Ethnomedicinal knowledge of a marginal hill community of Central Himalaya: Diversity, usage pattern and conservation concerns

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Abstract
Background Indigenous communities use wild plants to cure human ailments since ancient times, such knowledge has significant potential for formulating new drugs and administering future health care. Considering this the present study was undertaken to assess use value, diversity, and conservation concerns of medicinal plants used in traditional herbal care system of a marginal hill community in Bageshwar district of Uttarakhand in the Central Himalayan region of India.

Methodology Extensive surveys were made in 73 villages to gather information on ethnomedicinal use of plant species used in traditional herbal healing system. A total of 100 respondents were identified (30 herbal healers called ‘Vaidyas’ and 70 non-healers/natives) and interviewed using semi-structured questionnaires, target interviews and group discussion. Some important indices such as the use value index (UV), relative frequency citation (RFC), cultural importance index (CI), and informant consensus factor (F ic ) were calculated for the medicinal plants included in the present study.

Result It was recorded that the community use a total of 70 species with 64 genera and 35 families for curing various ailments. Family Lamiaceae recorded maximum number of medicinal plants. 21 species used most extensively in traditional health care system. The major parts of the identified plants used for treatment of various ailments were root/rhizome and leaf. The most common methods used for preparation of these plants were decoction and infusion. Ocimum basilicum L., Cannabis sativa L., Citrus aurantifolia (Christm) Sw., Curcuma longa L. and Setaria italic L. had the highest rate of use report. RFC value ranged between 0.03 to 0.91 with highest values for Setaria italic, Zingiber officinale, Ocimum basilicum, and Rephanus sativus . The traditional knowledge is passed verbally to generations and needs to be preserved for the future bio-prospecting of plants that could be a potential cure to any future disease.

Conclusion In recent years the community has access to modern hospitals and medicinal facilities, although a considerable number still prefer medicinal plants for curing select ailments. It is suggested that these ethnomedicinal species need to be screened and evaluated further for their effectiveness for pharmacological activity. Also, significant efforts are required to conserve traditional knowledge and
natural habitats of wild medicinal plants.

Introduction

Medicinal plants have been utilized for the treatment of various diseases since ancient time, thus form an important element of aboriginal curative systems. The Indian Rishis first documented the use of medicinal plants in the form of Samhitas. Charak Samhita (1000-800BC) and Shushrut Samhita (800-700BC) by Maharshi Charak and Maharshi Shashurut respectively, are the baselines of the Indian Medicinal System. Maharshi Charak mentioned over 500 medicinal plants, out of which 340 plants used in the production of herbal medicine[1-2]. AYUSH (i.e. Ayurveda, Unani, Siddha, and Homeopathy) is another traditional Indian healthcare system that is considered a great knowledge-based in herbal medicines. Ayurveda reports over 2000 medicinal plant species, Siddha 1121 plant species, Unani 751 species, and homeopathy 422 species[3]. Nearly 70-80% population worldwide still relies on traditional medicinal systems for their primary healthcare because of their effectiveness, cultural preferences, and lack of modern healthcare alternatives[4-5]. The global demand for herbal medicine continues to increase over the past few decades. The earlier studies stated that out of 2,50,000 flowering plants in the world only less than 10% have been examined successfully for their medicinal potency and still, 90% remains unexplored[2]. In recent times there is an increased interest regarding use of medicinal plant to develop new drugs and medicines for fulfilling the demand of growing population[6-8]. Therefore information on plants of ethnomedicinal importance holds high potential. Uttarakhand Himalaya is a mountainous region in the northern India that has unique geography, rich biological resources, cultural heritage and diverse climatic conditions which supports the highest number of medicinal plant species[9]. Over two-third population live in rural areas and depend on diverse natural resources to fulfil their need of food, fuel, fodder, timber, medicine, etc. Communities use large variety of medicinal plants for treating diverse ailments[10-11]. However, it is strongly being realized that the indigenous knowledge related to herbal medicines is continuously being eroded despite of high significance to humanity. The subject needs further research such as documentation of potential medicinal species, analyzing their active constituents, clinical trials for validations, and developing new drugs and medicines[1,4,8-12]. Considering this the present study
was undertaken. We hypothesize that sustainable management and conservation of medicinal plants can be achieved when information about medicinal plants that are utilized for treating ailments and traditional herbal practices within particular areas are available. Such information is strongly desired to be preserved from being lost for the use of both present and future generations. For the purpose of this study we selected marginal community and local herbal practitioners (Vaidyas) of Bageshwar district in Uttarakhand state in north India and documented ethnomedicinal plant diversity and traditional medicinal practices being used by them. Efforts are also made to scientifically validate and interpret the data using several indices such as Relative Frequency Citation (RFC), Use report (Categorical and disease-based), Cultural Importance Index (CI), and Informant Consensus Index (F_{CI}) so as to verify the homogeneity, importance, cultural similarity of the medicinal plants in communities. It is expected that the qualitative and quantitative information generated from this study will have immense utility for conservation and sustainable utilization of medicinal plants as well as for managing traditional health care system.

Materials And Methods

Study area

The aim of this study was to investigate the medicinal species used by the marginal hill community living in remote and high-altitude areas where medical healthcare facilities are not easily available. These practices are being used since eternity descended from the inherited knowledge of the locals and indigenous population of Uttarakhand. The study was carried out at Bageshwar district (geographical area 1687.8 km\(^2\)) of Uttarakhand State and lies between latitudes 29°42'40” to 30°18'56”N and longitudes 79°23' to 80°10'E (Fig.1). The district is situated on the confluence of Gomti river and Saryu river which is a tributary of Kali river. It is bounded by Almora district in the southwest, Chamoli district in the north and northwest, and Pithoragarh district in the east. Administratively the district is divisible into four Tehsils, viz. Bageshwar, Kapkot, Kanda (Sub-tehsil) and Garur, and three blocks, viz. Bageshwar, Garur and Kapkot. There are 947 revenue villages, out of which 874 villages are inhabited and 73 villages are uninhabited. As per the 2011 census the total population of Bageshwar district is 270,332. 259,898 (male 48%, female 52%) with 96% living in the
rural areas. The community of the area divided into 3 categories viz., General, Scheduled Class (SC), Scheduled Tribe (ST), and majority of them involved in primary sector (agricultural activities), while some also work in secondary and tertiary sectors, such as private works, businesses, govt. jobs etc. As such the community is highly marginal with small and scattered land holdings, low production and low income; therefore, highly dependent on natural resources. Male population out-migrates to earn better livelihoods that lead to continuous increase in fallow lands and culturable waste lands.

**Data collection:**

The study was conducted in 39 villages covering Garur-Ganga valley (23 villages) and Saryu valley (16 villages) of Garur and Kapkot Blocks during 2016-2018. To fulfil the objectives of the study, extensive field visits were made to gather information from traditional herbal healers (Vaidyas) and indigenous people using semi-structured questionnaires, target interviews, visual interpretation through snowball methodology. A total of 100 respondents were randomly selected for the present study from both valleys, 37 being male and 63 female respondents. Of them 30 were Vaidyas (male 19, female 11). Female informants were given preference in view of their dominance in villages when selecting the population due to their dominancy in household and foraging sector. The age group of informants varied between 30 to 83 year although most of them vary between 50-65 years of age(Fig.2). The questionnaire contains information about the ethnomedicinal plants with their local name, parts used, habit, ailment treated by medicinal plants and mode of utilization of herbal formulation. Two general meetings and interviews were also organized at each valley with Vaidyas and natives. The documented medicinal plant species were collected and validated for identification using available literature[13-16],The specimens matched with the herbarium lodged in CCRAS-RARI, Tarikhet, Ranikhet, Uttarakhand (acronym RKT), which houses largest medicinal plant herbariums in the northern India. A few generally available species were matched with the plant database of Centre for Socio-Economic Development deposited at G.B. Pant National Institute of Himalayan Environment (GBP-NIHE), Almora, Uttarakhand.

