

**ETHNOBOTANICAL STUDIES OF PLANTS USED BY
GADDI AND SIPPI TRIBES OF DISTRICT DODA, J&K**

Thesis Submitted for the Award of the Degree of

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in
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By

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2024

DECLARATION

I, hereby declared that the presented work in the thesis entitled “Ethnobotanical studies of plants used by Gaddi and Sippi tribes of district Doda, J&K” in fulfillment of degree of Doctor of Philosophy (Ph.D.) is outcome of research work carried out by me under the supervision of Dr. Vikas Sharma, working as Professor in the Department of Molecular Biology and Genetic Engineering of Lovely Professional University, Punjab, India and co-supervision of Dr. R. K Manhas, Associate Professor, Department of Botany, Govt. Degree College Basohli, J&K. In keeping with general practice of reporting scientific observations, due acknowledgements have been made whenever work described here has been based on findings of other investigator. This work has not been submitted in part or full to any other University or Institute for the award of any degree.



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CERTIFICATE

This is to certify that the work reported in the Ph.D. thesis entitled “**Ethnobotanical studies of plants used by Gaddi and Sippi tribes of district Doda, J&K**” submitted in fulfillment of the requirement for the award of degree of **Doctor of Philosophy (Ph.D.)** in the department of Botany, is a research work carried out by **Bhekam Pal Singh**, Registration No. **41900489**, is bonafide record of his/her original work carried out under my supervision and that no part of thesis has been submitted for any other degree, diploma or equivalent course.



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ABSTRACT

Nearly 70% of the total population of India lives in rural areas. Rural communities in general and tribals in particular are intimately associated with the forests and forest produce and are highly dependent on local plants for their sustenance. That is why tribals are known as the torch bearers of ethnobotany.

Gaddi and Sippi communities of UT of Jammu & Kashmir are less known, semi-nomadic, transhumant and pastoral Himalayan tribes who are shepherds by occupation. Their settlements are located on high altitudinal, remotely located and secluded mountainous tracts of North West Himalayas completely away from the influence of the mainstream of the society. These tribes are directly in touch with the forests by virtue of their profession of shepherding and location of their inhabitations in close vicinity of forests and thus depend upon large number of locally growing plants for meeting their day to day needs.

The present research work documented 236 plant species of ethnobotanical importance belonging to 183 genera and 77 families which were used traditionally by the Gaddi and Sippi tribes of district Doda, UT of Jammu and Kashmir for different purposes. The number of plant species used in ethnomedicinal practices, ethnoveterinary practices, as wild edible plants, as fodder/forage plants, for making traditional plant derived utility products (PUPs) and in socio-magico-religious practices were 155, 72, 88, 70, 60 and 62 respectively. Angiosperms, gymnosperms, pteridophytes and fungi were represented by 215, 7, 5 and 9 species respectively. Herbs with 142 species were the most represented plant habits followed by trees (44 sps.), shrubs (26 sps.), climbers (10 sps.), mushrooms (9 sps.) and ferns (5 sps.).

Fifteen different plant parts were used in different ethnobotanical practices. Leaves with 26.5% contribution were most used plant parts followed by aerial parts (15.2%), roots (11.0%), fruits (9.5%) and branches (9.0%). Sixteen and ten different types of crude drug preparations/dosage forms were used in ethnomedicinal and ethnoveterinary practices respectively. In ethnomedicinal practices the most utilized

dosage form was paste (26.4%) followed by raw form (14.7%), cooked vegetables (11.2%), crushed form (10.7%) and powder (10.2%). However, in ethnoveterinary practices crushed form (27.1%) was the most utilized dosage form followed by paste, raw form (19.8% each), decoction (12.3%) and boiled form (7.4%).

As many as 76 diseases/disorders of human beings and 29 diseases/disorders of livestock were reported by the informants which were cured by using 155 and 72 plant species respectively. All the documented diseases of human beings and livestock were categorized into 12 and 9 disease categories respectively for the ease of research study. Digestive problems, general and unspecified problems and skin problems were the most common human disease categories which were treated by using 65, 53 and 36 plant species respectively. The most common veterinary disease categories were general problems, digestive problems, foot and mouth disease and respiratory problems which were treated by using 34, 19, 8 and 7 plant species respectively. Hence, in the absence of modern healthcare facilities, Gaddi and Sippi tribes rely heavily on ethnomedicinal and ethnoveterinary plants for healthcare of humans and livestock.

Gaddi and Sippi tribes are highly dependent on wild sources of food plants for meeting their dietary requirements. These tribes use 88 species of Traditional edible plants, mostly wild, which were categorized into 8 edible usage categories viz. raw (39 sps.), cooked vegetables (31 sps.), chutney (8 sps.), flavouring agents, beverages, miscellaneous (7 sps. each), preserved foods (4 sps.) and pulao (3 sps.).

A total of 96 traditional plant derived utility products (PUPs) were made from 60 plant species by Gaddi and Sippi tribes. All the PUPs were categorized into five major usage categories and tools with 52.1% contribution were the major PUP category. Other categories include containers/storage products (9.4%), construction products, artefacts (8.3% each) and miscellaneous products (21.9%). *Cedrus deodara* (Roxb.) G. Don. is used for making more than one-third of the total PUPs and is culturally the most important species for Gaddi and Sippi tribes for making PUPs. These tribes use a large number of tools in agricultural practices (22) and for making woolen products (14) which

provides a deep insight into their pastoral occupation of practicing subsistence agriculture and rearing goats and sheep respectively.

Gadi and Sippi tribes also use 70 plant species as fodder/forage for their cattle.

Plants play an important role not only in fulfilling certain basic needs of human beings but have also influenced their cultural and religious life since time immemorial. As many as 62 plant species were used in socio-magico-religious practices by the tribes under survey which were categorized into four use categories viz. sacred and religious rites (SRR) (37 sps.), socio-cultural rituals (SCR) (11 sps.), magical belief and exorcism (MBE) (26 sps.) and taboos (TAB) (3 sps.). Hence, plants form an inseparable component of rich culture of Gadi and Sippi tribes.

Based on the use value index, *Ajuga parviflora* Benth., *Angelica glauca* Edgew., *Geopora arenicola* (Lev.) Kers., *Cedrus deodara* (Roxb.) G. Don., *Brassica juncea* (L.) Czern. and *Themeda anathera* (Nees ex Steud.) Hack. were the ethnobotanically most important plant species used by Gadi and Sippi tribes in ethnomedicinal practices, ethnoveterinary practices, as edible plants, plants used for making plant derived utility products, socio-magico-religious practices and as fodder/forage plants respectively.

The phytochemical analysis of five ethnomedicinally important plants viz. *Ajuga parviflora* Benth., *Dysphania ambrosioides* (L.) Mosyakin & Clemants., *Isodon rugosus* (Wall. ex Benth.) Codd., *Indigofera heterantha* Brandis. and *Pilea umbrosa* Wedd. ex Blume. was performed for qualitative and quantitative detection of some important secondary metabolites viz. alkaloids, flavonoids, saponins, steroids, tannins, phenols, terpenoids and glycoside in them. The results of phytochemical analysis indicated the presence of all these chemical compounds in all the selected five plant species except that no detectable steroids were found in *Indigofera heterantha* Brandis. *Isodon rugosus* (Wall. ex Benth.) Codd. was found to contain relatively high content of alkaloids and phenols. *Indigofera heterantha* Brandis was relatively rich in saponin and glycosides. *Dysphania ambrosioides* (L.) Mosyakin & Clemants contained relatively larger content

of flavonoids and steroids whereas *Ajuga parviflora* Benth was rich in terpenoids and tannins. Based on ABTS assay of the same five selected ethnomedicinal plants, *Dysphania ambrosioides* (L.) Mosyakin & Clemants showed the highest antioxidant potential.

As a novelty of the present study, the new records in plant species of ethnobotanical importance from UT of Jammu & Kashmir include 17 plant species in ethnomedicinal practices, 24 plant species in ethnoveterinary practices, 9 plant species used as wild edible plants, 51 plant species used for making plant derived utility products. Moreover, 113 new use reports of 84 ethnomedicinal plants have also been reported in the present study from UT of J&K. New records and novel use reports of ethnomedicinal and ethnoveterinary plants offer scope for future ethnopharmacological research and provide potential drug leads for discovery of novel drugs.

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A handwritten signature in black ink, appearing to read 'Bhokam Pal Singh', with a small dot at the end.

Bhokam Pal Singh

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Chapter 1

Introduction

The dependence of human beings on nature to cater to their varied needs dates back to prehistoric times (Choudhary et al., 2008). Aborigine societies across the globe are highly knowledgeable about the traditional use of plants for meeting their multifarious requirements like medicines, food, dyes, tools, artifacts, construction etc. Thus, locally available plants play a pivotal role in sustenance and subsistence of the indigenous tribal and rural communities (Kumar et al., 2015a).

Early human civilisations relied purely on magic, religious practices and crude herbal medicines for health care and physical well-being. The transition from traditional methods of curing diseases to science based modern medicines was a gradual process which lasted for hundreds of years (Subitha, 2012). Tribals and other rural communities lack access to modern healthcare facilities and hence depend on locally available medicinal plants for curing different ailments and diseases (Arya *et al.*, 2014). Tribal people have learnt the indigenous methods of using medicinal plants for health care and well-being after centuries of trials, many a time at the risk of their lives (Kaya et al., 2020). Traditional medicines include all sort of unconventional medicines or folk medicines as well as any therapeutic method that had been traditionally communicated by the aboriginal communities to their future generations (Bhasin, 2008). *Ayurveda*, *Homeopathy*, *Siddha*, *Unani* etc. are traditional systems of medicines practiced in India which are generally based on use of medicinal plants (Reddy et al., 2008). *Sushruta Samhita* (800-700 BC) and *Charaka Samhita* (1000-800 BC) are two most basic literatures of ancient Indian traditional systems of medicines which contain description of large number of diseases and medicinal plants (Khandelwal et al., 2019). Lord Dhanvantri is popularly known as father of Ayurveda as he brought Ayurveda to the world for alleviating suffering of mankind (Raj et al., 2011).

The ethnobotanical knowledge of indigenous people is known from the ancient period. However, ethnobotany has emerged as a field of scientific research only during 19th century (Shultes, 1991). It has attracted worldwide attention during the last 7 decades

and has established close linkages with many disciplines of science and arts. Dr. E.K Janaki Ammal and Dr. S.K Jain from Botanical Survey of India (BSI) were the pioneers of organised ethnobotanical research in India which started during second half of 20th century (Sreedevi et al., 2013). Ethnobotanical research in India got a boost during 1980s when “All India Coordinated Research Project on Ethnobiology (AICRPE)” was launched by Government of India with the objective of conducting exhaustive surveys for documenting the traditional knowledge of tribals associated with utilization of local flora and fauna (Pushpangadan et al., 2018). In 1980, Society of Ethnobotanists (SEB) was set up in India with Dr. S.K Jain as its founder President for promotion of plant based traditional knowledge (Padhy et al., 2015). In order to promote coordination between ethnobotanists of UT of Jammu and Kashmir, in 2021, a local chapter of ‘Society of Ethnobotanists’ has been set up with Dr. H.C Dutt as its regional coordinator (Daily excelsior newspaper, 25th October, 2021). In 2022, India achieved a landmark milestone and has emerged as a global leader in the field of traditional medicines as an agreement was signed between WHO and Ministry of Ayush, Govt of India to establish WHO Global Centre for Traditional Medicine (GCTM), the first of its kind, at Jamnagar, Gujarat. Its foundation stone was laid by Prime Minister Narendra Modi in April, 2022 in presence of WHO Director-General, Dr. Tedros Ghebreyesus. The objective of establishing WHO-GCTM is to reap the maximum benefits of traditional medicines at global level through science, technology, research and innovations (W.H.O, 2022).

Ethnobotany revolves mainly around tribals and other rural communities who are devoid of basic amenities and are living a primitive lifestyle. It has been observed that the social and economic upliftment of the tribals is accompanied by diminishing of their rich cultural heritage which is one of the big challenges in making policies for tribal development. Tribal Panchsheel, the five principles for tribal development formulated by Pt. Jawahar Lal Nehru support promotion of socio-economic development of tribals without damaging their socio-cultural fabric (Press Information Bureau, Vice President Secretariat, GOI, online).

1.1 Ethnobotany: Definition.

“Ethnobotany is the study of how people of a particular culture and region make traditional use of indigenous plants for meeting their multifarious requirements such as food, fodder, shelter, medicine, clothing, hunting and religious ceremonies” (Narendra Kumar et al., 2015). Ethnobotany also includes study of taboos, beliefs, avoidances and magico-religious practices associated with plants. The term ethnobotany consists of two parts ethno- the study of people and botany- the study of plants. Hence, ethnobotany is the branch of science which deals with relationship between aboriginal people and locally available plants. This relationship may be abstract, which includes plant based customs, beliefs, folklore, taboos, religious ceremonies, worships, myths etc. or it may be concrete, which includes material and cultural use of plants and their conservation (Sachidanand Padhy, 2017). The term ethnobotany was used for the first time by John W. Harshberger way back in 1895 to describe studies of “plants used by primitive and aboriginal people” and in 1896 his publication, ‘The Purpose of Ethno-botany’ (Harshberger, 1896) marked the beginning of this field of science as academic discipline (Balick and Cox, 1996). According to Jones (1941) ethnobotany is “the interrelationships of primitive men and plants”. Faluks (1958) defined ethnobotany as “the total relationship between men and vegetation”. In the words of Cotton (1996), “ethnobotany is the study of mutual relationship between plants and traditional people”. According to Jain (2001) “ethnobotany is defined as the study of total natural and traditional interrelationship between man and plants and his domesticated animals”.

