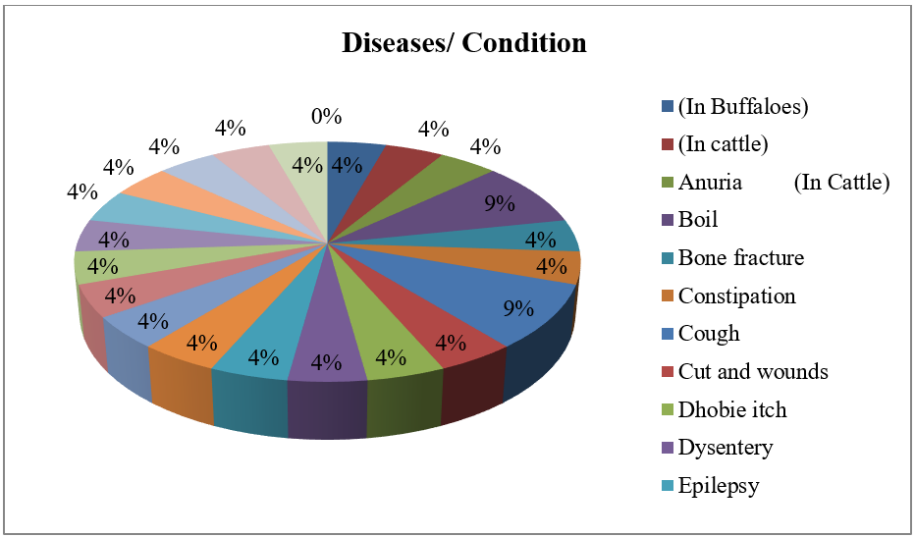


Figure 7. Plant used as Ethno medicine in different diseases by the Gujjar Community of Haridwar Forest division of Uttarakhand.

4. Conclusion

The social, spiritual, economical and medical spheres of rural and tribal lives in the Himalayan states had a significant place for traditional medicinal and fragrant plants. This local traditional knowledge and undocumented reservoir of natural resources in the form of raw drug formulation are the prime ground for their livelihood and this is disseminating from generation to generation verbally. But in the modern time, the globalization, climate change and urbanization, has led to the depletion of the natural resources and additionally the advancement in the Allopathic medical system and scarcity of the concern and shortfall of the documents has made the conditions more vulnerable. This research will be extremely beneficial not only for the investigation and preservation of cultural and social diversity but also for the creation of new drugs to treat terrible and catastrophic illnesses.

Author contributions: Conceptualization, PA and MA (Mokhtar Alam); methodology, PA and MA (Mokhtar Alam); formal analysis, MA (Mohd Asif) and PA; investigation, MA (Mohd Asif), PA and MA (Mokhtar Alam); resources, MA (Mohd Asif) and PA; writing—original draft preparation, PA and MA (Mohd Asif); writing—review and editing, MA (Mohd Asif), MA (Mokhtar Alam) and KV; supervision, MA (Mokhtar Alam) and NZA. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest: The authors declare no conflict of interest.

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