**Ethno-botanical Analysis**
The information on ethnomedicinal important species were recorded including the local names of the species, habit, their uses in different forms, the part used in the medical practice, mode of administration and the condition of the plant (fresh or dry). The plants were classified into 12 main categories of ailments which were further divided into different respective sub-categories on the basis of disease and affected body part. The data were then statistically analyzed for different parameters. In order to enhance the indicative value of the ethnomedicinal study suitable quantitative methods and approaches were used in the form of indices, such as relative frequency of citation (RFC); use report (on the basis of illness, on the basis of taxa); cultural importance (CI) and consensus factor of informants ($F_{ci}$).

**Use Report Values (UR)** provides information on the total number of reported uses for each species. It is similar to the use-value of a species but for use report, the number of events (interviews) the process of asking one informant on one day about the uses they know for one species, is one because the respondents were interviewed only once. And response use values are broken down by the number of uses reported for each plant species part.

**Use Value Index (UV)** depicts the importance of each species for each informant and calculated by $UV = \Sigma U/N$ formula where $U$ is the number of uses quoted in each interview by $N$ number of informants. Use values are high when there are many useful reports for a plant representing its importance, and come within reach of to zero (0) when the use reports are low[17].

**Relative Frequency Citation (RFC)** index reveals the usage importance of a particular species used by different informants. The index is calculated by dividing the total number of informants referring to a particular taxon with the total number of informants given ($RFC = FC_s/N$) Where $FC$ is the total number of informants that referred to the taxon and $N$ is the total number of informants[18].

**Cultural Importance Index (CI)** is estimated for each locality as the summation of Use-Report (UR) in every use category mentioned for a species in the locality divided by the total number of informants. This index provides an implication of the involvement of a particular taxon in the community and a greater value signifies that a particular is widely distributed amongst communities.
A null value indicates non-existence of the species in the area. CI is calculated as: \( CI = UR/N \) where \( UR \) is the total number of use reports for each species in every category of illness mentioned and \( N \) is the total number of informants[19].

**Informant consensus Factor** (\( F_{ic} \)) is used to test the consistency of information knowledge in treating a particular illness category. The values obtained, are near one (1) if there lie well-defined selection criteria in the community and/or if the information is exchanged between the informants. A value approaching zero (0) represents that the plants are chosen randomly and/or there is no information exchanged between the communities about their use. \( F_{ic} \) is calculated as \( F_{ic} = (N_{ur} - N_t)/(N_{ur} - 1) \). Where \( N_{ur} \) refers to the number of use reports for a particular use category and \( N_t \) refers to the number of taxa used for a particular use category by all informants [20].

**Result And Discussion**

**Ethnomedicinal uses of plants and mode of practice**

The residents of different age groups were surveyed to assess ethnomedicinal uses of plant species (Fig. 2). The survey revealed that a total of 70 medicinal plant species varying from 35 families and 64 genera have been used by the inhabitants of 39 villages for different (Table 1). Family Lamiaceae recorded maximum species (8) followed by Asteraceae (6 species), Fabaceae (5 species), Rosaceae (4 species) and Apiaceae, Liliaceae, Ranunculaceae, Rutaceae, Zingiberaceae (3 species each). The remaining families were represented with just one or two species. Almost all the species are widely used by the community. Of the total documented medicinal plant species the herbaceous habit (51 species) was most dominant life form, followed by the tree (10), shrub (7) and climbers (2 species) (Fig.3).

It was interesting to note that nearly 70% population still use prescription of Vaidyas for common ailments, although the Vaidyas were having an age of >50 years. The diseases cured by Vaidyas comprised fever, stomach problem, cough, cold, headache, etc. from centuries. The most common plant parts used was root/rhizome, followed by leaf, whole plant, seeds, fruits, flower, and bulb and latex (Fig. 4). The collection of plant part was very selective keeping into consideration the time of collection, plant matureness, and quantity of use thus ensuring a conservation approach. Vaidyas
comprised sound knowledge and species-specific method of preparing drugs to cure various ailments (Table 2). Making decoction and ingestion was the most common modes of plant part use (Fig.5). Poultice and cooking were also favored for many medicinal plants. Another mode of application include cooking and making into powder (9.42%), direct application (7.97%), emulsion and infusion (5.80%), and ointment (2.17%) (Fig. 5). Decoction is most commonly used method to cure ailments in traditional herbal systems [38-42]. It is considered to extract all potential bioactive compounds after heating [43]. The pleasant taste of the herbal drug can be attuned by adding together honey or sugar [44]. Ingestion and poultice was also common after crushing and/or mixing the plant parts with some solvent for application as paste and band-aid. In skeletal, muscle and dermatological issues application of plant parts as ointment was most prevalent.

The community and Vaidyas identify each medicinal plants with a specific vernacular name. For example, *Berginia ciliata* is identified by the community with a local name‘Pattharchatta’ (stone destroyer) and it is used in curing kidney stone. *Plantago ovate* is called ‘Jonkpuri’ (jonk resembles worms) is used in the treatment of Ascaris and other worms. *Viola betonicifolia* named as ‘Garur-Jadi’(Garur means eagle) and it is used as an antidote to treat snake bites. It is common that community identify a native name for species based on its local uses, ecology, physiology, anatomy, pharmacological activity, etc.[45].

It was recorded that the species were used to cure a total of 12 major ailments (Fig. 6). Most species were used for curing gastrointestinal and general health disorders. It was followed by species used for treating dermatological and respiratory problems.

Lamiaceae has been the most dominating family for ethnomedicinal uses in trans-Himalayan zone of Nepal [26] and Garhwal Himalaya in India as well [27]. Although the people in remote areas are still dependent on the traditional herbal cure system, it is being practiced by a few elderly people only. Young generation is not interested to take up this profession in view of minimal profit [3,10,12]. The common plant part in the present study is similar to other investigations [28-32]. The roots being the storage part of the plant it contains valuable bioactive compounds [33]. Apart from the root part, leaves also contain a high concentration of health-beneficial secondary metabolites,
phytochemicals, and essential oils, which contribute significantly to phototherapy or treatment of various health disorders [34-37]. The study reports 60% more species than reported earlier for the area under investigation [21-25].

**Quantitative analysis of ethnomedicinal information**

Use value of important ethnomedicinal species was also calculated to depict number of uses reported by the informants related to the utility of a species for a specific ailment or different ailments (Table 1,3). Two forms of use reports were analyzed; the URc defines use of a particular species to cure specific ailments as reported by all the informants, while URd reports the sum of all the uses for a particular disease/ailment. *Ocimum basilicum, Cannabis sativa, Citrus aurantifolia, Curcuma longa* and *Setaria italica* have been top positioned in terms of use-reports and different ailments cured. The usefulness of a species can be represented through its RFC value, which ranged 0.03 to 0.91 for different species (Table 1). Species with maximum RFC value were *Setaria italica, Zingiber officinale, Ocimum basilicum, and Rephanus sativus* which depict their higher use, while those with least value comprised *Duchesnea indica* and *Thalictrum foliosum*.

The Cultural importance index (CIc) specifies the distribution and importance of species in traditional herbal system and the value ranged from 0.03 to 0.97. A total of 21 species have been identified as most commonly used (Table 3). *Ocimum basilicum, Cannabis sativa, and Citrus aurantifolia* registered highest cultural importance in traditional herbal cure system. Low CI values specify that these species are either least used or their use is declining up in traditional herbal cure system [49].