In 1916, the term ethnobotany was further elaborated by Robbins, Harrington and Freire-Marreco as “a branch of science which deals with the exploration and appraisal of the plant based knowledge possessed by the primitive societies during different stages and should include the role of plants in the life, history, culture, beliefs and customs of such societies” (Gurib-Fakim, 2006). In the words of Shultes (1967) ethnobotany is “study of relationships between man and his ambient vegetation” (Gurib-Fakim et al., 2006). As per Ford (1978), “ethnobotany is concerned with a wide range of interest of

plants in cultural and ecological context”. Martin (1995) defined ethnobotany as “part of ethnology which concerns plants”.

Thus, different workers have defined ethnobotany in different ways but its interpretation and meaning was same for all of them which revolves around “the direct relationship between plants and man” (Dr. S.K Jain, 1986). Richard Evans Schultes is known as the Father of Ethnobotany and Dr. S. K. Jain is popularly acclaimed as “Father of Indian Ethnobotany”.

1.2 Ethnobotany: Importance

Ethnobotany is an interdisciplinary science which includes botany, phytochemistry, ecology, anthropology, pharmacology, taxonomy, geography, agroforestry, agriculture, archeology, linguistics, medicine etc. (Ghorbani et al., 2006). Because of its interdisciplinary nature ethnobotany plays a vital role in meeting medicinal requirements, ensuring nutritional security, combating malnutrition, deriving plant based utility products, drug discovery, folklore, cottage industries, environmental conservation, income generation and livelihood promotion for rural communities (Lele et al., 2017, Kharwal and Rawat, 2009, Khan et al., 2016).

1.2.1 Rural Healthcare.

A sizeable rural population of the world depends on plant derived medicines for maintaining good health. Herbal medicines are becoming popular across the world because of their increasing recognition as natural products, readily availability, being cheaper, and having no or negligible side-effects (Sajem et al., 2008). That is why, recently, a transition from allopathic medicines to herbal medicines has been observed at global level, which can be referred to as “return to nature” (Jain, 2019). Medicinal plants produce different kinds of secondary metabolites like alkaloids, steroids, phenolics, flavonoids, tannins etc. which have proved their worth in pharmaceutical industries for drug preparation (Sharanabasapa, 2007; Jain, 2019). With the emerging awareness, the significance of plant-based ethnomedicinal knowledge is being progressively recognized

across the globe and this traditional knowledge has significantly contributed towards the physical well-being of people.

1.2.2 Drug discovery

Ethnobotanical research provides clue and fundamental information for future scientific research leading to the discovery of many plant based drugs (Anyinam, 1995; Pandey and Tripathi, 2017). For example, Tu Youyou received Nobel Prize in Medicine or Physiology in 2015 for discovery of a highly effective anti-malarial drug Artemisinin and this discovery was based on review of literature of ancient traditional Chinese medicines (Su and Miller, 2015). It has been estimated about 40% of approved pharmaceutical products of the present times are the derivatives of natural substances (WHO, 2022).

1.2.3 Nutritional and nutraceutical source.

Hunger and malnutrition are among the major global challenges of 21st century. India has also not remained untouched by the scourge of hunger. Most of the wild food plants have been underutilized by humans as 90% of human food is derived from only 20 plant species with rice, wheat and corn as the major source of staple food (Singh et al., 2020) and thus the potential of WEPs in ensuring food security has been overlooked, underestimated and understudied (Narayanan et al., 2011; Niveditha, 2017; Duguma, 2020; Mishra et al., 2021). Against this backdrop the nutraceutical potential of hitherto neglected and underutilized wild edible plants could be exploited for making our food system viable, sustainable and more nutritious.

Some of the forest foods possess nutritional as well as therapeutic properties and are known as nutraceuticals (Singh et al., 2016). Moreover, there is a growing awareness among the people worldwide about the health benefits associated with organic foods. WEPs are the purest form of naturally growing organic foods which are environment friendly, not treated with pesticides and chemical fertilizers, highly nutritious, healthy and safe for consumption (Shaheen et al., 2017). The shelf life of many wild fruits has been found to be longer than their cultivated species (Biswas et al., 2018) and are relatively more nutritious (Seal et al., 2014). Some WEPs are resilient to unfavourable climatic conditions

and are thus referred to as emergency food or famine food or reserve food as they help to cope with food shortage in times of starvation and hunger caused due to famine, drought or other adverse environmental conditions (Adlin et al., 2018; Mallick et al., 2020; Duguma, 2020).

1.2.4 Socio-economic upliftment of tribals

Tribals are highly knowledgeable about the utility of various ethnobotanical plants which are still unknown to modern society. This valuable knowledge confined to the tribal groups could be commercially exploited for the common good of the whole society. The plant based traditional knowledge could be commercially exploited for providing new plant sources as raw material for plant based cottage industries such as basketry, carpet industry, food processing industry etc., consequently, it may go long way in socio-economic upliftment and livelihood promotion of tribals and rural communities (Sharma et al., 2019). The wild plant species not only play a crucial role in the sustenance of the tribal groups but also form an essential part of the tradition and culture of these communities (Rana et al., 2019).

Contrary to the market products, the traditional plant products are environment friendly and friendly to the poor rural communities as they are economically affordable, cost-effective and readily available and thus play a key role in the subsistence of rural communities (Dangi and Endo, 2016; Giri, 2020).

Traditional agricultural tools are easy to handle as they do not require any special skill for their operation. Furthermore, such tools are more convenient for use in hilly areas where modern heavy machinery and tools are not feasible for use (Dangi and Hitoshi, 2016).

1.2.5 Development of improved crop varieties.

Wild edible plants show adaptations to the adverse environmental conditions (Sundriyal and Sundriyal, 2001), are resistant to many diseases and this potential could be utilized in breeding programmes for developing improved varieties of crop plants (Rana et al., 2012). For example the Himalayan wild species *Allium fistulosum* is resistant

to white rot and anthracnose (Verma et al., 2008, Galvan et al., 1997) while *A. roylei* is resistant to downy mildew (Scholten et al., 2007) and leaf blight (de Vries et al., 1992).

1.2.6 Biodiversity conservation.

The forest dwelling tribes are not only well versed with the traditional uses of plant wealth but also familiar with the ecological interactions between different components of forest ecosystem much better than the environmental scientists. The various myths, taboos, beliefs and avoidances like establishment of sacred grooves by the tribal societies have proved instrumental in conservation of forests. Ethnobotanical studies, thus, help the conservation biologists in understanding the relationship between local communities and their environment and to devise strategy for biodiversity conservation in local context (Kumar et al., 2011; O'Neill et al., 2017). Agenda 21 of Rio Declaration on Environment and Development (1992) also advocates the participation of tribals and other rural communities in sustainable management of ecosystem and ecosystem services because of their long association and experience with nature (UN Conf. on Env. & Dev., Rio de Janeiro, 1992; Simon, 2011).

1.2.7 Conservation of culture.

The role of plants is deep rooted in culture and traditions of human societies. A number of plants find their use in different socio-magico-religious practices in Indian societies like worshipping, festivals, birth and death ceremonies etc. Ethnobotany aims at studying the influence of human culture on local vegetation and vice-versa. Hence, documentation of socio-magico-religious practices involving use of plants may lead to understanding as well as conservation of a part of culture of the rural societies.

However, exploitation of ethnobotanical knowledge by external entities for scientific and commercial purposes has posed a threat to the indigenous communities to protect their cultural heritage, livelihood and biodiversity conservation. IPRs could be integrated into ethnobotanical research for proper recognition of indigenous communities and benefit sharing for their rich cultural heritage. However, the individualistic nature of IPRs, unawareness of indigenous communities towards IPRs, high cost and requirement

of expertise for IPRs processes makes implementation of IPRs challenging for indigenous communities.

1.3 Choice of the present work

Although tribals and other rural communities are generally illiterate, they are well versed in identifying and traditionally utilising wild plants because they are directly linked with forests and this traditional knowledge is transmitted orally from one generation to the next (Deb et al., 2013; Das, 2013; Rajkumari et al., 2013; Clothe et al., 2014; Shrivastava, 2016). The tribals are thus known as torch bearers of ethnobotany (Remesh, 2007). The tribal communities inhabiting mountainous tracts of Himalayas are heavily reliant on local plant species for meeting their varied needs (Bodh et al., 2019; Chandra and Uniyal, 2021; Wali et al., 2022; Chandra and Uniyal, 2021; Rehmat Wali et al., 2022) and most significantly for medicinal purpose (Singh and Lal, 2008; Malik et al., 2015; Negi et al., 2018; Bisht and Adhakari, 2018; Dhiman and Bhattacharya, 2019). The excessive utilization of forest resources may adversely affect the plant wealth. However, tribals are the ecosystem communities who live in utter concordance and cooperation with nature without disturbing the ecological balance (Sajem and Gosai, 2006).

Gaddis and Sippis are less known, semi-nomadic and transhumant Himalayan tribes. Their settlements are located on high altitudinal, remotely located and secluded mountainous tracts of Himalayas. Their main occupation is shepherding and they graze their livestock in highly inaccessible, temperate and alpine zones of North West Himalayas which are rich repositories of plant diversity. These tribes undergo seasonal migration along with their flock of goat and sheep from hills to plains and vice-versa in search of pastures for their livestock (Sharma and Singh, 1989). During this migration they move across different mountainous passes and are thus familiar with high altitudinal medicinal plants which are hardly known to modern society. Many studies have found that herders are the chief collectors of medicinal plants growing on high altitude snow-capped alpine pastures (Kumar and Hamal, 2009). Thus, these forest dwelling agro-pastoral tribes are closely related to the forests and forest produce by virtue of their

occupation and lifestyle. Since they are relatively isolated from the mainstream society, they have maintained their ethnic and cultural distinctness. Hence, these communities are still carrying forward the legacy of their rich cultural heritage and are thus expected to be highly knowledgeable about traditional use of plants for varied purposes.

Although several ethnobotanical studies have been previously conducted on Gaddi tribe of Himachal Pradesh, the review of published literature has shown that the Gaddi and Sippi tribes of UT of J&K have not received the required attention of ethnobotanists so far. Hence there is a significant research gap in current knowledge. Moreover, the author belongs to Gaddi tribe, has a long association with the people of Gaddi and Sippi tribes of the study area, familiar with the Gaddi culture and Gaddi language and thus has easy access to the informants. The present research work is, therefore, an attempt to record the hitherto undocumented plant based traditional knowledge of Gaddi and Sippi tribes of district Doda, J&K.

The present research work was carried out with the following objectives.

Objectives

1. To collect, identify and inventories plant specimen of ethnobotanical importance used by Gaddi and Sippi tribes of district Doda, J&K.
2. To study how locally available plants are traditionally used by Gaddi and Sippi tribes of the study area.
3. To record the plant specimen of ethnobotanical importance and activities of the community members related to traditional plant/plant product usage with the help of photographs.
4. To identify the culturally important plants by using quantitative/statistical indices.
5. To perform the phytochemical analysis for the availability of different secondary metabolites from a few culturally important ethnomedicinal plants.

Scope of the present research work.

1. **To enrich the discipline:-** The ethnobotanical knowledge possessed by *Gaddi* and *Sippi* tribes has been documented in the form of research thesis as well as quality publications which would enrich the discipline of ethnobotany.
2. **Knowledge preservation and transmission:-** Since ethnobotanical knowledge is transmitted orally by the *Gaddi* and *Sippi* tribes in their scriptless local dialect known as *Gadyali* language, its documentation in the form of thesis and publications would lead to knowledge preservation and transmission, which would otherwise disappear from the face of earth forever in near future.
3. **Improvement in tribal/rural healthcare:-** The documentation, preservation and transmission of traditional knowledge of ethnomedicinal plant usage would enhance the chances of these medicinal plants to be used by large number of community members of *Gaddi* and *Sippi* tribes as well as by other rural communities, thereby improving rural healthcare.
4. **Baseline information for development of modern drugs:-** Traditional knowledge on ethnomedicinal plants provides clue and fundamental information for future scientific research which may lead to novel drug discovery from medicinal plants.
5. **Conservation of plants of ethnobotanical importance:-** Documentation of ethnobotanical practices will help in spread of traditional knowledge among different rural communities. More the rural communities become aware of the importance of local plants of ethnobotanical importance, more they will become concerned towards community based conservation of such plants.
6. **Livelihood promotion/Socio economic upliftment of tribals:-** Tribals have knowledge about the utility of many ethnomedicinal plants which are hardly known to the mainstream of the society. These plants can be exploited as a source for their commercial use in cottage industries like basketry, food processing industry etc. These cottage industries could be set up by the tribals in collaboration with SC, ST and Backward Classes Development Corporation.

7. **Preservation of culture of *Gaddi* and *Sippi* tribes:-** The culture of *Gaddi* and *Sippi* tribes has been studied with the objective of identifying different plant species used by these tribes as a part of their culture. Thus, a part of their culture involving traditional use of plants has been documentation and hence preserved.

Chapter 2

Review of Literature

2.1 Ethnobotany: Concept.

Ethnobotany is the study of how the indigenous communities inhabiting a particular region and having their own specific culture utilize locally growing plant species to satisfy their certain basic requirements like medicine, food, fodder, utility products, clothing, shelter, etc. (Kumar et al., 2015). According to Shah, ethnobotany is “the use of plants in material or abstract form among ethnic communities or tribal people” (Shah, 2008). Martin (1995) defined Ethnobiology as “an explanation on local people’s perspectives on cultural and scientific knowledge”. According to Botanical Survey of India, ethnobotany is “documentation of traditional knowledge associated with plants” (<https://bsi.gov.in/page/en/ethnobotany>).

2.2 Ethnobotany: Background.

From time immemorial, humans are intimately associated with nature and fulfill all their basic needs of food, shelter, clothing and medicine from it (Kumar, 2014; Kumar et al., 2020; Pangging et al., 2021). Surprisingly, most of the previous research in ethnobotanical studies has been carried out around medicinal and dietary aspects of locally available plants and only a few studies are based on other ethnobotanical uses of plants (Maguipinamei, 2016). Traditional use of herbal medicines is based on firm belief handed down through several generations and dates back before the advent of modern medicines. Traditional herbal preparations developed by the aboriginal communities after several years of trial and error methods as a cure for different diseases are called ethnomedicine or tribal medicine (Bhatia et al., 2014). Crude herbals preparations like powder, tinctures, decoction, tea, poultice etc. were the first medicines used by the early human civilisations for treatment of diseases and ailments (Balunas and Kinghorn, 2005; Lone and Bhardwaj, 2013; Giannenas et al., 2020). Herbal medicines have little or no

side-affects (Sajem et al., 2008; Laldingliani et al., 2022), that is why World Health Organization also encouraged the blending of Traditional Medicines with modern healthcare practices and policies (WHO, 2013).

However, the belief that herbal medicines are safe and have no side effects is not always true as some medicinal plants contain highly toxic compounds (Ekor, 2014). Some plant alkaloids like sanguinarine derived from *Argemone mexicana* exhibit significant toxic effect on human body and may cause epidemic dropsy and glaucoma (Brahmachari et al., 2013). The clinical studies of *Bergenia ciliata* on certain animals has shown toxic effects on them which resulted in different health complications like bloody diarrhea, breathing problems and gastrointestinal disorders (Ruby et al., 2012). Very small quantity of betamethasone has been found in some herbal medicines which developed steroid hormone like side effects in patients. Hence, recently, the monitoring of herbal medicines have been included within the ambit of pharmacovigilance centres established under WHO International Drug Monitoring Programme to ensure quality and safety of herbal medicines (WHO, 2004).

The medicinal properties of medicinal plants are ascribed to presence of different bioactive compounds in them which bring specific changes in human physiology (Daimari et al., 2019; Radha et al., 2021). Same plant species could be used effectively as a remedy for different diseases because different parts of the medicinal plants contain different bioactive compounds and thus possess different therapeutic properties or the same compound can act against different pathogens (Namukobe et al., 2011; Raj et al., 2018). Based on a review study, Qian et al. (2022) reported that more than 307 bioactive compounds have been isolated and identified worldwide from medicinally important plant *Impatiens balsamina* which confers different biological properties to this plant like antimicrobial, antioxidant, antitumor, anti-inflammatory, antiallergic, anthelmintic, insecticidal etc.

The ethnomedicinal plants with most citations and high use value (UV) are considered to be culturally most important and the bioactive compounds present in them could be isolated, identified and subjected to clinical studies to test their safety, efficacy

and toxicity which may lead to novel drug discovery (Rokaya et al., 2010; Kadir et al., 2012; Mahmood et al., 2012; Kunwar et al., 2013; Kayani et al., 2014; Shah et al., 2014; Thakur et al., 2016; Rana et al., 2019; Panmei et al., 2019). Based on the findings of the studies carried out by Dua et al. (2011) in Garhwal Himalayas, *Roylea cinerea*, *Artemisia roxburghiana*, *Leucas cephalotes* and *Nepeta hindostana* have been reported to exhibit significant anti-plasmodial activity and could be utilised as promising agents for developing herbal formulations for treatment of malaria. Secondary metabolites like phenols, steroids, glucosides and fatty acids exhibit cytotoxic properties due to which they could be used as abortifacient. The abortifacient properties of phenols are attributed to aristolochic acid, β -sitosterol and ceryl alcohol components (Surendran et al., 2022).

Sharma et al. (2013) have made a mention of 26 plant species utilised for treatment of epilepsy by the Bhoja, Tharu and Gujjar communities of Uttarakhand Himalayas. They observed that the same parts of the same plants were used by the geographically distant ethnic groups for preparing herbal medicines for treatment of epilepsy in Uttarakhand and advocated that such plants with wider acceptance for treatment of epilepsy need ethnopharmacological investigations which could provide potential leads for development of modern drugs for curing Central Nervous System disorders. This is because, the consensus among different communities in using same plant species for treatment of the same disease is the testimony of the medicinal potential and therapeutic effectiveness of such species (Singh et al., 2014). Ethnopharmacological screening of medicinal plants helps in determining not only their therapeutic properties but also toxic effects which in turn helps in selecting promising medicinal plants and eliminating harmful ones (Rout et al., 2009). Tyrosinases are one of the major inhibitors of melanin synthesis (Nagarani et al., 2014). In a significant study Sharma et al. (2014) have reported some of the plants having tyrosinase inhibitory properties e.g., *Azadirachta indica*, *Cannabis sativa*, *Chrysopogon zizanioides*, *Ficus religiosa*, *Lawsonia inermis*, *Sesamum indicum* etc. which could be exploited in the cosmetic industry for making skin care products for regulating hyperpigmentation.

Wild plants are used by the rural populace not only for medicinal purpose but also for meeting their nutritional requirements. Wild edible plants (WEPs) are those edible plant species which reproduce and grow naturally under wild conditions without being domesticated or cultivated or any interference by human beings (Bhatia et al., 2018; Mallick et al., 2020; Farooq, 2021; Bhagat et al., 2022). In India, about forty million tribal population resides in or around the forests (Wankhade, 2015) and 24.56 % geographical area of the country is covered by the forests (ISFR, 2019). The rural and forest dwelling communities consume large number of WEPs which are inseparably associated with cultural gastronomic heritage (Pinella et al., 2017; Abdullah and Andrabi, 2021; Kidane and Kejela, 2021) and increase the variety and nutritional quality of their diet (Clothe et al., 2014; Prabakaran et al., 2013; Aadhan and Anand, 2018). The WEPs plants are eaten in different forms like vegetables, fruits, flowers, bulbs, seeds, rhizome, tubers, tea etc. (Mallick *et al.* 2020).

Wild vegetable are generally eaten in cooked form (Garcia-Herrera et al., 2020) whereas most of the wild fruits are consumed raw and a few are eaten in cooked form or after making chutney or pickle (Murtem and Chaudhry, 2016a). Indigenous communities consume wild fruits because of their nutritional and organoleptic properties as they are highly nutrient rich, tasty and refreshing (Shirsat and Koche, 2020). WEPs are consumed not only by human beings but also by the wild birds and animals to satiate their hunger (Dogan et al., 2004; Al-Fatimi, 2021; Ajesh et al., 2012; Suthari et al., 2021). Wild edible plants have an advantage over their cultivated counterparts as they have been found to be drought resistant, disease resistant, not treated with pesticides and fertilizers, purely organic, highly nutritive and do not include GMOs (Shaheen et al., 2017).

Biswas et al. (2018) documented 15 wild edible fruits consumed by the indigenous communities of four districts of Tripura namely Khowai, West Tripura, Dhalai and Sipahijala for dietary and medicinal purpose. The findings of their studies revealed that the shelf life of 11 reported fruits species was more than that of their cultivated counterparts by 3 to 7 days. The proportion of vitamins and different micronutrients like Fe, Zn, Cu, Mg and Mn in some wild fruits (Seal et al., 2014) and wild vegetables (Garcia-Herrera et al., 2020) was found higher than that of their cultivated counterparts. The wild fruits and vegetables have been found to be the rich

source of proteins, carbohydrates, fats, vitamins and minerals which could be consumed for curing nutrient deficiency diseases and they also help in the sustenance of rural communities (Sundriyal and Sundriyal, 2001; Kumar and Hamal., 2009; Dangwal et al., 2014; Singh and Bedi, 2017; Biswas et al., 2018).

The therapeutic potential of some wild vegetables and fruits could be effectively used against various diseases and ailments like cardiovascular diseases, stroke, cancer of alimentary canal and lungs etc. and thus play a significant role in tribal and rural healthcare (Aberoumand and Deokule, 2009). Hence, indigenous rural communities who consume ethnic forest foods have strong immune system and better health and body strength (Reddy, 2012; Das, 2013; Guite, 2016). WEPs could play a pivotal role in addressing COVID-19 like pandemics as they are known to enhance the immunity against many diseases (Sen, 2021). De Meyer et al. (2022) also argued that traditional herbal medicines can be used as alternative medicines for curing COVID 19 disease. They have reported 13 plant based medicines which were used against COVID 19 by the Congolese community in Belgium. It would be, therefore, apt to mention that certain wild foods possess nutraceutical values as they provide both dietary and therapeutic benefits (Singh et al., 2016). Nutraceutical plants are preferred for preventing and curing diseases because these plants do not cause any side effect on human health (Seal et al., 2014). However, further pharmacological and clinical investigations of such plants are strongly recommended for determining the presence of anti-nutritional and bioactive compounds in them to ascertain their efficacy and safety (Rana et al., 2012; Shirsat and Koche, 2020; Duguma, 2020).

The rampant use of chemical fertilizers, pesticides and insecticides on agricultural crops by the farmers for increasing yield and controlling diseases has resulted in poor quality of the food crops which adversely affects the human health through food chain. Humans are suffering from different diseases like hypothyroidism, low haemoglobin, cancer, blood pressure, cardiac diseases etc. because of inadequate intake of healthy and balanced food (Deb et al., 2013). Most of the WEPs are endemic to the rural indigenous communities as they are not sold in the markets and thus the mainstream society is not familiar with these uncultivated sources of edible plants (Singh and Kumar, 2014; Niveditha, 2017). Hence, such plants are 'Poor People Friendly Foods' because they are inexpensive, easily available and accessible to poor rural communities and are thus

natural source of nutrition and subsidiary livelihood for such communities (Patil et al., 2017; Pradhan, 2020; Kidane and Kejela, 2021; Abdullah and Andrabi, 2021). The traditional knowledge possessed by the aboriginal communities about the usage of locally available plant species play a significant role in livelihood promotion, survival and cultural adoptions of human beings (Maikhuri et al., 1998; Jain et al., 2011; Singh et al., 2017a).

The nutritional potential WEPs has not been explored and exploited fully (Narayanan et al., 2011; Mishra et al., 2021). According to an estimate, about 690 million people constituting 8.9% world population is suffering from hunger. The United Nations Sustainable Development Goal (SDG) of achieving zero hunger by 2030 seems to be a distant dream because based on present trends, it is projected that by 2030 the number of hungry people in the world would be more than 840 million (UN, SDG Report, 2016). India having Global Hunger Index (GHI) score of 27.5 ranked 101 in GHI Ranking- 2021 and is one of the serious hunger countries of the world. Hence, ensuring nutritional wellbeing for all entails not only increasing the quantity of food but also its quality (Sivakumar and Murugesan, 2005; FAO, IFAD, UNICEF, WFP and WHO, 2020). The ever increasing human population is a big challenge to cope with hunger and malnutrition and against this backdrop wild sources of food plants could play a key role in reducing the gap between food requirement and food supply but they have not received much attention so far (Sundriyal and Sudriyal, 2001; Das, 2013).

Hence, cultivation and domestication of WEPs is recommended which would lead to a decrease in the rate of exploitation of their wild populations and thus their conservation. It will also ensure nutritional and economic security for indigenous rural communities (Narayanan et al., 2011; Singh and Kumar, 2014; Aadhan and Anand, 2018; Murtem and Chaudhry, 2016a; Golait et al., 2021). Wild fruit trees should be planted or introduced in agro-forestry and afforestation programmes for their ex-situ conservation (Sawian et al., 2007; Paul et al., 2020). Some other methods should also be adopted for conservation of WEPs like folk traditions and community based plant conservation

(Angami et al., 2006; Prakash et al., 2016; Afsana and Biswas, 2020; Cao et al., 2020). Hence, it is now obvious that ethnobotanical studies deal not only with how the locally available plants are traditionally used by aboriginal communities but also with the conservation of cultural heritage of indigenous communities, biodiversity and natural habitats (Kayabasi, 2018).

Utilisation of local plant species by aboriginal communities for making plant derived utility products (PUPs) of day to day use is another important aspect of ethnobotany. Tribals and other rural communities adhere to primitive and traditional methods of agriculture and prefer to use traditional agricultural implements (Vasava, 2021). The findings of different studies have revealed that most of the farming communities in different parts of India use some common traditional agricultural implements derived from plants like plow, yoke, hoe, harrow, sickle, rake, spade, trowel, and axe (Pandit, 2001; Choudhary et al., 2008; Prabakaran et al., 2013; Sarkar et al., 2015; Kumar, 2016; Dangi and Endo, 2016; Brahma and Daimary, 2017; Giri et al., 2020; Sundaramv et al., 2020; Langthasa et al., 2021). However, modern factory-made tools are also being used by many farming communities recently (Sundaramv et al., 2020).

Both environment and culture are dynamic entities as they keep on changing with time (Sujarwo and Keim, 2017). As a result of industrialization, modernization, and increased accessibility to new market products some of the traditional plant-based products which were in vogue in the recent past have been replaced by new market products which are considered to be more efficient and superior (Byg and Balslev, 2001; Pardo-de-Santayana and Macia, 2015). Moreover, such market substitutes are expensive and are made up of plastic, nylon, etc. which have severe detrimental effects on the environment. However, despite having many advantages over their market alternatives, like eco-friendly, affordable etc., PUPs have witnessed a decline in recent past because of modernization and intermingling of rural culture with the modern culture (Pandey, 2015; Zhang et al., 2016).

Since ethnobotanical knowledge is not documented and the younger generations are distancing themselves from traditional practices, there is perceptible future threat to

maintaining and passing traditional knowledge to future generations (Harsha et al., 2002; Sajem & Gosai, 2006; Chander et al., 2015; Bano et al., 2017; Lele et al., 2017; Gupta et al., 2018; Kumar and Singhal, 2019; Simsek et al., 2020). The rural people and traditional healers show reluctance to disclose the folk medicinal knowledge possessed by them to other people because they believe that if they do so, the medicinal plants will lose their healing powers. Moreover the women informants feel shy in interacting with outsiders for sharing the information (Singh et al, 2012; Kumar and Singhal, 2019). The plant based traditional knowledge is possessed only by the older people in a community, and hence will disappear with their death, if not documented (Dixit and Goyal, 2011; Sop et al., 2012; Verma, 2014; Maguipinamei, 2016; Pandey and Pande, 2016; Slathai et al., 2017; Patil *et al.*, 2017; Mallick et al., 2020). The loss of traditional knowledge is irreversible and if lost once, it will become extinct forever just like extinct species (Joshi and Joshi, 2005). Liu et al. (2021) conducted ethnomedicinal survey of a 200 years old Kaili medicinal market, Southeast Guizhou, China and recorded 237 medicinal plant species used by Mio people. However, they observed that the future of this medicinal market is at stake as most of the vendors and customers in this market are old people. Hence they strongly recommended the conservation of folk medicinal practices and the concomitant ethnomedicinal knowledge possessed by the aboriginal communities.