An analysis of Informant Consensus Factor (Fic) for 12 broad treatment categories most ranged between 0.92 to 1.0 (Table 4). The data revealed high homogeneity as per local people for all treatments. Immuno-regulatory category was assigned the value 1 due to presence of only one taxa in the particular category. Apart from this, hepatic health care and urogenital categories obtained the value of 0.98 indicating a well-defines criteria among the local population and non-random selection of species for the ailment category. *Asparagus recemosus, Glycine max, Hordium vulgare, Polygonatum cirrhifolium, Punica granatum, Rephanus sativus* and *Urtica dioica* not only used in
hepatic health care but also provide nutritive benefits and warm-potency particularly at higher altitude areas. These species are commonly used in daily food habit of the local community. Also, a higher value of $F_{ic}$ verifies the distribution of the different species used for a specific ailment. The urogenital category, with only 4 taxa included comes second in terms of CI as there is a widely accepted notion of using these species for such disorders. The higher value of informant consensus factor for all the ailment categories also imply that the documented species are the most commonly used thin traditional healing system.

The gastrointestinal ailments comprised of 695 use reports from the total categories with a medicinal importance index value of 30.22 (Table 4). Some most sought species in this category are Cannabis sativa, Citrus aurantifolia, Angelica galuca, Ajuga parviflora, and Emblica officinalis. These species are placed in accordance with their use reports mentioned during data collection. In the category of general health care, 22 species are being used with 524 numbers of use-reports & medical importance of 23.82. The species indicated with the highest number of use-reports are Ocimum basilicum, Citrus aurantifolia, Curcuma longa, Ajuga parviflora and Picrorhiza kurrooa on the basis of user reports. Dermatological category ranks third with 21 taxa in use and use report value of 617 and medicinal importance of 29.82. The main species employed for this category on the basis of use reports are Setaria italica, Eupatorium adenophorum, Artemisia martima. Although the hepatic health cure category comprised of only 8 taxa, it has a medicinal importance index values of 45.50, which is highest of all the categories since the species used under the category are of daily usage and are often included in daily food products with nutritive values. The species include Glycine max, Hordium vulgare, Punica granatum, Urtica dioica, Polygonatum cirrhifolium etc. In other works carried out in Uttarakhand, they were reported these medicinal plants and use different plant parts in different ratio to cure disease or ailments [16,21-23,25,27,28,46-48].

A correlation analysis was done among RFC, CI, UR, number of species used in treating different ailments, Informant consensus factor ($F_{ic}$) and Medical Importance. No evidence of any correlation was observed in most of the parameters, a highly positive correlation was only observed in Number of
taxa used and number of use reports (0.963). Also, there has been a moderately positive correlation observed between $F_{ic}$ and RFC which is of no significance in the study as both the parameters have been described differently.

Some species are also used in ethnoveterinary purposes for curing domestic animals. *Ajuga parviflora* is used to cure throat infection, *Coriandrum sativum* against poison, *Taraxacum officinale, Verbascum thapsus* and *Viola canescens* to increase lactation in milching animals.

**Weakening of traditional ethnobotanical knowledge**

It is alarming to note that there has been continued decline in traditional ethnobotanical knowledge in the target area (Fig.7). An analysis of community perception on change in use pattern of medicinal plants in 2018 and a decade earlier (i.e. 2008) revealed that there are less number of species used for curing different ailments in recent years (Table 5). People are moving away from traditional herbal cure system and the young generation has no interest in the traditional customs and values. Earlier the people of remote areas preferred to consult with Vaidyas for primary healthcare but for last one decade since there is an increase in accessibility, availability and affordability towards the allopathic medicinal system, the local community is also opting for such options. Despite of that 57% of the total respondents believe that these plants are highly effective, 30% found moderately effective, while only 13% feel it less effective (Fig. 8). Interestingly, to cure selective diseases in children, such as *Juga* (removal of Ascaris), *Chupad* (heavy cough), and *Kasar* (constipation) still people prefer traditional cure system as it has no side effects. During the study it was observed that the Vaidyas do not share their knowledge, they believed that the treatment will not be effective if they share the knowledge with anybody. In the changing lifestyle and socioeconomic scenarios, most of the inhabitants are reluctant to live with their traditional heritage leading to the vanishing of the knowledge [50].

**Conclusion**

Community knowledge on use and management of wild plant resources has always been integral to the survival, sustenance and adaptation of human cultures [46,50,56]. This study revealed 70 medicinal plant species being used by local marginal community of which 21 are most extensively
used species to treat various ailments. The significance of traditional herbal healing system is highly relevant due to its effectiveness. It is cost effective and based on local resources, and still only means of cure for marginal communities in remote localities. Uttarakhand and with population growth and lack of health care there is a need to adhere to the locally available resources to be utilized for general health care and provisioning of suitable side-effect free treatment to the communities. The community still use these species, however the level of use is decreasing in view of upcoming modern allopathic based health-care services. At the same time there is also a decline in number of local Vaidhyas and herbal practitioners. This is because increased access to modern hospitals and medicinal facilities in recent times. This possess significance challenge to the continuity of traditional herbal cure system. The impoverishment of such knowledge may lead to an enormous loss to the scientific community. The ethnomedicinal knowledge and information provided in this study is of significant value for scientific validation, product development, conservation and policy planners for sustainable management of medicinal plants and traditional herbal cure system. It is suggested to explore and establish linkage between traditional health practices and modern health-care systems. It can be done by testing bioactive compound and biological activity of most preferred plant species, and assessing safety and efficacy of local herbal formulation. Such an investigation may lead to many new and novel drug discovery. It is also recommended that the natural habitats of medicinal plants should be protected for conservation of valuable gene pool and to control over exploitation of species. Since ethnomedicinal information is strongly linked to local livelihoods, culture and environment, it is strongly recommended to further continue studying the subject so as to serve the humanity with healthier and operative health care measures.

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Declarations

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**Authors’ contributions**

SNO, DT and AA planned and performed the study and field survey, writing the draft manuscript, and analyzed the data and RCY revised the manuscript and data analysis. All authors read and approved the final manuscript.

**Competing interests**

The authors declare that they have no competing interests.

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**Availability of data and materials**
The authors already included all data in the manuscript collected during the field surveys. The documented medicinal plant species were deposited at Centre of Socio-economic Development (CSED), GBPNIHE, Kosi-Katarmal, Almora, Uttarakhand.

**Ethics approval and consent to participate**

During field work prior consent of the informants was taken conducting these studies. This was done to adhere to the ethical standards of community participation in scientific research.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

**Tables**

Table 1. Quantitative enumeration of ethno-medicinal plants used by marginal hill community of district Bageshwar.

| Botanical Name | Local Name | Voucher/ Ident. No. | Habit | Part Used | Popular Ailment Uses Categories |
|----------------|------------|---------------------|-------|-----------|---------------------------------|
| *Allium sativum* L. | Lasan | GBPCSED1 | H | B | Skeleton & muscles- Joint Pain (Group & Categories) |
| *Angelica glauca* Edgew. | Gandaraini | RKT 27789 | H | Rt | Gastrointestinal- Stomach ache Other - Spices & condiment, Herbal |
| *Centella asiatica* L. | Brahmi | RKT 28186 | H | L | General health care - Headache |
| *Coriandrum sativum* L. | Dhaniya | RKT 28118 | H | Sd | Antidote - Against poison |
| *Acorus calamus* L. | Bojh/Buch | RKT 27965 | H | Rh | Skeleton & muscles- Sprain, Inflammmation Other - Insect repellent |
| *Ageratina adenophora* (Spreng.) King & H. Rob. | Nargadiya/Pagaljhad | RKT 22106 | H | L | Dermatological- Cuts & wounds |
| *Artemisia martima* L. | Pati/Titpati | RKT 23793 | H | L | Dermatological- Cuts & wounds, Respiratory- Cough |
| *Saussurea costus* (Falc.) Lipsch. | Kut/Kuth | RKT 28203 | H | Rt | General health care- Fever, Respiratory- Cough, Gastrointestinal- Stomach ache, |
| *Taraxacum officinale* Weber. | Dudhil | RKT 27817 | H | L,Rt | Antidote- Snake bite Other- To increase lactation in n |
| *Tegetus erecta* L. | Hazari | GBPCSED2 | H | L | General health care- Fever, ear |
| *Berberis asiatica* Roxb. | Kilmori | RKT 22109 | S | Rt | General health care - Fever |