Tribals are also known as ecosystem communities as they live sustainably in cooperation and complete harmony with the nature (Sajem and Gosai, 2006). Tribals rely on wild plants not only for meeting their dietary and medicinal requirements (Lele et al., 2017) but also for house construction, making agricultural tools and household articles of day to day use (Kumar et al., 2007; Kharwal and Rawat, 2009).

2.3 Ethnobotany: A Global Perspective:

The ancient written record of medicinal plants reveals that Chinese, Indian and Egyptian used medicinal plants about 5000 years ago and were one of the earliest human societies to use medicinal plants. However, the history of medicinal plant usage in Central Asia and Greece dates back to about 2500 years ago (Jamshidi-Kiaet al., 2017;

Giannenas et al., 2020). The first written text of Chinese medicines has been reported from the time of Emperor Shen Nong Ben Jing (2700 BC) whereas the famous Chinese *Materia Medica* (1100 BC) meaning pharmacognosy and “Pen T’ Sao” (2700 BC) contain the mention of more than 300 and 365 medicinal plant species respectively (Giannenas et al., 2020). Hippocrates (460-377 BC) was Greek Physician who is known as the father of medicine and his pupil Aristotle (384 BC-322 BC) were the pioneers in the field of Greek medicines. Afterwards, a Greek scientist viz. Theophrastus (370 BC-287 BC), who is known as father of Botany and who was the founder of the *School of Medicinal Plants* also made his contributions towards Greek medicines (Jamshidi-Kiaet al., 2017).

Unani system of medicines originated in the ancient in Greek (400 BC) and it was introduced in India during 13th century by the Arab Physicians who accompanied Mughal invaders. At present Unani system of medicines is prevalent in different countries including India, Pakistan, Bangladesh, Britain, USA, Canada and Germany (Giannenas et al., 2020). Dioscorides, a pharmacognist and Military Physician of Roman Army, who is also known as father of pharmacognosy, described more than 600 plants of medicinal importance in five volumes of his book on pharmacopeia titled ‘De Materia Medica’ written in 78 AD (Alamgir, 2017). Leonard Fuchs (1501-1566), a German Physician, mentioned more than 500 plant species in his book *De Historia Stirpium* (1542) (Giannenas et al., 2020). During 18th century, a Swedish botanist viz. Carolus Linneaus, published many books on medicinal plants including *Materia Medica* (pharmacognosy), *Medicamenta graveolentia* (medicines having strong smell) etc. (Alamgir, 2017).

I.A Abbot (1919-2010) was a distinguished ethnobotanist who worked on ethnobotanical studies of Hawaii, USA (Abbott, 1982; Abbott, 1991; Abbott, 1992a; Abbott, 1992b; Abbott, 1996). Ethnobotany and ethnopharmacology are two closely interrelated branches of science which aim at bioprospecting which deals with the conversion of traditional knowledge about medicinal plants into tangible commercial products of social and economic importance like medicinal drugs and other important biochemical compounds (Soejarto et al., 2005). According to International Society of

Ethnopharmacology Constitution, 2005, Ethnopharmacology is the “interdisciplinary study of the physiological actions of plant, animal and other substances used in indigenous medicines of past and present cultures” (International Society of Ethnopharmacology Constitution, 2005).

The 19th century witnessed peak of botanical explorations across the length and breadth of the world. During 19th century several pure bioactive compounds have been isolated from medicinal plants which include morphine from opium poppy in 1803, strychnine from *Strychnos nux-vomica* in 1817, caffeine from green coffee beans in 1820, quinine from cinchona in 1820, nicotine from tobacco plant in 1828, atropine from *Atropa belladonna* and *Hyoscyamus niger* in 1833 and cocaine from coca plant in 1855 (Alamgir, 2017; Giannenas et al., 2020). National Cancer Institute of USA supported project “Natural Inhibitors of carcinogenesis” (1991-2004) has led to the isolation of many plant derived compounds like resveratrol, brassinin, oxomate, deguelin and bruceantin which exhibited cancer chemoprevention activities *in vivo* (Kinghorn et al., 2004). “National Cooperative Drug Discovery Group (NCDDG)”, a research project of United States of America, has identified many anticancer compounds from medicinal plants of tropical rain forests. Recently USA has introduced many plant based drugs to the US market like, galantamine, tiotropium, arteether and nitisinone (Balunas and Kinghorn, 2005).

Richard Evans Schultes (1915 - 2001), an American ethnobiologist and also known as father of modern ethnobotany, worked primarily on ethnobotany of hallucinogenic plants particularly in Amazon and Mexico (Schultes, 1960; 1991; 1994; Schultes and Plowman, 1979; Schultes and Hofmann, 1992). J.A Duke (1929 – 2017), an American ethnobotanist, has written many books on ethnobotany (Duke, 1981, 1992, 1999, 2002, 2008). He used the term ‘green pharmacy’ for herbal medicines and plant derived foods having healing powers. He argued that just like pharmaceuticals, plant based foods can also be used for treating medical conditions. For example, a flavonoid pterostilbene which is an ingredient of blueberries is as effective as the drug, ciprofibrate

(Liponor) in lowering cholesterol (Duke, 2008). Duke (1981) documented medicinal use of 176 plants mentioned in the Bible. E. Wade Davis worked on ethnobiology of tribes and other indigenous communities of Canada and South America (Davis, 1983a, 1983b, 1983c, 1983d, 1988, 1991). He has reported the utilisation of 35 medicinal plant taxa by the Waorani of Amazonian Ecuador (Davis, 1983c). M.J Balick, an American ethnobotanist, worked on ethnobotany of New York City and rural areas of America (Balick, 1984; Balick and Mendelsohn, 1992; Balick, 1996; Balick et al., 2000). Balick et al. (2000) documented 67 plant species prescribed by the healers for treatment of women diseases and ailments in New York. Dennis Jon McKenna is an American ethnopharmacologist and he carried out his studies mainly on hallucinogenic plants (McKenna, 1984; McKenna and Towers, 1985; McKenna, 1998; McKenna et al., 2008, McKenna and Hughes, 2014; McKenna et al., 2018).

Etkin (1948-2009) has authored many books on ethnobotany (Etkin, 1986; 1998; 2000; 2006) and in her book "Edible Medicines: An Ethnopharmacology of Food" she has described the importance of foods in general health (Etkin, 2006). Her work included the role of indigenous medicines in alleviating diseases in Hawaii, Indonesia and Nigeria. She has also held the important position of President of the International Society of Ethnopharmacology (Barbas-Rhoden, 2010). Wayne Arthur Whistler (1944-2020), an ethnobotanist and Professor at University of Hawaii (USA), worked mainly on ethnobotany of flora of the Tonga, Cook and Samoa Pacific islands (Whistler, 1988, 1990, 1991a, 1991b, 2000). Whistler (1990) has reported about 600 plant species of ethnobotanical importance used by the indigenous populations of Cook islands for varied purpose. In his another study on herbal medicines used by the people of Tonga islands, Whistler (1991a) has made a mention of 105 plant species. Paul Alan Cox is a distinguished American ethnobotanist of late 20th century who has received many awards including E.K Janaki Ammal Medal (India) for his contributions in the field of ethnobotany ("Prof. E. K. Janaki Ammal Medal, Society of Ethnobotany India"). Together with his colleagues he was instrumental in discovering the anti HIV/AIDS

properties of a phorbol compound viz. prostratin isolated from the bark of *Homalanthus nutans* tree in Samoa (Cox, 2001).

Bhattarai et al. (2010) made an attempt to understand the ethnomedicinal significance of 121 plants utilized by the local populace of Mustang district, Nepal for curing different diseases. Singh et al., 2012 has made a mention of 66 medicinal plant species used in folk medicine practices in Rupandehi district of Nepal. The people of Allai valley in Western Himalayan region of Pakistan utilize 172 species of medicinal plants for combating various diseases (Haq, 2012). Kayani et al. (2014) dealt with the indigenous use of 120 medicinally important plants for curing 25 types of respiratory disorders by the inhabitants of Gallies in Abbottabad district of Pakistan. Shah et al. (2014) mentioned indigenous uses of 84 plants for curing malaria by tribal communities of three districts of Pakistan namely Abbottabad, Haripur and Mansehra out of which 13 species were reported to be the most cited species.

Yang et al. (2014) inventoried 106 cultivated medicinal plants from the homegardens of Naxi healers and farmers in Northwestern Yunnan, China which were used for treatment of more than 160 health problems. They observed that more than one plant species could be used together for making crude drugs so as to increase their effectiveness against the diseases to be cured. A review of published literature by Rokaya et al. (2014) revealed the folk use of 947 medicinal plants for treatment of gastrointestinal disorders in Nepal. They argued that gastrointestinal disorders are more prevalent in developing countries due to lack of proper sanitation. A review of published literature by Tariq et al. (2015) enumerated 64 anticancer plant species used in traditional medical practices in Himalayan region out of which 42 and 17 species were reported from India and Pakistan respectively.

Many workers have observed dwindling of medicinal plant diversity in the Western Himalayan region of Pakistan due to overexploitation, unsustainable harvesting, deforestation, urbanization and habitat loss (Haq, 2012; Kayani et al., 2015). A review study conducted by Joshi et al. (2016) on the utilization of aromatic medicinal plants in

folk medicines in Indian Himalayan Region, Bhutan and Nepal summarised 116 plant species. A review of published literature on medicinal plants used for treatment of the skin diseases in cross nation Himalayan region by Heinrich et al. (2021) made a mention of 606 plant species. Rokaya et al. (2010) studied the ethnomedicinal values of 161 plant species for treatment of human and animal diseases in Humla district of Nepal and claimed ethnopharmacological use of 93 plant species as new reports from Nepal. They recommended sustainable harvesting and cultivation of commercially important and highly traded wild species of medicinal plants. Ripu M Kunwar has made tremendous contributions towards ethnobotanical investigations in Nepal Himalayas, where the indigenous communities of Jumla, Humla, Dolpa, and Mustang districts use 84 species of medicinal plants (Kunwar et al., 2006) whereas the local populace of Baitadi, Bajhang, Darchula and Dadeldhura districts depend on 258 medicinal plant taxa (Kunwar et al., 2015) for meeting their medicinal needs. The findings of the ethnomedicinal survey carried out by Kunwar and Bussmann, (2009) in two districts of Nepal namely Darchula and Baitadi revealed that the indigenous use of some of the ethnomedicinal plants was contradictory to those of Ayurveda which indicates that herbal medicines evolved as an independent healing system in Nepal Himalayas. Based on review of published literature, Kunwar et al. (2022) reported traditional use of 1762 medicinal plants for 8737 different uses from 77 districts of Nepal.

Islam et al. (2021) carried out ethnomedicinal explorations in the Palas valley, Pakistan and listed 65 plant species used as a remedy for various ailments and disorders out of which 9 species were reported to be threatened. In their study they have claimed new reports of 15 medicinal plant species used for therapeutic purpose in Pakistan. Gary Paul Nabhan, popularly known as "father of the local food movement" is another renowned ethnobotanist of the 21st century who worked primarily on traditional foods of Southwestern United States (Nabhan, 2008; 2013; 2016). He has documented the health benefits of volatile oil obtained from 178 plant species in Sonoran desert, Mexico (Nabhan et al., 2022). The ethnobotanical survey carried out by Lopez-Patino, et al. (2022) in South Mexico documented ethnomedicinal use of 52 plant species. Bautista-

Gonzalez et al. (2022) mentioned ethnomedicinal use of 6 lichens and 14 non lichen fungi based on ethnomedicinal survey carried out on the aboriginal populace in Yuman, North Mexico.

Based on collection of information from traditional healers, Agize et al. (2022) reported ethnomedicinal uses of 274 plants against different diseases in Dawuro zone of Southwestern Ethiopia. Belichenko et al. (2022) described the medicinal values of 112 plants used by Russians and Setos of Pechorsky district in Northwest Russia for their healthcare. The findings of their study revealed that the people rely more on wild sources of medicinal plants than cultivated sources. Olivares et al. (2022) made a mention of 30 plant taxa utilized for ethnoveterinary purpose in Curarrehue and Pucon municipal districts of Southern Chilean Andes. They also observed a decline in use of traditional veterinary medicines due to increase in use of modern drugs.

Kunwar et al. (2022) reviewed 275 published literatures on medicinal plants and mentioned district wise application of 1762 plant taxa by ethnic groups in Nepal which were further categorized into aromatic medicinal plants and traded medicinal plants. Ullah et al. (2022) reported 131 species of mushrooms from Pakistan occupied Jammu and Kashmir out of which 97 species were claimed to be new record. These taxa were used traditionally as a remedy for various diseases. Guo et al. (2022) reported 111 plants traditionally used by the indigenous people of Gyirong valet, Tibet (China) for meeting their medicinal, nutritional and other requirements. A review study by Cock et al. (2022) recorded 203 plants used in South Africa for alleviating fever. However they observed that the efficacy of most of these plants has not been verified so far.

Traditional Chinese medicines are promising source of tyrosinase inhibitors which reduce secretion and deposition of melanin in skin and used for anti-melanoma, spot removing and skin whitening. As many as 186 chemical compounds derived from 61 different Traditional Chinese medicines and mainly belonging to terpenoids, flavonoids, simple phenylpropanoids, Diels-Alder adducts exhibit tyrosinase inhibitory activity (Li et al., 2022).