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| Botanical Name | Local Name | Voucher/ Ident. No. | Habit | Part Used | Popular Ailment Uses Categories |
|----------------|------------|---------------------|-------|-----------|---------------------------------|
| *Cynoglossum zeylanicum* Thunb. Ex Lehms. | Chtkura | RKT 22969 | H | Rt | Dermatological- Boils |
| *Rephanus sativus* L. | Mooli | RKT 27049 | H | WP | Hepatic health cure- Jaundice |
| *Cannabis sativa* L. | Bhaang | GBPCSED3 | H | Sd, L | Gastrointestinal- Carminative, Constipation, Stomach ache, Antidote- Insect bite Other- Warm effect in winters |
| *Drymaria cordata* (L.) Willd. ex Schult | -- | RKT 19989 | H | WP | Respiratory- Cough |
| *Silene vulgaris* (Moench) Garcke | Pyankura | GBPCSED4 | H | WP | General health care- Fever Gastrointestinal- Removal of As locally known as *juga* |
| *Terminalia chebula* (Gaertner) Retz. | Harar | RKT 15469 | T | Fr | Gastrointestinal- Carminative, Constipation, Diarrhoea |
| *Momordica charantia* L. | Karela | RKT 27529 | Cl | Fr | Circulatory- Diabetes |
| *Dioscorea deltoidea* Wall. | Genthi | RKT 27301 | Cl | Fr (Atu) | Respiratory- Cough & cold |
| *Swertia angustifolia* Buch.-Ham. ex D.Don | Chiraita | RKT 25110 | H | WP | General health care- Fever Dermatological- Skin ailments |
| *Glycine max* (L.) Merri | Kala Bhatt | RKT 15664 | H | Sd | Hepatic health cure - Jaundice |
| *Microtyloma uniflorum* (Lam) Verdc. | Gahat/Kulthi | GBPCSED5 | H | Sd | Urinogenital disorder- Stone |
| *Trifolium repens* L. | Chalmoda | RKT 26479 | H | L | General health care - Headache Dermatological- Skin disease of |
| *Trigonella foemungraecum* L. | Maithi | RKT 28507 | H | L, Sd | Circulatory- Diabetes Gastrointestinal- Carminative Indigestion, Constipation |
| Botanical Name               | Local Name | Voucher/Ident. No. | Habit | Part Used | Popular Ailment Uses Categories |
|-----------------------------|------------|--------------------|-------|-----------|---------------------------------|
| **Vigna mungo** L. (Fabaceae) | Mass, Urad | RKT 27199          | H     | Sd        | Skeleton & muscles- Fracture    |
| **Ajuga bracteosa** Wall. ex Benth. | Ratpatia | RKT 25182          | H     | WP        | General health care- Fever,Gastrointestinal- Constipation, Urinogenital- Diuretic |
| **Ajuga parviflora** Benth. | Ratpatia | RKT 26408          | H     | Rt        | General health care- Fever, Ti animal (Galghotu), Gastrointestinal- Constipation, S Urinogenital- Stone |
| **Leucas lanata** Benth | Nirasi Jhad | RKT 29214          | H     | L         | Respiratory- Cough             |
| **Mentha arvensis** L. | Pudina | RKT 4355           | H     | L         | Gastrointestinal- Stomach ache, |
| **Micromeria biflora** Benth. | --        | RKT 22949          | H     | WP        | General health care- Fever      |
| **Ocimum basilicum** L. | Tulsi | RKT 19325          | S     | L, Sd     | General health care- Fever, Respiratory- Cough & cold, Other- Herbal tea, Warm effect |
| **Origanum vulgare** L. | Van Tulsi | RKT 29244          | L, Rt |           | General health care- Fever, Respiratory- Cough & cold, Dermatological- wounds, Other- Herbal tea |
| **Thymus serpyllum** L. | Van-ajwayan | RKT 27966          | H     | WP        | Skeleton & muscles- Joint pain, Respiratory- Asthma, Gastrointestinal- Digestive & Stc, Other- Spices & condiments |
| **Asparagus racemosus** Willd. | Keruwa | RKT 28055          | S     | Rt        | Immuno-regulatory- Stimulant, Hepatic health cure- Tonic, Gastrointestinal- Stomach ache |
| **Polygonatum cirrhifolium** (Wall.) Royle | Maha-Meda | RKT 26144          | H     | WP        | Hepatic health cure- Tonic, Dermatological- Cuts & wounds, Circulatory - Blood purifier |
| **Polygonatum verticillatum** L. | Meda | RKT 25894          | H     | Rt        | Gastrointestinal- Carminative, Dermatological- wounds |
| **Ficus palmata** Forsk. | Bedu | RKT 28094          | T     | Lt        | Dermatological- Cuts & wounds |
| **Ficus roxburghii** Wall. | Timul | GBPCSED6          | T     | Fr        | Gastrointestinal- Acidity, Carmi Circulatory - Blood pressure |

| Botanical Name               | Local Name | Voucher/Ident. No. | Habit | Part Used | Popular Ailment Uses Categories |
|-----------------------------|------------|--------------------|-------|-----------|---------------------------------|
| **Psidium guajava** L. | Amrood | GBPCSED7          | T     | L         | General health care- Mouth blist |
| **Dactylorhiza hatagirea** (D.Don)Soo | Salmanpanja/ | RKT 26089          | H     | Rt        | Circulatory- Bleeding, Dermatological- Wounds |

| **Plantago ovate** Forsk. | Isabgoal | RKT 1899          | H     | Sd        | Gastrointestinal- Constip |
| Botanical Name                  | Local Name        | Voucher/Ident. No. | Habit | Part Used | Popular Ailment Uses | Categories |
|-------------------------------|-------------------|--------------------|-------|-----------|----------------------|------------|
| Plantago lanceolata L.        | Jonkuri           | RKT 8154           | H     | Rt        | Gastrointestinal- Removal of stomach worm of domestic animals |            |
| Family: Poaceae               |                   |                    |       |           |                      |            |
| Hordium vulgare L.            | Jau               | RKT 26630          | H     | Sd        | Hepatic health cure- Warm & nutritious effect |            |
| Setaria italica L.            | Kouni             | RKT 7389           | H     | Sd        | Dermatological - Measles & Chickenpox |            |
| Family: Podophyllaceae        |                   |                    |       |           |                      |            |
| Podophyllum hexandrum Royle   | Van-Kakri         | RKT 27764          | H     | Fr, Rt    | Dermatological - Wounds |            |
| Family: Polygonaceae          |                   |                    |       |           |                      |            |
| Rheum emodi Wall.             | Dolu              | RKT 27793          | H     | Rt        | General health care - Fever |            |
| Family: Punicaceae            |                   |                    |       |           | Dermatological - Wounds |            |
| Punica granatum L.            | Darim             | RKT 28845          | T     | Fr        | Respiratory - Cough & cold |            |
| Family: Ranunculaceae         |                   |                    |       |           | Hepatic health cure - Anaemia |            |
| Aconitum heterophyllum Wall.  | Atis              | RKT 29008          | H     | Rt        | General health care - Fever |            |
| Ranunculus repens L.          | Aingadua          | GBPCSED8           | H     | Rt        | Gastrointestinal - Intestinal pains |            |
| Thalictrum foliosum DC.       | Uppankat hi/Mamira | RKT 29204         | H     | WP        | Ophthalmic- Eye infection (White dot-cataract) |            |
| Family: Rosaceae              |                   |                    |       |           | Other- Insect repellent |            |
| Duchesnea indica (Andrews)    | Van Kafal         | GBPCSED9           | H     | L         | Dermatological- Burns and removal |            |
| Focke                         |                   |                    |       |           |                      |            |
| Prunus persica Stokes.        | Aaru              | RKT 26465          | T     | L         | General health care- Headache |            |
| Rosa moschata Hermm.          | Kunja             | RKT 28695          | S     | L, F      | Dermatological- Cuts & wounds, |            |
| Rubus ellipticus Smith.       | Hisalu            | RKT 29240          | S     | Rt        | Ophthalmic- Eye diseases |            |
| Family: Rubiaceae             |                   |                    |       |           | General health care- Fever |            |
| Rubia cordifolia L.           | Manjistha         | RKT 27933          | H     | Rt        | Gastrointestinal- Stomach ache |            |
| Family: Rutaceae              |                   |                    |       |           |                      |            |
| Citrus aurantifolia (Christm) Sw. | Kagji Nimboo       | GBPCSED10         | T     | Fr        | General health care - Headache |            |
| Citrus hystrich DC.           | Jamer/ Jamir      | GBPCSED11          | T     | Fr        | Gastrointestinal- Constipation, Weight loss |            |
| Zanthoxylum armatum DC        | Timoor/ Timuru    | RKT 28615          | S     | Sd        | Respiratory - Cough & cold |            |
|                               |                   |                    |       |           | Carminative, Other- Spices & condiments |            |
|                               |                   |                    |       |           |                      |            |
Family: Saxifragaceae

*Bergenia ciliata* (Haw) Sternb

Silphora RKT 25124 H Rt Urinogenital - Urinary infection

Family: Scrophulariaceae

*Picrorhiza kurrooa* Royle.

Kutki RKT 27765 H Rt General health care - Fever

*Verbascum thapsus* L.

Akalveer RKT 27890 H WP Gastrointestinal - Abdominal pain

Family: Urticaceae

*Urtica dioica* L.

Shishun/ Bichhu ghas RKT 22903 S L Skeleton & muscles - Joint pain

Family: Violaceae

*Viola betonicifolia* J.E. Smith

Garurjadi/ garurabuti GBPCSED12 H WP Antidote - Snake bite

*Viola canescens* Wall. Ex Roxb

Gulovansh RKT 17561 H WP Other - To increase lactation in milking animals

Family: Zingiberaceae

*Curcuma longa* L.

Haldi RKT 5970 H Rh General health care - Internal injury

*Hedychium spicatum* Buch. Ham. ex Smith.

Van Haldi RKT 24059 H Rh Gastrointestinal - Intestinal problems, Purgative & Laxative, Carminative

*Zingiber officinale* Rosc.

Adrak RKT 5921 H Rh Respiratory - Cough & cold

Use Citation of Taxa (The no. of informants that referred the taxon); RFC = FC/N, Where N is the total no. informants; Use-reports of the taxon by ailment category; Use-reports of the taxon; CI = UR/N, where N is the total no. of reported taxa;

Aerial tuber (Atu); Bulb (B); Cattle (C); Climber (Cl); Cooking (Co); Decoction (De); Direct application (Da); Emulsion (Em); Flower (F); Fruit (Fr); Herb (H); Insect (I); Infusion (Inf); Ingestion (In); Hour (hr); Human (Hu); Leaves (L); Latex (Lt); Ointment (O); Poultice (Po); Powder (Pw); Rhizome (Rh); Root (Rt); Shrub (S); Seed (Sd); Steam (Ste); Tree (T); Whole Plant (WP).