In one of the major surveys on ethnobotanical studies on wild mushrooms in Southwest Yunnan (China), Wang et al., (2022) reported 623 mushroom species collected from wild as well as from market vendors. Jia et al. (2022) documented the use of 53 species of forest food plants eaten by different ethnic communities in Gansu–Ningxia–Inner Mongolia junction zone. da Silva Souza et al. (2022) described nutritional values of 98 taxa of food plants consumed by the people in Bahia, Northwest Brazil. According to Yangdon et al. (2022) WEPs not only provide nutritional security but also play a pivotal role in alleviating poverty and improving socio-economic status of rural masses. They have reported 52 forest food plants eaten by the denizens of Eastern Bhutan. He et al. (2022) documented 34 traditional food plants eaten by Dong people for fish grilling in three villages in Qiandongnan area, Guizhou Province, Southwest China. According to Ghanimi et al. (2022) the indigenous knowledge about consumption of forest food plants has shown a significant decline during recent past. They have reported 64 plant species traditionally used by Messawa population in Morocco for nutritional as well as medicinal purpose. Janackovic et al., (2022) documented 114 plants with their ethnobotanical uses for varied purpose from Central Balkans (Eastern Siberia).

Most of the previous ethnobotanical studies have been carried out on medicinal and dietary uses of plants. A very few studies on traditional use of plant derived utility products (PUPs) have been done previously worldwide (Salerno et al., 2005; Sharma et al., 2019). Moreover, most of such studies did not include all types of PUPs and were based only on traditional uses of plant derived agricultural implements (Das and Nag, 2006; Karthikeyan et al., 2009; Arya, 2014; Sarkar et al., 2015; Brahma and Daimary, 2017; Giri et al., 2020; Sundaramv et al., 2020) or handicraft products (Dogan et al., 2008; Nedelcheva et al., 2011) or storage structures (Kanwar and Sharma, 2006; Nagnur et al., 2006; Sundaramari et al., 2011; Mobolade et al., 2019) or construction products (Sujarwo and Keim, 2017) or cookwares (Mensahet al., 2012) or tools and construction products (Zambrana et al., 2017), or handicraft products, fiber and construction products (Kang et al., 2017), or construction products, agricultural implements and furniture

(Singh et al., 1990) or household articles, handicraft products and agricultural tools (Salerno et al., 2005).

At global level, the ethnobotanical studies carried out by Suksri et al. (2005), Ibrar et al. (2007), Sop et al. (2012), Neelo et al. (2015), Li et al. (2015), Zambrana et al. (2017) in certain parts of Pakistan, Burkino Faso, Tibet, Bolivia, Botswana and Thailand have documented, inter alia, 14, 12, 54, 38, 4 and 25 plant species respectively, used for construction purposes. Some of the commonly used species documented in these studies include *Albizia sps.*, *Eucalyptus sps.*, *Dalbergia oliveri*, *Ficus sps.*, *Cedrela fissilis*, *Juglans regia*, *Olea ferruginea*, *Morus nigra*, *Pinus sps.*, *Parrotiopsis jacquemontiana*, *Quercus sps.*, *Acacia sps.*, *Abies sps.*, *Tamarandus indica*, *Terminalis sps.*, and *Zizyphus sps.* Ding et al. (2022) have explored the traditional uses of plants for making wooden bowls in Gyirong valley, Tibet, China and reported 16 plant species used for this purpose. The most commonly used species are *Betula utilis*, *Rhododendron arboretum* and *Quercus semecarpifolia*.

2.4 Ethnobotany: Status in India.

The three important components which contribute to ethnobotanical richness of India are rich phytodiversity, ethnic diversity and rich traditional customs (Jain, 1965a, Ratna Manjula, 2012, Ph.D Thesis). India has diverse physiographic and climatic conditions with sub-tropical climate in Northern and North eastern region which experiences very high temperature during summers and very low temperature during winters, tropical wet climate in Western Ghats, tropical dry climate in Western Rajasthan and alpine climate in Indian Himalayan region which receives heavy snowfall during winters. India, one of the leading suppliers of medicinal plants in the world (Bano et al., 2017), is home for a diverse variety of herbal plants due to its distinguishing topographic and climatic conditions (Sharma et al., 2020). India, having 4 biodiversity hotspots, is one of the 12 mega biodiversity countries of the world Kumar et al., 2007; Kumar, 2016). Different climatic conditions in India favours growth of about 47,513 plant species

(Singh & Dash, 2014) which are mainly concentrated in three global biodiversity hotspots viz. the Himalayas, Andaman and Nicobar Islands and the Western Ghats (Arisdason and Lakshminarasimhan, 2020).

The largest population of tribals in the world is found in Africa followed by India (Jagtap et al., 2009). A sizeable population of about 10.45 crore scheduled tribes reside in India (Ministry of Tribal Affairs, GoI). In India, the historical record of use of medicinal plants for curing diseases traces back to the period of Rigveda (4500-1600 BC). The three important ancient Indian literature on medicinal plants are Charaka Samhita (1000-800 BC), Sushruta Samhita (800-700 BC) and Ashtanga Hridaya of Vagbhatta (500-600 BCE). Charaka, Sushruta and Vagbhatta are popularly known as “The Trinity of Ayurvedic knowledge” (Jain, 1965a). Charak Samhita (300 BC), an ancient Indian treatise on herbal medicines contains a mention of 340 plant based drugs and their traditional uses (Prajapati et al., 2003; Kala, 2009). Siddha is another ancient system of traditional medicines practiced in South India which deals with the wellbeing of not only the body but also the soul and the mind. It is believed that Siddha was developed by Bhagwan Shiv and was transmitted to several disciples through his wife Parvati. (Indian National Health Portal, Govt. of India).

The establishment of School of Tropical Medicines in Kolkata in 1921 and Drug Research Laboratory in Jammu in 1941, inter alia, marked the beginning of research on medicinal plant species in India during first half of 20th century (Jain, 2007). The ethnobotanical work in India was started in an organised manner by “Botanical Survey of India” where the research work was initiated by Dr. Janaki Ammal on ethnobotany of tribals of South India. Another renowned ethnobotanist from BSI, Dr. S.K Jain further intensified ethnobotanical research in India from 1960 onwards and his work revolved mainly around the tribals of Central India. He made significant contribution to ethnobotanical studies in India by publishing “A Manual of Ethnobotany” (Jain, 1987), “A Dictionary of Indian Folk Medicine and Ethnobotany” (Jain, 1991), “Bibliography of Indian Ethnobotany” (Jain, 2002) and several research papers (Jain, 1965; 1965b; Jain

and Dam, 1979; Jain and Goel, 1987; Jain et al., 1994; Jain et al., 1997; Jain and Sikarwar, 1998; Jain, 2002; Jain, 2005; Jain and Goel, 2005; Jain, 2006; Jain, 2010; Jain and Tiwari, 2012).

In India, the ethnopharmacological research was started at Regional research laboratory Jammu way back in 1985 by Dr. C.K Atal and Dr. P. Pushpangadan, the then Chief Co-ordinator of “All India Co-ordinated Research Project on Ethnobiology” (Pushpangadan et al., 2016). Different institutions involved in ethnobotanical research in India include “Botanical Survey of India”, Howrah, “Indian Institute of Integrative Medicine”, Jammu, “National Botanical research Institute”, Lucknow, “Central Drug Research Institute”, Lucknow, “Central Institute of Medicinal and Aromatic Plants”, Lucknow, “Tropical Botanical Garden and Research Institute”, Trivandrum, “Central Council of Research in Ayurveda and Siddha” (CCRAS), “Central Council of Research in Unani Medicines (CCRUM)” and many more (Shah, 2008).

“Central Institute of Medicinal and Aromatic Plants (CIMAP)” was established in 1959 under the “Council of Scientific and Industrial Research (CSIR)” for steering quality research in medicinal and aromatic plants. (“CSIR-Central Institute of Medicinal and Aromatic Plants”). The “All India Coordinated Research Project on Medicinal and Aromatic Plants” (AICRP-MAP) was started during late 1960s with the objective of conserving and making available quality resources of medicinal and aromatic plants (“Indian Council of Agricultural Research-ICAR”). “All India Coordinated Research Project on Ethnobiology (1982-88, 1989-1994)” was initiated in 1983 at the then Regional Research Laboratory in Jammu and the number of medicinal plants, edible plants, fiber yielding plants, fodder plants, pisci-cides/pesticides reported in this project was 7500, 3900, 525, 400, 300, respectively (BSI, Govt. of India). The research work under this project was done in different institutions in different parts of the country under “Council of Scientific and Industrial Research (CSIR)” and the “Botanical Survey of India (BSI)”. The setting up of “Society of Ethnobotanists” in 1982 gave further impetus to ethnobotanical work in India (Jain, 2007).

The 19th century witnessed the peak of botanical explorations in India. Jain reported use of 101 medicinal plants (Jain, 1965) and nine timber yielding plants (Jain, 1965b) used by the tribal communities of Bastar for their health care and making different musical instruments respectively. He has also mentioned ethnobotanical use of 48 plants for different purposes by indigenous communities in Northeastern India (Jain and Dam, 1979). Jain further made his contribution in the field of ethnobotany by publishing a Dictionary of Indian folk medicine and ethnobotany which contains mention of 2532 plants (Jain, S.K., 1991).

BSI, the apex body of taxonomic research in India, has recently completed two research projects namely “Ethnobotanical Study of Kaimur and Rohtas districts of Bihar (2018-19)” and “Ethnobotanical Study of West Champaran district of Bihar (2018-19)” and documented 173 and 185 plant species of ethnobotanical importance respectively. Earlier BSI has completed one more research project on “Ethnobotanical Study of Odisha (2006-2017)” in which 1158 plant species have been collected alongwith ethnobotanical data from 23 districts of Odisha. (BSI, “Ministry of Environment Forest and Climate Change, GOI”).

Katewa et al. (2004) described traditional use of 61 medicinal plant species by different tribes of Rajasthan. Kaur et al. (2020) inventoried 50 medicinal plants from Kapurthala district of Punjab, India. Kareti et al. (2022) documented 118 plant species utilised by the aboriginal tribal groups of Amarkantak region of Madhya Pradesh, India. They opined that an increased awareness about therapeutic uses of traditional medicinal plants would pave the way for conservation of such plants. Acharaya et al. (2022) made a mention of 160 species of medicinally important plants used by the Nalike tribe of Bantwala taluk in Karnataka state. According to Das and Leelaveni (2022) indigenous knowledge on medicinal plants plays a key role in industrial manufacturing of modern drugs. They have thrown light on importance of 50 species of medicinal plants used by the tribals of Kalahandi district, Orissa.

2.5 Ethnobotanical Studies in the Indian Himalayan region (IHR).

Himalayas extremely rich in biodiversity and it provides shelter to many aboriginal communities (Samant & Dhar, 1997). The Indian Himalayan Region, comprising of 12 states, extends from Jammu and Kashmir (east) to Arunachal Pradesh (west) and is inhabited by 75% rural population (G.B Pant National Institute of Himalayan Environment). As many as 17000 species of angiosperms in India have been found growing in Himalayas (Hajra and Mudgal, 1997) out of which about 50% species have been reported from Indian Himalayan Region (Bargali et al., 2022; Mehta et al., 2020) and about 7500 species have medicinal values (Shiva, 1996). Almost 18,440 plant species grow in IHR, out of which nearly 45% have therapeutic potentials (Arya et al., 2015). The wild plant species play a crucial role in the sustenance of Himalayan tribal groups (Rana et al., 2019).

Indian pharmaceutical industries are making use of 280 species of medicinal plants out of which 175 species have been recorded from Indian Himalayan Region (Dhar et al., 2000). No other part of India is having as rich phytodiversity as Himalayas (Rao, 1993) with angiosperms, gymnosperms and pteridophytes represented by 8000, 44 and 600 species respectively in this region (Singh and Hajra, 1996). The Himalayan regions have been acknowledged across the globe as rich source of herbals medicines by many workers (Singh et al., 2014; Joshi et al., 2016; Khanday and Singh, 2017b; Chakraborty et al., 2017; Bisht and Adhikari., 2018). The rich floristic diversity in the Himalayan region is attributed to the diverse climatic, topographical, geographical and ecological conditions which has resulted in the formation of different climatic zones along the altitudinal gradient (Choudhary et al., 2008; Kala and Mathur, 2002; Kumar et al., 2011; Ajab and Khan, 2014; Hanief et al., 2016; Rawat et al., 2019). The number of traditional medicinal plants increases (Malik et al., 2015) whereas that of wild food plants decreases (Sharma et al., 2018) with an increase in altitude. An increase in the proportion of medicinal plants with an increase in altitude in Himalayan region has been attributed to the firm belief of the native people in efficacy of herbal remedies (Kunwar and Bussmann, 2008; Chandra and Uniyal, 2021).

In case of high altitude medicinal plants in Himalayan region, roots are the most commonly used plant parts (Uniyal et al. 2002, 2006; Sharma et al. 2004). Akhtar et al., (2013) suggested that harvesting of leaves, flowers and fruits for medicinal purpose would not harm the population of medicinal plants whereas overexploitation of those medicinal plants in which whole plant, roots, rhizome or corms are collected should be avoided as it may cause the depletion of such plant species.

About 6% of the total population of India hail from Himalayan region out of which 25.08% is the aboriginal population belonging to diverse ethnic and cultural groups like Gaddis, Gujjars, Bakerwals (North West Himalaya), Bhotiyas (Central Himalaya), Bhotiyas, Buxas, Rajees, Jaunsarees, Tharus (West Himalaya), Garos, Nagas, Kashis (North East Himalaya) etc. (Nautiyal et al., 2000). According to Akash Tariq et al. (2015) the use of traditional medicinal plants in Himalayan region dates back to 6500 years.

To cope with the increasing pressure on health care services due to constant increase in population, there is a need to rely on herbal medicines which are cost effective and have little or no side effects (Rajoriya et al., 2016; Ojha et al., 2020). The therapeutic potential and safety of ethnomedicinal plants has progressively been recognized across the globe during recent past due to which the herbals medicines are emerging as an alternate therapeutic system with immense healing potential and thus the conservation of ethnomedicinal plants and ethnomedicinal practices need to be prioritized (Negi et al, 2018). Singh et al. (2017a) have enumerated 78 species of medicinal plants used in traditional healing practices by the denizens of Jakholi block of Uttarakhand Himalaya out of which 29 plant species were reported to be threatened due to unplanned harvesting and overexploitation. Kala, 2005 investigated the ethnomedicinal wisdom of *Apatani* tribe of Arunachal Pradesh, Eastern Himalayan region and documented 198 plant species used in folk medicinal practices. They opined that medicinal plants studies play role not only in combating diseases and ailments but also help in conservation of biodiversity and provide base line information for further scientific research.

According to Uniyal et al. (2006) *Bhangali* tribe of Himachal Pradesh, Western Himalaya, use 35 plant species of medicinal importance for their healthcare out of which some of the plants like *Aconitum heterophyllum*, *Picrorhiza kurrooa* and *Rheum australe* find their use in Ayurveda and Unani system of medicines. Different systems of medicines in India like Ayurveda, Allopathy, Homeopathy, Sidha and Unani heavily depend upon wild medicinal plant resources (Rajoriya et al., 2016; Khan and Wani, 2017) and more than 500 million people across the globe are reaping the benefits of traditional herbal medicines included and well documented in these systems of medicines (Bano et al., 2017). Kala et al. (2006) reported the application of about 2000, 1121, 751 and 482 medicinal plants in Ayurveda, Siddha, Unani and Homeopathy systems of medicine respectively.

Ballabh & Chaurasia (2007) reported that the people of Ladakh Himalayas depend mainly on Amchi system of medicines, a plant based medicinal system, for their healthcare and wellbeing. They have investigated traditional herbals medicines used by the Boto tribe of cold desert Ladakh and inventoried 56 plant species used as a source of medicines to cure fever, cough and cold. Sajem et al. (2008) documented 34 threatened species of medicinal importance from North Cachar Hills district, Assam and recommended their conservation to protect them from extinction. Singh and Lal, (2008) described the indigenous use of 58 medicinal plant species for curing four major disease categories viz. liver disorder, stomach problems, rheumatism and sexual dysfunctions by Lahaulas and Bhotias ethnic groups in Lahaul-Spiti region of Himachal Pradesh. They have made a mention of 38 new or less known therapeutic applications of 34 plant species in their study. Gangwar et al. (2010) carried out ethnobotanical exploration in Champawat, Almora, Pithoragarh and Bageshwa districts of Kumaun Himalayas, Uttarakhand and dealt with 102 medicinal plants utilised by the aboriginal communities for combating different diseases. Kumar et al. (2011) documented 57 medicinal plants employed in ethnic medicinal system in Garhwal Himalayas and observed that the composition of the species varies with a change in climatic conditions. Uniyal et al. (2011) dealt with ethnic medicinal plants used by Gaddi, Brahmin, Masas, Lohar and

Rajput communities of Kangra district, Himachal Pradesh and reported 66 plant species. Economic and technological developments across the globe has resulted in major social, cultural and ecological changes and even the rural societies have not remained untouched by this change because of their interactions with the modern urban societies (Khan et al., 2013).

Bhat et al. (2013) explored ethnomedicinal knowledge of Kedarnath Wildlife Sanctuary in Garhwal Himalayas, Uttarakhand and described traditional medicinal use of 152 plant species. Raj et al. (2018) explored the folk medicinal practices of the indigenous communities living along fringes of Chilapatta Reserve Forest, Alipaurdaur district, West Bengal and recorded 140 ethnomedicinal plant species out of which they claimed new records of therapeutic properties for 30 species. Tangjang et al. (2011) reported 74 medicinal plants employed traditionally against different diseases by the inhabitants of three districts of Arunachal Pradesh namely the Dibang Valley, the Tirap and the Papum Pare. Sharma et al. (2012) inventoried 40 plant species of medicinal importance which were utilised as a remedy for jaundice by Bhoja, Gujjars and Tharu communities of Uttarakhand Himalayas, India. Tag et al. (2012), described traditional use of 46 medicinally important plants for curing diabetes mellitus by Khampti traditional healers, locally known as 'Chauya' in Lohit district, Arunachal Pradesh (Northeast Himalayas). They have claimed the use of 11 species for treatment of diabetes mellitus as new reports from the study area.

Rani et al. (2015) studied the traditional phyto-wisdom of the aboriginal inhabitants of four districts of Himachal Pradesh viz. Chamba, Hamirpur, Kangra and Mandi and documented 47 plant species used in traditional healing practices. They have claimed four new reports of traditional herbal remedies in *Clematis grata*, *Pinus wallichiana*, *Indigofera hamiltonii* and *Polygonum persicaria* and considered unsustainable harvesting practices responsible for dwindling phytodiversity. The Tagin, Nyshi and Galo tribes of Arunachal Pradesh use 140 medicinally important plant species as a remedy for different human diseases. These tribes also use folk medicines derived from 18 plant species for alleviating the diseases of their cattle (Murtem and Chaudhary,

2016b). Thakur et al., (2016) enumerated 73 plant species used by the Gujjars and Gaddis of Kangra district of Himachal Pradesh for health care of human beings and livestock. They have claimed new reports of 20 therapeutic uses of 18 plant species. Chakraborty et al. (2017) documented the procedures used for preparation of 24 different types of medicines derived from 53 plant species by Monpa tribe of Arunachal Pradesh. They have laid emphasis on the documentation of traditional knowledge possessed by the Himalayan communities in view of migration of rural masses to the urban areas at faster pace. Paul (2017) described the traditional use of 26 plant species in folklore medicines by the Gujjars and Gaddis of Kangra district of Himachal Pradesh.

Bisht and Adhikari (2018) reported ethnic use of 70 medicinal plant species as a remedy for 31 diseases by *Banraji* ethnic group in Kumaun Himalaya, Uttarakhand. The documentation of ethnomedicinal knowledge helps in its fast dissemination and thus plays pivotal role not only in healthcare system but also in conservation of medicinal plants (Raut et al., 2012; Bisht and Adhikari, 2018). Daimari et al. (2019) explored the ethnomedicinal importance of 37 plant species used against diabetes by Bodo community of Kokrajhar district, Assam. Panmei et al. (2019) studied the traditional therapeutic potential of 145 medicinal plants used by Zeliangrong tribe of Manipur for curing 59 health disorders and diseases. They recommended scientific validation of the therapeutic properties, safety and toxicity of those medicinal plants which have higher use reports.

According to Rana et al. (2019) wild plants not only satisfy the basic needs of the Himalayan tribal communities but also form an indispensable part of their culture and traditions. They explored 83 plants utilised by the nomadic Gujjars of Chamba district of Himachal Pradesh for varied purpose like food, fodder, medicine, making household articles etc. Baidya et al. (2020) described 38 species of ethnomedicinal plants used by the Kabri tribe living in the vicinity of Harlong and Bichikri sacred grooves in Assam for treatment of 30 human diseases. The people of this tribe offer leaves of *Piper betle* and nuts of *Areca catechu* to the deity for seeking permission to collect medicinal plants from the sacred groves. Akash et al. (2021) reported 60 plant species used by Gujjar community of Rajaji Tiger Reserve in Uttarakhand for medicinal purpose. A review of

literature by Raghuvanshi et al. (2021) dealing with the herbal remedies for jaundice in Himalayan state of Himachal Pradesh revealed the traditional use of 87 anti-jaundice medicinal plants out of which the most commonly used species include *Berberis aristata*, *Cuscuta reflexa*, *Embllica officinalis*, *Justicia adhatoda*, *Ricinus communis*, *Terminalia chebula* and *Tinospora cordifolia*. Khajuria et al., (2021) enumerated 236 plant species used as source of folk medicines by the inhabitants of Pauri district of Uttarakhand, India. They have recommended further phytochemical investigations and therapeutic validation of some of plants including *Begonia picta*, *Citrus pseudolimon*, *Parochetus communis*, *Cotoneaster rotundifolia*, *Plantago erosa* and *Rhododendron arboretum* reported from the study area.

Dorjey et al. (2022) recommended the conservation of *Dactylorhiza hatagirea*, an important Himalayan medicinal plant which finds its use in different medicinal systems like Ayurveda, Unani, Siddha and Sowa-rigpa for treatment of different diseases and which has become threatened due to its overexploitation. Laldingliani et al. (2022) described 93 ethnomedicinal plants utilised by Mizo tribe of Champhai district of Mizoram for curing human diseases. Based on the findings of their survey, they recommended 10 plant species for scientific validation of their medicinal efficacy and 13 species for phytochemical analysis for the isolation of bioactive compounds present in them which may provide a lead for development of new modern drugs. According to Bargali et al. (2022), more than 5000 species of vascular plants have been recorded from Uttarakhand state in NW Himalayas out of which about 33% species have medicinal values and hence Uttarakhand is known as 'herbal state of India'. According to Grover et al. (2002), there are about 2,50,000 higher plants out of which less than 1% plants have been subjected to ethnopharmacological studies and thus there is lot scope to find out options in plant based ethnomedicines for treatment of different diseases.

Tribals are the repository of rich ethnomedicinal knowledge but the safety and efficacy of ethnomedicines is lacking scientific validation and hence many workers have recommended further scientific investigations of potential medicinal plants to ascertain their safety, efficacy and mode of action. (Sawian et al., 2007; Kunwar et al., 2009;

Tangjang et al., 2011; Sharma et al., 2012; Tag et al., 2012; Rokaya et al., 2014; Tariq et al., 2015; Kayani et al., 2015; Subba et al., 2016; Shrivastava, 2016; Joshi et al., 2016; Bisht and Adhikari., 2018; Ojha et al., 2020; Khajuria et al., 2021).

Several plant explorations dealing with indigenous use of wild food plants have also been carried out in IHR. IHR support growth of 670 wild edible plants (Samant and Dhar, 1997). Das (1997) documented 60 species of wild edible plants used as food by tribes of Tripura. Sundriyal and Sundriyal (1998, 2001, 2003, 2004a, 2004b) have made significant contributions in exploring the folk use of wild food plants of Sikkim Himalayas. According to Sundriyal and Sundriyal (2001), wild edibles constitute an important component of traditional food among Himalayan communities. They have reported 190 species of wild food plants used in Sikkim Himalayas. Angami et al. (2006) documented the traditional use of 118 wild edible plants in Arunachal Pradesh. Sawian et al. (2007) have thrown light on the role of 249 species of wild edibles in meeting dietary needs of indigenous communities of Meghalaya. Since Indian Himalayan Region has higher incidence of threatened and endangered species (Hajra and Mudgal, 1997), emphasis should be laid on sustainable utilization of wild edible plants in this region (Angami et al., 2006; Sawian et al., 2007). Sharma et al. (2009) enumerated 24 species of wild edible plants and 11 species of wild edible macrofungi used as supplementary foods by the inhabitants of hilly region of district Shimla, Himachal Pradesh. Rana et al. (2012), made a mention of 164 species of wild edible plants utilized by the tribal communities inhabiting the Trans Himalayan Region of India. They observed that wild edible plants were stored in dried form and consumed during winter season when fresh fruits and vegetables were not available. The conservation of ethnobotanical knowledge of tribal ethnic groups may help in their sustenance and socio-economic upliftment (Sawian et al., 2007; Rajkumari et al., 2013).

Mehta et al. (2010) has made a mention of 97 cultivated crop species, 67 wild edible fruit species and 27 wild edible vegetable species used by the indigenous people of Uttarakhand Himalayas for making 125 different cuisines. Tiwari et al. (2010) dealt with the ethnobotanical significance of 55 wild edible plants in ensuring nutritional security

for the local people of Alaknanda valley, Garhwal Himalayas out of which 32 species were reported to be eaten as raw and 23 species after cooking as vegetable. Chandra et al. (2013) inventoried 20, 38 and 45 species of wild plants used as supplementary foods, edible fruits and wild vegetables respectively by the aboriginal populations of Rudraprayag district, Uttarakhand. They recommended value addition in the recipes of wild edible plants to broaden their user base. According to Sharma et al. (2013) the rural and tribal people in the Himalayan regions have been consuming wild edible plants for medicinal and dietary purpose since long time. They have made a mention of 43 wild food plants eaten by the local people of Mandi district of Himachal Pradesh. Deb et al. (2013) dealt with the utilization pattern of 41 wild plants by the three indigenous communities of Tripura viz. Molsom, Rupini and Tripuri and reported eight unique traditional recipes used by these communities.

Radha et al. (2013) enumerated 82 wild food plant species used the denizens of Kedarnath Forest Division, Garhwal Himalayas. The different plant parts consumed as food include flowers, fruits, leaves, roots, shoots, tender twigs, tubers, rhizome, seeds etc. Singh et al. (2014) reported 31 wild vegetable species eaten by tribals of Kinnaur district, Himachal Pradesh. The most commonly used wild vegetables reported from the study area include *Nasturtium officinale*, *Diplazium esculentum* and *Phytolacca acinosa*. Negi and Subramani (2015) enumerated 116 species of wild food plants consumed by the inhabitants of Kinnaur district of Himachal Pradesh for ensuring food security and livelihood promotion. They emphasized the need for conservation of some of the highly exploited species like *Allium stracheyi*, *Angelica glauca*, *Bunium persicum*, *Juglans regia*, *Prunus armeniaca*, *Sinopodophyllum hexandrum* etc.

Suresh et al. (2014) described the traditional use of 21 wild tree fruits from Sikkim Himalayas and reported fruits of some of the species like *Castanopsis hystrix*, *Spondias axillaris* and *Terminalia chebulia* as nutraceuticals having nutritional as well as medicinal uses. Pandey and Pande (2016) investigated the role of 51 wild edible plants in meeting nutritional requirement of Gujjar community of Kumaun Himalayas, Uttarakhand. They suggested that the wild edible plants provides healthy diet for the rural communities

and also broaden their menu choice and recommended the conservation of wild sources of edible plants and associated traditional knowledge.