### Table 2. Bio-processing of Medicinal Plants of District Bageshwar.

| Scientific Name                      | Mode of administration                                                                 |
|--------------------------------------|----------------------------------------------------------------------------------------|
| *Aconitum heterophyllum* Wall.       | Dry root powder (1TS) taken orally with boiled water twice a day for 2-3 days against fever; 1-2 roots chewed to control vomiting. |
| *Acorus calamus* L.                  | Root powder mixed with grains used as insect repellent, 3-4 dry roots heated with mustard oil applied on the sprain and inflammatory region. |
| **Ageratina adenopora** *(Spreng.)* King & H. Rob | Leaf paste prepared from 100g fresh leaf twigs applied on affected parts for early healing. |
| **Ajuga bracteosa** Wall. ex Benth. | Juice of whole plant (10-20 ml) taken twice a day for 2-3 days. |
| **Ajuga parviflora** Benth. | Decoction prepared from 100g fresh or dried roots with water given 3-5TS orally in fever, stomach ache and constipation for 5 days; this decoction taken orally in empty stomach regularly for stone; 1-2 leaves chewed on empty stomach for gastric problem; decoction of whole plant (5-8) crushed with red chilli (3) and 100g Jiggery *(Gur)* given twice a day for 2-3 days to treat throat infection in domestic animals. |
| **Allium sativum** L. | Paste prepared from 5-7 Spilled bulb heated with 20 ml mustered oil, massage on joints. |
| **Angelica glauca** Edgew. | Root powder (50g) mixed with 100ml water used to control vomiting & stomach ache; rhizomes are used as spices & condiments and tea (as flavour). |
| **Artemisia martima** L. | Juice (5-10ml) of fresh leaf applied on the affected area. |
| **Asparagus racemosus** Willd. | Root decoction (100 gm) prepared in water given to cure stomach ache (5 ml for adult, 1TS for children) for 3-5 days, one palm full root powder taken with water as stimulant and tonic. |
| **Berberis asiatica** Roxb. ex DC | Root powder (100-150g) taken with warm water given twice a day for 3 days against fever; fresh or dried roots soaked in water overnight, filtered and taken orally to cure diabetes in empty stomach. |
| **Bergenia ciliata** *(Haw)* Sternb. | Fresh or dried roots (50-100g) socked overnight and filtered, taken orally in morning for kidey stone. Root powder (50g) taken with water twice a day for urinary infection. |
| **Cannabis sativa** L. | Grinded seeds cooked with some local vegetables *(e.g. Colacasia esculanta, Brassica oleracea)* for warm effect; broiled seeds are grinded with salt and green chilli to prepare salt *(Pahadi namak)*, Broiled seeds grinded with *Punica garnatum* mixed with green leaves of coriandum, green chilli, salt and sugar to prepare *Chatni*; Fresh leaves crushed with 3-5 seeds of black pepper and applied on insect bite. |
| **Centella asiatica** L. | Fresh leaf paste is applied on forehead. |
| **Citrus aurantifolia** *(Christm)* Sw. | Juice extracted from fruit mixed with 1TS honey and 50 ml water taken orally in empty stomach for constipation and weigh loss; lemon tea used in Fever & Cold. |
| **Citrus hystrix** DC. | Fruit juice given orally (1TS) to children for removal of ascaris; cough & cold 10 ml thrice a day; fruit juice with mentha leaves (100g) and coriander seeds made into paste given to domestic animals against poison. |
| **Coriandrum sativum** L. | Seed (80-100g) paste mixed with 1-2 ltr. processed curd *(Mattha)* is given to domestic animals against poison for 2-3 days. |
| **Curcuma longa** L. | Haldi powder (5g) mixed with a full glass of warm milk for internal injury; paste of rhizome applied on cuts and wounds. |
| **Cynoglossum zeylanicum** Thunb. Ex Lehm. | Fresh or dried root paste applied on the affected parts. |
| Scientific Name | Mode of administration |
|-----------------|------------------------|
| *Dactylorhiza hatagirea* (D.Don)Soo. | Decoction of 100 gm root with water taken orally (10-15ml) twice a day for excessive bleeding; root paste applied on wounds |
| *Dioscorea bulbifera* L. | Broiled fruit and cooked vegetable. |
| *Drymaria cordata* (L.) | Juice of aerial parts (2-4 drops) taken orally for 2-3 days. |
| *Duchesnea indica* (Andrews) Focke | Leaf paste is regularly applied on affected part. |
| *Emblica officinalis* Gaertn. | Fresh fruits are chewed regularly to control diabetes; dried fruits (3-5) boiled with water, filtered and taken orally against cough, stomach ache; fresh and proceedued fruits are source of Vitamin ‘C’. |
| *Euphorbia sp.* | Whole plant (50-100) mixed with FYM. |
| *Ficus palmata* Forsk. | Milky latex applied on cuts & wounds. |
| *Ficus roxburghii* Wall. | Fresh fruits are cooked as vegetable. |
| *Glycine max* (L.) Merri | *Bhatt ka Jaula* (an indigenous dish) is prepared from paste of seeds (soaked overnight) & cooked with rice in an iron vessel “Kadahi”. |
| *Hedychium spicatum* Buch. Ham. ex Smith. | Dried rhizome powder (2-3g) taken with hot water once a day; paste of fresh rhizome used as anti-lice |
| *Hordium vulgare* L. | *Sattu* prepared from 200g broiled seeds mixed with 100g jaggery (*Gur*) and 100g *Ghee* for warm and nutritive effect; 50g broiled seeds heated with 40ml mustard oil applied on burns. |
| *Leucas lanata* Benth | Leaf juice with 3-5 drops of breast milk taken orally twice a day for one week. |
| *Mentha arvensis* L. | Leaves (100g) boiled with water and filter, the filtrate (50ml) given orally twice a day. |
| *Micromeria biflora* Benth. | Juice of whole plant with water (1-2 times in a day). |
| *Macrotyloma uniflorum* (Lam) Verdc. | *Gahat ka Ras* (an indigenous dish) prepared by 150g seeds cooked with water (1 ltr.) until the volume reduced (100ml) and taken regularly. |
| *Momordica charanti* L. | Vegetable and juice (50ml) of fresh fruit taken regularly. |
| *Ocimum basilicum* L. | Decoction of 100g leaves and seeds, zinger (50g), 5 seeds black paper with 150 ml water taken orally 2-3 times a day for fever, cough & cold; aerial part used to make herbal tea. |
| *Origanum vulgare* L. | Decoction of 1 00g fresh & dried leaves with water taken orally (10ml) for a week in cough, cold & fever; root paste applied on wounds. |
| *Picrorhiza kurrooa* Royle. | Decoction of 50g root with water taken orally against fever and abdominal pain for 5-7 days. |
| *Plantago ovate* Forsk. | Seeds (10g) soaked overnight or consumed directly with water twice a day for 30 days against constipation and digestive problems; *Isabgoal* (15g) mixed with 10TS fresh curd taken after meal for diarrhoea. |
| *Plantago lanceolata* L. | Paste of roots (100g) given to domestic animals. |
| *Podophyllum hexandrum* | Root paste applied on wound. |
| Scientific Name | Mode of administration |
|-----------------|------------------------|
| **Polygonatum cirrhifolium (Wall.) Royle** | Small pieces of tuber (8-10) soaked in water for overnight, taken in empty stomach for weakness and develop immunity; cooked green leaves eaten as blood purifier; root paste applied on cuts and wounds. |
| **Polygonatum verticillatum L. All** | Root powder (50g) is taken with warm water in gastric complaints; fresh root paste applied for wound healing. |
| **Prunus persica Stokes.** | Fresh leaf paste applied on head for 2-3 hr. |
| **Psidium guajava L.** | Fresh leaves are chewed. |
| **Punica granatum L.** | Powder (50g) of dried fruit peel taken orally with warm water for old cough; Fruit juice (50ml) given twice a day to anaemic patient. |
| **Ranunculus repens L.** | Root paste (50g) applied for boils and 30-50ml filtered root extract (juice) is given twice a day against intestinal pain. |
| **Rephanus sativus L.** | Vegetable prepared from fresh leaves and root as salad. |
| **Rheum emodi Wall.** | Decoction of 100g root with warm water taken orally (10ml) for fever twice a day; root paste applied on wounds. |
| **Rhododendron arboreum Smth** | Juice extracted from fresh flowers |
| **Rosa moschata Hermm.** | Fresh leaf paste is applied on cuts, wounds and boils; water extracted from fresh flowers used in eye diseases. |
| **Rubia cordifolia L.** | Root decoction with water given orally (1-2TS) against fever twice a day to children (5 months-10years) |
| **Rubus ellipticus Smith.** | Decoction (10ml) of 100g roots with water taken orally against fever and stomach ache for 5 days. |
| **Saussurea costus (Falc.) Lipsch** | Decoction of root (50g) with water given against dysentery for 3-5 days twice a day; root powder (50g) taken orally with boiled water in fever, cough and stomach ache. |
| **Setaria italica L.** | Koni ka Jaula (an indigenous dish) prepared from seeds cooked with water. |
| **Silene vulgaris (Moench) Garcke** | Root decoction (10ml) with warm water given against fever for 3 days; 1TS is used for removal of ascaris (Juga); leaves are used as a vegetable. |
| **Swertia spp** | Juice of fresh leaves (100g) given with boiled water 3TS for 3-5 days for fever; Panchang (whole plant) is used after soaking overnight and taken (50-100ml) orally in empty stomach for 15 days. |
| **Taraxacum officinale Weber.** | For snake bite: juice of whole plant with water taken orally (1-2TS) thrice a day & applied on injured part for one week; mixture of 100g roots with 9 seeds of black pepper, 1-2 ltr. processed curd (Mattha) and 250g paste of black soybean given to increase lactation in milching animals |
| **Tegetus erecta L.** | Fresh leaf juice with water taken against fever(3-5 TS twice a day); leaf extract (2-3 drops) in ear infection; fresh leaf paste is applied for healing cuts & wounds. |
| **Terminalia chebula** | Dried fruit powder (100g) given orally with boiled water twice a day for 3-5 days in |
| Species | Description |
|---------|-------------|
| (Gaertner) Retz. | stomach ache; dried fruit crushed with water and given (1-2 ml) orally to children (3 months to 5 years) and small amount applied around the navel. |
| *Thalictrum foliosum* DC. | Fresh roots (50g) soaked in rose water (100ml) for overnight, filtered and used as eye drop. |
| *Thymus serpyllum* L. | Paste of whole plant mixed with mustered oil gently applied on joints; whole plants juice (10ml) mixed with honey (20g) is taken orally for cough and asthma; broiled seeds (10-15g) with warm water taken for digestive and stomach problems; leaves and seeds are used as spices & condiment. |
| *Trifolium repens* L. | Leaf paste (5g) with water. |
| *Trigonella foemun-graecum* L. | Leaf juice is taken orally for curing obesity, indigestion, joints pain and constipation; 25g seeds are soaked overnight filter, the filtrate taken orally in empty stomach for gastric problems and diabetes. |
| *Urtica dioica* L. | Branches with leaves are gently rubbed on joints and muscles; Fresh leaf twigs taken as vegetable; fine powder of dry leaf (5-10 g) dissolve in 50 ml water is taken orally in joints & muscular pain. |
| *Verbascum thapsus* L. | Fresh leaf paste applied on affected part for boils; 8-10 whole plants mixed with grass given mulching animals. |
| *Viola betonicifolia* J.E. Smith (Violaceae) | Paste of whole plant (fresh or semidry) applied on affected part for 1-2 weeks. |
| *Viola canescens* Wall. Ex Roxb | Fresh plants (30-50) given with grass for one to two weeks. |
| *Vigna mungo* L. | Paste prepared by grinding of 150g seeds with water applied on the fractured part. |
| *Zanthoxylum armatum* DC | Seeds (100g) boiled with water taken orally twice a day; seed bark used as a spices. |
| *Zingiber officinale* Rosc. | A piece (5-10g) of broiled rhizome mixed with small amount of honey and chewed. |