Guite (2016), conducted an ethnobotanical exploration on wild edible foods consumed by the Paite tribe of Manipur for dietary purpose and reported 115 species. It was also observed that over exploitation of some of the wild edible plants by the aboriginal communities and drug traders has resulted in depletion of their population. Thakur (2017) conducted ethnobotanical explorations in some villages in the Tirthan Wild life sanctuary in Kullu district of Himachal Pradesh and enumerated 93 species of wild edibles from the study area. He observed that wild edible plants play a key role in providing food security to the local people but their unplanned exploitation during recent past in the study area has resulted in their depletion and many species have become threatened. Sharma et al. (2018) documented 91 species of wild edible plants from Cold Desert Biosphere Reserve of Trans Himalayas. Radha et al. (2018) carried out an ethnobotanical exploration on diversity and utilization pattern of wild edible plants used by transhumant shepherds of Himachal Pradesh enroute their seasonal migration in search of grazing lands for their flock and inventoried 50 plant species used as forest foods. They opined that shepherds are intimately associated with the forests and highly knowledge about traditional uses of forest products as they spend most of their time in the forests grazing their livestock.

Prasad and Sharma (2018) reported that 72 species of wild edibles were used by the inhabitants of Kedarnath valley in Garhwal Himalayas because of their food values and these species were also marketed by the local people for earning their livelihood. Bodh et al. (2019) dealt with wild edible plants of Shikari Devi Wild Life Sanctuary in Mandi district of Himachal Pradesh and enumerated 71 plant species used as forest foods by the indigenous communities. Thakur et al. (2020) inventoried 49 edible plants consumed by the pastoral Gaddi tribe of Chamba and Kangra districts of Himachal Pradesh, North West Himalayas in different forms like fruits, vegetables, pickle, chutney, spices etc. They observed that this invaluable traditional knowledge is vanishing among

the Gaddi tribe because of the invasion of modern culture on their tribal culture. Singh and Mathew (2021), have thrown light on traditional use of 43 species of wild fruit plants used by the Garo tribe of Meghalaya for their nutraceutical properties.

Wild sources of edible plants play an important role in meeting the dietary needs of the poor rural communities particularly during the period of crop failure and famine when there is shortage of food and hence are known as emergency foods (Prasad and Sharma, 2018; Sharma et al., 2018; Singh and Mathew, 2021). Many workers have recommended agricultural diversification through introduction of wild medicinal plants into cultivation as a means for conservation of such plants as it will reduce pressure on their wild counterparts (Tiwari et al., 2010; Bhat et al., 2012; Sharma et al., 2013; Shah et al., 2015b; Guite, 2016; Murtem and Chaudhary, 2016b; Bano et al., 2017; Radha et al., 2018; Rommila Chandra and Uniyal, 2021). Sen (2021) investigated the importance of wild edible plants of Himachal Pradesh, NW Himalayas in boosting immunity and combating COVID-19 disease. Based on the findings of his study, he recommended the use of ninety five wild edible plants rich in antioxidants, Vitamin C, A and Zinc for boosting immunity.

2.6 Current Status of Ethnobotanical Research in UT of Jammu and Kashmir.

Himalaya is extremely rich in biodiversity and also provides shelter to many aboriginal communities (Samant & Dhar, 1997). According to Khan et al. (2013) mountain ecosystems in different parts of the world support rich biodiversity and are also home to about 12% of total human population on the earth which derive different ecosystem services from the locally available natural resources. Ecosystem services are the benefits derived by human being from natural resources (Butler and Oluoch-Kosura, 2006). However, there are many areas located at higher elevations in Himalayas in which the floristic diversity has been poorly explored due to remoteness, poor connectivity, difficult terrain and harsh climatic conditions (Khan et al. 2013).

Several ethnobotanical explorations have already been conducted in Jammu & Kashmir by many workers including Sharma and Singh (1989), Abrol et al. (1962),

Kachroo and Nahvi (1976), Srivastava (1988), Kaul et al (1989), Kiran et al. (1999), Khan et al. (2009), Kumar et al. (2009), Sharma et al. (2012), Gairola et al. (2014), Bhatia et al. (2015), Kumar et al. (2015), Rao et al. (2015), Jan et al. 2022 etc. Jammu and Kashmir is a biocultural hotspot with strong biocultural relationship between a large number of ethnomedicinal plants and different ethnic groups. The Jammu and Kashmir Himalaya harbours rich floristic diversity (Tali et al. (2019) and about 2118 plant species have been reported from erstwhile state of Jammu and Kashmir (Rana and Rawat, 2017). However, Gairola et al. (2014) and Tali et al. (2019) have reported 948 species and 1123 species of ethnomedicinal plants respectively from this region. According to Singh et al. (2021a), 226 plant species were used for the treatment of humans and livestock diseases by 17 different communities residing in hilly areas of Jammu Province of the UT of Jammu Kashmir. There is a great variation in traditional medicinal practices and medicinal plant species used in three different divisions of erstwhile Jammu and Kashmir state viz. Jammu, Kashmir and Ladakh because of cultural divergence and phytodiversity distinctness (Gairola et al., 2014).

Khan et al. (2009a) reported traditional use of 28 species of ethnobotanical importance used by the rural populations of Poonch district, J&K for different purposes like edible fruits, fodder, construction wood, making agricultural implements, fuel wood etc. Khan et al. (2009b) also made a mention of 97 species of WEPs consumed in various ways by the local populace of Sewa catchment, J&K. Kumar and Hamal (2009) carried out ethnobotanical survey of WEPs consumed by the aboriginal people of Kishtwar High Altitude National Park, Jammu and Kashmir and reported 50 plant species. According to Kumar and Sharma (2011) the Gaddi and Sippi tribes of Jammu and Kashmir are the chief collectors of wild edible mushroom. They have reported 41 species of wild edible mushrooms from J&K which were consumed by the local populations. The inhabitants of Kathua district, J&K, use 72 plant species of ethnoveterinary importance for curing different diseases and ailments of milk yielding animals (Sharma et al., 2012) whereas 41 plant species were utilised for treatment of camels in this region (Renu Sharma et al., 2015). The rich traditional knowledge w.r.t ethnoveterinary plant usage in Kathua district

is attributed to the predominance of agro-pastoral culture in the rural areas (Sharma et al., 2012).

Bhatia et al. (2014) have reported 166 species of medicinal plants used against 78 different ailments by the aboriginal people of Udhampur district of Jammu & Kashmir. Kumar et al., (2015) studied 130 plant species of medicinal importance from Shankracharya hills, Srinagar, Jammu and Kashmir which were utilized by the local populations for their healthcare. An increase in the ethnomedicinal knowledge with an increase in the age of the informants was observed by different workers, however this knowledge decreased with an increase in the level of education of the informants (Uniyal et al., 2006; Tangjang et al., 2011; Kumar et al., 2015; Rao et al., 2015; Singh et al., 2020; Dutt et al., 2015; Thakur et al., 2016). According to Bhatia et al. (2018), WEPs play a pivotal role in ensuring food security, combating malnutrition, income generation, alleviating poverty and agricultural diversification. They had made a comprehensive inventory of 90 WEPs consumed by indigenous communities in different parts of Udhampur district, Jammu and Kashmir for dietary and medicinal purposes.

Rao et al. (2015) discussed the use of 197 plant species for treatment of different human diseases and ailments in Kathua district of Jammu and Kashmir. Singh et al. (2016) made an inventory of 111 plant taxa consumed traditionally by the inhabitants of Bandipora district of Jammu and Kashmir in different forms like alcoholic drinks, chutneys, cooked vegetables, herbal teas, raw fruits, salads, spices, soups and underground snacks. Showkat and Akhtar (2018) documented 33 WEP species eaten by the locals of Baramulla district, J&K for organoleptic and nutritional use. Fayaz et al. (2019) inventoried 65 species of wild plants used as fruits and vegetables, 51 species used for medicinal purpose and 21 species used in religious ceremonies by the aboriginal people of Daksum Forest range, Anantnag district, UT of J&K. Singh et al. (2021b) described 42 species of WEPs consumed by the inhabitants of Paddar Valley, Kishtwar district, J&K and reported ethnobotanical use of two WEP species for the first time from the study area.

Farooq (2021) described ethnobotanical significance of 58 WEP species consumed by the residents of Poonch district, UT of J&K. The inhabitants of Jasrota Hills of Kathua district, Jammu and Kashmir utilize 121 ethnomedicinal plant species for treatment of 93 types of diseases (Singh et al., 2020). Different ethnic groups inhabiting Himalayan region use ethno-medicinal plants in different ways for healing purpose. 32 species of ethnomedicinal plants have been documented from Kashmir Himalayas, India, out of which some plants like *Aconitum heterophyllum*, *Arnebia benthami*, *Trillium govianum*, *Bergenia ciliata* and *Rheum webbianum* have been reported to be threatened due to their over exploitation for commercial purpose (Mir et al., 2021). Medicinal plants are utilised by the rural masses not only for their personal use but also for marketing and hence play a significant role in maintaining good health as well as improving the economic conditions of poor rural masses. However increased commercialization of medicinal plants has resulted in their over-exploitation due to which many important medicinal plants have become endangered and threatened (Kala, 2009).

Bhagat et al. (2022) made an appraisal of the ethnobotanical importance of 58 species of WEPs consumed by the indigenous communities of Purmandal block of Samba district, UT of J&K, because of their organoleptic and nutritional properties. Sharma et al. (2022) have reported 14 edible fungi from Jammu district of UT of Jammu and Kashmir out of which 11 fungi were the new records from this region. Some of the reported fungi were also having medicinal values and used as nutraceuticals. The study revealed that reduced forest area and increased agricultural fields were the two main reasons for lesser number of wild edible mushrooms in the study area.

2.7 Status of Tribal ethnobotany in Jammu and Kashmir

Jammu & Kashmir, the Western part of Himalayas, harbours different tribal communities out of which 12 communities have been declared as scheduled tribes by the government of India (Tribal Affairs Department, Govt. of J&K, 2022). The most prominent of these are the agro-pastoral migratory tribal groups viz. Gaddi, Sippi, Gujjar and Bakerwal who rear large flocks of buffaloes, goats, sheep and horses and migrate from one place to another in search of pastures for their livestock (Sharma and Singh,

1989; Shah et al., 2015b; Riaz and Bhandari, 2015; Trak and Giri, 2017). It has been observed that herders are the chief collectors of medicinal plants growing on high altitude snow-capped alpine pastures (Kumar S, Hamal, 2009).

As far as the status of ethnobotanical studies on tribal groups of Jammu and Kashmir are concerned, the review of published literature reveals that most of the such studies have been carried out on only two major tribes viz. Gujjar and Bakerwal (Srivastava, 1988; Sharma and Singh, 1989; Beig et al., 2003; Khuroo et al., 2007; Rashid et al., 2008; Lone et al., 2012; Bhat et al., 2012b; Shah et al., 2012; Rashid, 2012; Rashid, 2013; Dangwal & Singh, 2013; Kumari et al., 2013; Lone & Bhardwaj, 2013; Mir, 2014a; Mir, 2014b; Mir, 2014c; Dangwal et al., 2014; Dar et al., 2015; Jan and Khare, 2015; Riaz & Bhandari, 2015; Shah et al., 2015a; Shah et al., 2015b; Rajoriya et al., 2016; Khan & Wani, 2017; Sarad et al., 2017; Khanday & Singh, 2017a; Ahmed & Ajaz, 2017; Bano et al., 2017; Singh & Khanday, 2017a; Singh & Khanday, 2017b; Trak & Giri, 2017; Dar et al., 2018; Kanta et al., 2018; Mir et al., 2021). However Dutt et al., 2015 conducted the only ethnobotanical study on Gaddi tribe of J&K and no study has been conducted on marginal Sippi tribe of this region so far.

Gujjar and Bakerwal tribes rely on traditional herbal remedies because of poverty, remoteness of their habitation, lack of access to modern medicines and firm belief in herbal medicines (Jan and Khare., 2015). In Jammu and Kashmir, Gujjar and Bakerwal tribes predominantly inhabit Rajouri district and constitute about 40% of the total population of this district, where these tribes together use 28 species of ethnomedicinal plants for treatment of gastrointestinal disorders (Rashid, 2012), 31 plant species for curing chest diseases (Rashid, 2013), 45 species of medicinal shrubs for treatment of different non-communicable diseases (Shah et al., 2015b), 56 species of folk medicinal plants (Riaz and Bhandari, 2015), 50 ethnomedicinal plant species belonging to family Asteraceae (Dar et al., 2015) and 25 plant species (Sarad et al., 2017) for treatment of different human diseases and ailments. Based on ethnobotanical studies carried out jointly on Gujjars and Bakerwals in smaller geographical units of Rajouri district, Shah et

al. (2012) and Ahmed & Ajaz (2017) reported 13 species and 40 species of ethnomedicinal plants from Budhal and Manjakote tehsils respectively.

The Gujjar and Bakerwal tribes inhabiting Shopian district of J&K use, alongwith other ethnic groups, 23 species (Bhat et al., 2012), 32 species (Jan and Khare, 2015), 35 species (Khanday and Singh, 2017a), 25 species (Singh and Khanday, 2017a) and 22 species (Singh and Khanday, 2017b) of ethnomedicinal plants for combating different human ailments. With the objective of catering to their medicinal needs, these two tribes rely on 25 species of ethnomedicinal plants in Bandipora district (Lone and Bhardwaj, 2013), 48 sps (Lone et al., 2012) and 36 species (Mir, 2014a) in Kupwara district and 36 sps in Kishtwar district (Trak and Giri., 2017). The Gujjar and Bakerwal tribes, alongwith other tribal groups, use 23 species of ethnomedicinal importance in Langate tehsil of Kupwara district (Kanta et al., 2018), 28 such species in Pampore tehsil of Pulwama district (Dar et al., 2018) and 15 species in Pir Panjal Region of Jammu and Kashmir (Khan and Wani, 2017).