Farm Yard Manure (FYM); Tablespoon (TS);

Table 3. Use value of important ethnomedicinal species of target area
| Taxa                              | UR<sup>a</sup> | FC<sup>b</sup> | CI<sup>c</sup> | NDAS | Ailments Categories (Decreasing order)                      |
|----------------------------------|----------------|--------------|--------------|------|------------------------------------------------------------|
| *Ocimum basilicum* L.            | 97             | 88           | 0.97         | 5    | Respiratory, general health care and others                |
| *Cannabis sativa* L.             | 94             | 63           | 0.94         | 6    | Gastrointestinal, others and antidote                     |
| *Citrus aurantifolia* (Christm) Sw. | 94            | 38           | 0.94         | 6    | Others, gastrointestinal, general health care and respiratory |
| *Curcuma longa* L.               | 91             | 78           | 0.91         | 5    | General health care, dermatological and respiratory        |
| *Setaria italic* L.              | 91             | 91           | 0.91         | 2    | Dermatological                                             |
| *Angelica glauca* Edgew.         | 89             | 44           | 0.89         | 4    | Others and gastrointestinal                               |
| *Zingiber officinale* Rosc.      | 89             | 89           | 0.89         | 2    | Respiratory                                                |
| *Ajuga parviflora* Benth.        | 87             | 56           | 0.87         | 5    | General health care, gastrointestinal and urinogenital disorder |
| *Repbanus sativus* L.            | 87             | 87           | 0.87         | 1    | Hepatic health cure                                       |
| *Emblica officinalis* Gaertn.    | 85             | 35           | 0.85         | 6    | Gastrointestinal, others, circulatory and respiratory      |
| *Glycine max* (L.) Merri         | 84             | 84           | 0.84         | 1    | Hepatic health cure                                       |
| *Plantago ovate* Forsk.          | 83             | 74           | 0.83         | 3    | Gastrointestinal                                           |
| *Ageratina adenophora* (Spreng.) King & H. Rob. | 80         | 80           | 0.80         | 2    | Dermatological                                             |
| *Leucas lanata* Benth            | 80             | 80           | 0.80         | 1    | Respiratory                                                |
| *Picrorhiza kurrooa* Royle.      | 80             | 53           | 0.80         | 2    | General health care and gastrointestinal                   |
| *Artemisia martima* L.           | 77             | 55           | 0.77         | 3    | Dermatological                                             |
| *Zanthoxyllum armatum* DC        | 77             | 61           | 0.77         | 5    | Others, general health care, respiratory and gastrointestinal |
| *Acorus calamus* L.              | 74             | 55           | 0.74         | 3    | Others and skeleton & muscles                              |
| *Ajuga bracteosa* Wall. ex Bent. | 72             | 55           | 0.72         | 3    | General health care, gastrointestinal and urinogenital disorder |
| *Origanum vulgare* L.            | 71             | 31           | 0.71         | 5    | Dermatological, respiratory, General health care and others |
| *Punica granatum* L.             | 71             | 59           | 0.71         | 4    | Respiratory, others and hepatic health cure                |

<sup>a</sup> Total no. of Use-reports of the taxon; <sup>b</sup> Use Citation of Taxa (The no. of informants that referred the taxon; <sup>c</sup> CI = UR/N<sub>t</sub>, where N<sub>t</sub> is the total no. of reported taxa; No. of different ailment subcategories (NDAS).

Table 4. Informant consensus factor (F<sub>ic</sub>) and medicinal importance (MI) of Ethno-medicinal plants.
| Ailments Category          | No. of Taxa (Nₜ)ᵃ | Frequency (%)ᵇ | No. of Use - reports (Nₚ)  | Informant consensus factor (Fᵢc)ᶜ | Medicinal Importance (MI)ᵈ |
|---------------------------|-------------------|----------------|-----------------------------|----------------------------------|----------------------------|
| Gastrointestinal          | 23                | 32.86          | 695                         | 0.97                             | 30.22                      |
| General health cure       | 22                | 31.43          | 524                         | 0.96                             | 23.82                      |
| Dermatological            | 21                | 30.00          | 617                         | 0.97                             | 29.38                      |
| Respiratory               | 15                | 21.43          | 402                         | 0.97                             | 26.80                      |
| Hepatic health cure       | 8                 | 11.43          | 364                         | 0.98                             | 45.50                      |
| Circulatory               | 7                 | 10.00          | 126                         | 0.95                             | 18.00                      |
| Skeleton & muscles cure   | 6                 | 8.57           | 178                         | 0.97                             | 29.67                      |
| Antidote                  | 5                 | 7.14           | 83                          | 0.95                             | 16.60                      |
| Urinogenital              | 4                 | 5.71           | 137                         | 0.98                             | 34.25                      |
| Ophthalmic                | 2                 | 2.86           | 14                          | 0.92                             | 7.00                       |
| Immuno-regulatory cure    | 1                 | 1.43           | 15                          | 1.00                             | 15.00                      |
| Other                     | 15                | 21.43          | 377                         | 0.96                             | 25.13                      |

ᵃNo. of species listed in several of the categories of medicinal usage;ᵇPercentage of records on the total of 70 records;ᶜFᵢc = (Nₚ - Nₜ) / (Nₚ - 1);ᵈMI = Nₚ/Nₜ.

Table 5. Similarity between present and past ethno-medicinal uses of important species

| Botanical Name                      | Use Reports in Study Area | Earlier Use Reports from Uttarakhand                                      |
|------------------------------------|----------------------------|-------------------------------------------------------------------------|
| Aconitum heterophyllum Wall.       | Fever & Vomiting           | Fever, Vomiting and cough [21,28,51,59]                                   |
| Acorus calamus L.                  | *Inflammation & Insect repellent, Sprain | Arthritis, Cancer, Convulsions, Diarrhoea, Dyspepsia, Epilepsy [21,23]; Sprain [51] |
| Ageratina adenophora (Spreng.)     | Cuts & wounds              | Cuts and Wounds [21, 28]                                                 |
| Ajuga bracteosa Wall. ex Benth.    | *Constipation               | Fevers, Diuretic [21]                                                   |
|                                   | Diuretic, Fever             |                                                                         |
| Ajuga parviflora Benth.            | *Constipation, Stone, Throat infection in animal (Galghotu), Fever, Stomach ache | Headache, Fever, stomach-ache [54]                                      |
| Allium sativum L.                  | *Joint Pain (Arthritis)     | Mascular pain [23,52]; Ear pain [59]                                     |
| Angelica glauca Edgew.             | *Spices & condiment & Herbal tea, Stomach ache, Vomiting, | Constipation, bronchitis and stomach disorders, Vomiting [23,28,51]      |
| Artemisia martima L.               | Cuts, Skin ailments, Wounds | Skin ailments [54]                                                      |
| Asparagus racemosus Willd.         | *Stimulant, Tonic & Stomach ache | Leucorrhoea, Headache, Hysteria, Ulcer, Liver disorders [21,23]          |
| Botanical Name | Uses Report in Study Area | Earlier Uses Report from Uttarakhand |
|---------------|---------------------------|-------------------------------------|
| Berberis asiatica Roxb. ex DC | *Fever, Diabetes | Diabetes, Jaundice [21] |
| Bergenia ciliata (Haw) Sternb | Urinary infection & Stone | Fever, Digestive disorders, skin diseases, Urinary infection & Stone [16,28] |
| Cannabis sativa L. | *Insect bite, Stomach ache, Purgative & Laxative, Warm effect in winters Carminative, Constipation | Analgesic, Cough, Cold, Sedative, Narcotic, Skin diseases [23] |
| Centella asiatica L. | *Headache | Inflammatory infections, Wounds [21, 23] |
| Citrus aurantifolia (Christm) Sw. | Cold, Constipation, Headache, Herbal tea, Source of vitamin ‘C’ & Weight loss, | Diarrhoea, Dysentery, Fever, Headache [56] |
| Citrus hystrix DC. | *Against poison, Cold, Removal of Ascaris (Anti-parasitic) | Vomiting [52] |
| Coriandrum sativum L. | *Against poison | Stomachic and diuretic [23] |
| Curcuma longa L. | *Internal injury Cough, Cuts & wounds & Cosmetics | Skin disorders, Wound healing [23,52] |
| Cynoglossum zeylanicum Thunb. ex Lehm. | *Boils | Asthma, Bronchitis, Cough, Vomiting, [16,55] |
| Dactylorhiza hatagirea (D.Don)Soö | Bleeding & Wounds | Burns, Cuts, Checks bleeding [21,28] |
| Dioscorea deltoidea Wall | Cough & cold | Cough, Fever Urenogenital disorders, [21,23,28,54] |
| Drymaria cordata (L.) Willd. ex Schult | *Cough | Laxative [48]; Bile complaints [54] |
| Duchesnea indica (Andrews) Focke | *Burns and removal of burn scars | Diarrhoea, Fever, Leucorrhoea [55]; Skin diseases [56] |
| Emblica officinalis Gaertn. | Diabetes, Purgative & Laxative, Carminative, Stomach ache & Source of vitamin ‘C’ | Asthma, Digestive disorders, Hair fall [28]; Dysentery, Cholera and Jaundice [21,54] |
| Euphorbia prolifer Ehrenb. ex Boiss | *Insect repellent | -- |
| Ficus palmata Forsk. | *Cuts & wounds | Lungs diseases, Skin diseases [23,48,54] |
| Ficus roxburghii Wall. | *Acidity, Source of vitamin ‘C’ | Laxative [48] |
| Glycine max (L.) Merri | *Jaundice | -- |
| Hedychium spicatum Buch. Ham. ex Smith. | Anti-lice, Cough, Cosmetics, Intestinal problems, Purgative & Laxative, Carminative | Carminative, Stomachic, Liver complaints, Fevers, Vomiting, Diarrhoea, Inflammation, Snake bite [16,21,54] |
| Hordeum vulgare L. | *Burns, Warm and nutritive effect | -- |
| Leucas lanata Benth | *Cough | Cuts, To check bleeding, Wounds [54] |
| Mentha arvensis L. | Stomach ache & Vomiting, | Diarrhoea, Stomach ache [53,54] |
| Micromeria biflora Benth. | *Fever | Joints pain, Worm infested wounds 21 |
| Plant Name                                      | Diseases/Conditions                                                                 |
|------------------------------------------------|--------------------------------------------------------------------------------------|
| Microtyloma uniflorum (Lam) Verdc.             | Stone                                                                                |
| Momordica charantia L.                         | Diabetes, Jaundice, Diabetes [23]                                                   |
| Ocimum basilicum L.                            | Cough & cold, Fever, Herbal tea, Warm effect in winters                               |
| Origanum vulgare L.                            | Cough & cold, Fever, Herbal tea & Wounds                                             |
| Picrorhiza kuruoa Royle.                       | Abdominal pain, Fever                                                                |
| Plantago ovate Forsk.                          | Constipation, Digestive problems & Diarrhoea                                          |
| Plantago lanceolata L.                         | *Removal of stomach worm of domestic animals                                         |
| Podophyllum hexandrum Royle                    | Wounds                                                                               |
| Polygonatum cirrhifolium (Wall.)               | *Blood purifier, Cuts, Tonic & Wounds                                                |
| Polygonatum verticillatum L.                   | Carminative & Wounds                                                                 |
| Prunus persica Stokes.                         | *Headache                                                                            |
| Psidium guajava L.                             | Mouth blisters (astringent)                                                         |
| Punica granatum L.                             | *Anaemia, Cough, Cold, Source of Vitamin 'C'                                          |
| Ranunculus repens L.                           | *Boils & Intestinal pains (Nas Palatana)                                             |
| Rephanus sativus L.                            | Jaundice                                                                             |
| Rheum emodi Wall.                              | Fever & Wounds                                                                       |
| Rhododendron arboreum Smth                     | Liver complaints, Tonic                                                               |
| Rosa moschata Hermm.                           | *Boils, Cuts, Eye diseases, Wounds                                                   |
| Rubia cordifolia L.                            | *Fever                                                                               |
| Rubus ellipticus Smith.                        | *Fever & Stomach ache                                                                 |
| Saussurea costus (Falc.) Lipsch.               | Cough, Dysentery, Fever, Stomach ache                                                |
| Setaria italic L.                              | *Chicken pox & Measles                                                                |
| Silene vulgaris (Moench) Garcke                | *Fever & Removal of Ascaris (Antiparasitic)                                          |
| Swertia angustifolia Buch.-Ham. ex D.Don.      | *Skin ailments                                                                       |

Note: The table lists various plants and their medicinal uses. Each plant is associated with multiple conditions it can treat, and some entries include references to the specific conditions treated. The table structure allows for easy lookup and comparison of different plants and their uses.
| Botanical Name | Uses Report in Study Area | Earlier Uses Reports from Uttarakhand |
|----------------|---------------------------|--------------------------------------|
| *Taraxacum officinale* Weber. | *Snake bite & To increase lactation in mulching animals* | Headache, acts as a heart tonic and blood purifier [28,59] |
| *Tegetus erecta* L. | *Ear infection, Fever & Wounds* | Muscular pain, Piles, Ulcer, Wound healing [23] |
| *Terminalia chebula* (Gaertner) Retz. | Carminative, Constipation, Digestive problems, Diarrhoea, Purgative | Asthma, Digestive problems, Diarrhoea, Purgative [16,28] |
| *Thalictrum foliosum* DC. | *Eye infection (White-dot-cataract), Insect repellent* | Gastric trouble, Used to control external parasites [21] |
| *Thymus serpyllum* L. | *Asthma, Joint pain, Spices & condiments Digestive & stomach problems,* | Laxative, Stomachic [21]; Cough, Epilepsy, Itching & skin diseases, Menstrual disorders, Swelling [54] |
| *Trifolium repens* L. | *Headache & Skin disease of dogs* | Astringent [16] |
| *Trigonella foemun-graecum* L. | Carminative, Constipation, Diabetes, Indigestion, Joint pain & Obesity, | Diabetes, Rheumatism [16,52] |
| *Urtica dioica* L. | *Joint pain, Warm & nutritive effect* | Skin diseases, Boils [21,28]; Bone fracture [54] |
| *Verbascum thapsus* L. | *To increase lactation in milching animals* | Cough, Fever, Rheumatism [21]; Boils Eye cataract [54] |
| *Viola betonicifolia* J.E. Smith | *Snake bite* | Blood diseases, Cough, Fever, Skin [58] |
| *Viola canescens* Wall. Ex Roxb | *To increase lactation in milching animals* | Cough, Cold, Malaria, Jaundice [23,48] |
| *Vigna mungo* L. | *Fracture* | -- |
| *Zanthoxylum armatum* DC | Carminative, Cough & cold, Toothache, Spices & condiments | Toothache [28]; Constipation, Gastric disorders [21,23,51] |
| *Zingiber officinale* (Zingiberaceae) | Cough & cold | Asthma, Cough & cold [23] |

*New ethno-medicinal use reports documented from study sites.

Figures
Figure 1

Study area and villages in Garur and Kapkot Blocks of District Bageshwar, Uttarakhand, India

Figure 2

Age distribution of respondents
Figure 3

Distribution of medicinal plants in different life form
Figure 4
Plant part used in preparation of medicine

Figure 5
Processing of plant parts in preparation of medicine
Figure 6

Distribution of medicinal plants in different ailments category

Figure 7

Past (2008) and present (2018) use of plants in traditional healthcare system
Figure 8

Community view points on effectiveness of traditional healthcare system