Most of the ethnobotanical studies conducted on Gujjars and Bakerwals of J&K were based on the ethnobotanical plants used together by these two tribes. However, 70 species (Kumari et al., 2013) and 29 species (Dangwal and Singh, 2013) of ethnic medicinal plants were used exclusively by Gujjar tribe of Trikuta Hills and Rajouri district of Jammu and Kashmir respectively. Dutt et al. (2015) carried out the only ethnobotanical study on Gaddi tribe of Jammu and Kashmir and highlighted the ethnomedicinal importance of 190 plant species used by migratory Gaddi shepherds for treatment of 80 diseases. They observed that gastrointestinal and liver disorders were the most prevalent diseases among *Gaddi* shepherds and nearly 29% of the reported species were used against these diseases.

Bhat et al. (2014) documented 132 plant species of ethnomedicinal importance used by the tribal communities of Lolab valley in Kashmir Himalaya, India, for curing different human ailments. Khanday and Singh (2017b) dealt with ethnopharmacological potential of 52 plant species used by the tribal communities inhabiting South Kashmir Himalaya, India. Bano et al. (2017) surveyed the traditional phytotherapy practices of

ethnic communities, including Gujjar and Bakerwal tribes, in Budgam and Anantnag districts of Kashmir Himalaya and enumerated 65 plant species of medicinal importance. The rural communities have exhibited increased and continued social acceptance for the use of traditional medicines since ages because of their firm belief on the efficacy of these medicines against various diseases (Mir, 2014a; Rajoriya et al, 2016). In Kashmir Himalaya, the species richness was found maximum in the elevation range of 2000-3000 masl and this zone could be called as ‘zone of economic activity’ as most of the species in this zone are of ethnobotanical importance (Bhat et al., 2014). In order to protect medicinal plants, cattle grazing should be prohibited particularly in sub-alpine and alpine regions, above the elevation of 3500 m (Kumar and Singhal (2019), as the number of traditional medicinal plants increase with an increase in altitude (Malik et al., 2015). Nurseries should be set up at higher altitudes for in situ conservation of high altitudinal medicinal plants (Kumar and Singhal, 2019).

In addition to a number of ethnomedicinal surveys, a few ethnoveterinary explorations have also been carried out on the tribals of Jammu and Kashmir. According to Sharma and Singh (1989), the upper reaches of Himalaya in Jammu and Kashmir are home to many pastoral and nomadic tribes like Gujjars, Bakerwal, Gaddis and Paharis who keep on moving from one place to another in search of grazing lands for their livestock. In such a remote and mountainous tracts, these communities lack access to modern medicines for healthcare of their animals and thus depend on traditional herbal remedies for curing diseases and ailments of their livestock. They have reported traditional ethnoveterinary use of 18 plant species for treatment of different diseases and ailments of animals by the nomadic tribes of Jammu and Kashmir. Beig et al. (2003) documented 25 species of ethnoveterinary plants used by Gujjar, Bakerwal, Chopan and other shepherd communities of Kashmir Himalaya, India, for treatment of their ailing livestock.

According to Khuroo et al. (2007), keeping in view the increasing awareness of the people about the significance of herbal medicines in healthcare system, it would be appropriate to say that the world is moving back to natural medicines. They have thrown

light on the ethnoveterinary importance of 24 angiospermic species used by Gujjar tribe of Kashmir Himalaya, India, for alleviating different ailments of their cattle. Mir (2014b) explored the ethnoveterinary potential of 25 plant species used by Gujjar, Bakerwal and other traditional healers of Kupwara district, Kashmir Himalaya for health care of their livestock. Mir et al. (2021) reported 32 species of high altitude medicinal plants from Kashmir Himalayas which were used by Gujjar, Bakerwal and Kashmiri ethnic groups for treatment of various diseases.

As far as ethnobotany of wild edible plants consumed by tribals of J&K is concerned a very few studies have been previously done. Srivastava (1988) has made an attempt to catalogue 109 species of wild edible plants used by the Gujjars, Bakerwals and other denizens of Jammu and Kashmir as food. Based on ethnobotanical survey of wild edible plants (WEPs) used by Gujjar and Bakerwal tribes of Rajouri district of Jammu and Kashmir, Rashid et al. (2008) and Dangwal et al. (2014) reported 57 species and 58 species of WEPs respectively. Mir (2014c) made an attempt to assess the ethnobotanical knowledge possessed by the Gujjar and Bakerwal tribes of Kupwara district, J&K and enumerated 31 WEP species consumed by these tribes. Sarver and Nigam (2020) carried out an ethnobotanical exploration on WEPs consumed by Gujjar, Bakerwal, Gaddi, Sippi and other ethnic groups inhabiting Latti-Duddu valley, Udhampur district, J&K and enumerated 47 species of WEPs. They observed that the different tribal groups in the study area earn their livelihood by selling some of the local WEPs in the market.

Chapter 3

Materials and Methods

3.1 Study area

Doda was formed as a district in 1948 when it was cut separated of erstwhile Udhampur district. In 2006, this geographically large administrative unit was trifurcated into three districts namely Kishtwar, Ramban and the present Doda district. According to census of 2011, the total population of the Doda district is 4,09,936 (<https://doda.nic.in/demography/>). As per the Census of 2011, the population of *Gaddi* and *Sippi* tribes in Jammu and Kashmir is 46,489 and 5,966, respectively whereas in district Doda it is 5,999 and 810, respectively (Registrar General and Census Commissioner, India).

3.1.1 Physiography

Doda district is located in outer Himalayas in eastern part of Jammu division of UT of Jammu and Kashmir between geographical coordinates of 32° 53' to 34° 21' N latitude and 75° 1' to 76° 47' E longitude. The district has mountainous terrain with rugged topography. The geographical area of Doda district is approx. 4500 sq. km (Manhas, 2018). The district is bounded by district Anantnag in the North, district Ramban in the West, district Udhampur in the South West, district Kishtwar in the North East and district Kathua and district Chamba (Himachal Pradesh) in the South. Evergreen coniferous forests are the most common type of forests growing along the slopes of mountains in temperate region. The area is drained by the mighty Chenab River which traces its course through Thathri, Pul Doda and Assar areas. Two main tributaries of river Chenab viz. Neeru and Kalguni traverse through the Bhaderwah valley and Bhalessa valley respectively. Bhaderwah valley in Doda district is the most beautiful tourist destination which attracts a large number of tourists every year and is commonly known as “*Chhota Kashmir*”(Directorate of Tourism, J&K Govt., 2022), because of its natural scenic beauty and mesmerising tourist places.

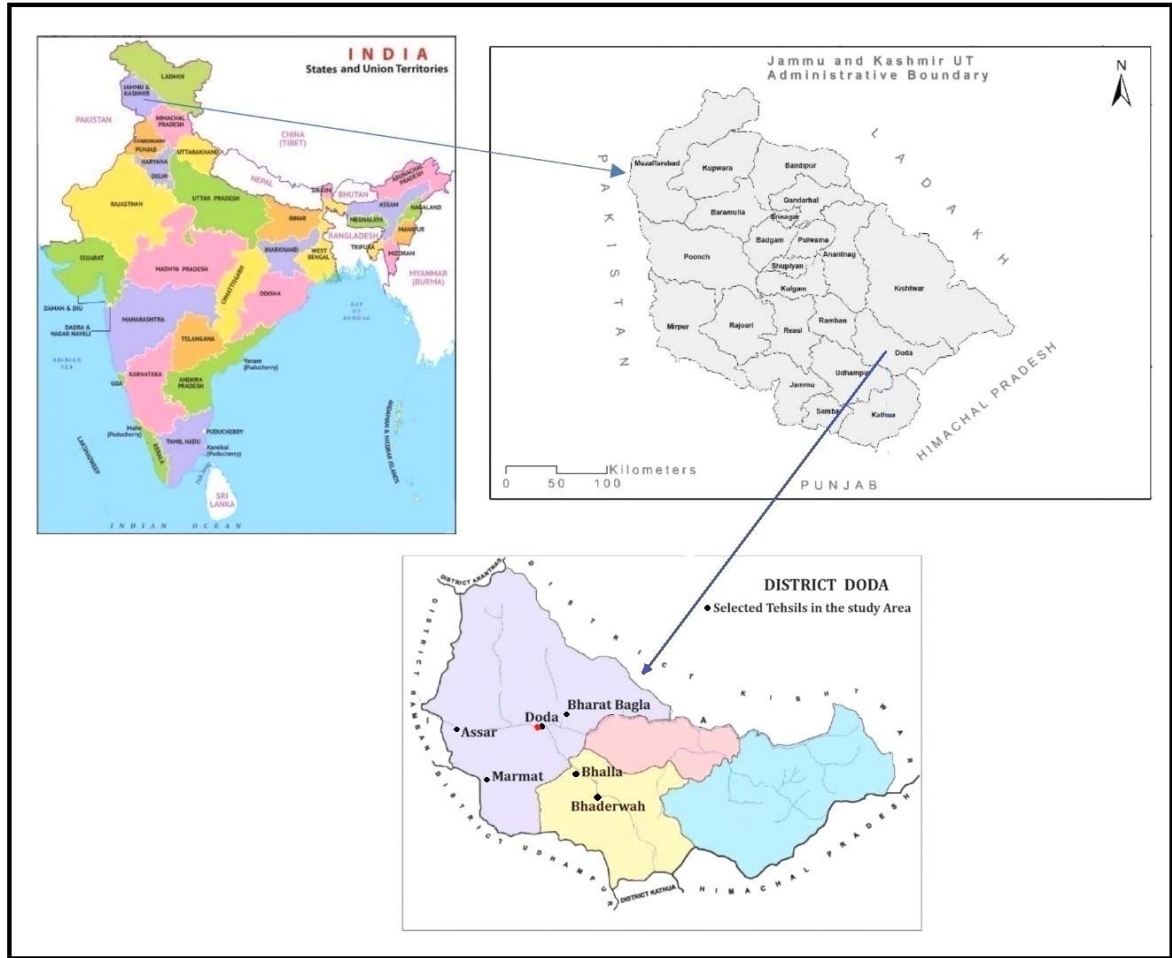


Fig. 3.1. Location map of study area.

3.1.2 Climate

Because of mountainous topography, the district has a wide range of altitude (approx. 1000-4500 masl) and thus the climate is not uniform throughout the district. Three different climates zones viz. sub-tropical, temperate and alpine zones are found along the altitudinal gradients of this mountainous district. The climate is sub-tropical in low lying areas with altitudinal range of 1000 masl to 1125 masl like Pul Doda, Doda city, Thathri, Khellani and Assar, whereas the places located at higher elevation (1500-3200 masl) like Bhaderwah and Bhalessa experience temperate climate. Alpine zones exists above tree line (approx. 3200 masl) e.g., Seoj Dhar and Tibba Dhar (Bhadarwah),

Jantroon Dhar (Chiralla), Kanthi Dhar and Dagan Dhar (Bhalessa). The varied climatic and topographic conditions favour growth of a wide variety of plant species and thus the district is endowed with rich phytodiversity. The temperature also varies from place to place and the average temperature ranges between 26⁰C and 29⁰C during summer, and 2⁰C and 15⁰C during winter. The district experiences average annual rainfall of 926 mm and average annual snowfall 135 mm (Anonymous, 2014).. Since, the district receives scanty rainfall the climate is almost dry in this region and the district has been declared as drought prone.

All parts of the district receive snowfall during winter and the peaks of the Himalayas towards South West of Bhaderwah valley remain snow clad for 6-7 months in a year. The settlements of Gaddi and Sippi tribes are located at higher elevation (1900 to 2400 masl) on difficult slopes of the Himalayas and get cut off from the rest of the world due to heavy snowfall during winter.

3.1.3 Vegetation and Forest Types of district Doda

Based on topography, physiognomy, climate, vegetation type, altitude, aspect and soil factors, the forests of India were classified into 6 major forest types which were further sub divided into 16 major groups (Champion and Seth, 1968).

According to the classification of Champion and Seth (1968), the forests of Doda district could be divided into three major forest groups which were further divided into five forest groups which in turn were sub divided into six forest types and 7 sub-types as shown in Table 3.1 below.

Table 3.1. Forest types of Doda district based on classification of Champion and Seth (1968).

Major Forest Groups	Forest Groups	Forest Types	Forest Sub-types
Montane Subtropical Forests	Group 10: Subtropical dry evergreen forests	Type 10/C1: Subtropical dry evergreen forests	10/C1a: <i>Olea cuspidata</i> scrub forest
Montane Temperate Forests	Group 12: Himalayan moist temperate forests	12/C1: Lower Western Himalayan temperate forests	12/C1a: Ban Oak forest
			12/C1b: Moru Oak forest
			12/C1c: Moist Deodar forest
			12/C1d: Western mixed coniferous forest
			12/C1f: Low level blue pine forest
		12/C2: Upper West Himalayan temperate forests	12/C2a: Kharsu Oak forest
	Group 13: Himalayan dry temperate forests	13/C1: Dry broad-leaved and coniferous forest
Alpine Forests	Group 15: Moist-Alpine Scrub	15/C1: Birch/Rhododendron scrub forest
	Group 16: Dry-Alpine Scrub	16/E1: Dwarf Juniper scrub

Major group: Montane Subtropical Forests.

Group 10: Subtropical dry evergreen forests.

Type 10/C1: Subtropical dry evergreen forests.

Sub-type 10/C1a: *Olea cuspidata* scrub forest:

This type of forest is located in lower elevations of Doda district ranging from 820 masl to 1180 masl and is characterized by *Olea ferruginea* trees along with few patches of *Quercus baloot*, *Zizyphus mauritiana*, *Pinus roxburghii*, *Punica granatum*, *Calotropis procera*, *Dalbergia sissoo* and *Alnus nitida*. It extends from Pranoo to Pul Doda predominantly on right bank of Neeru stream and is also found in Sindra and Shiva forest belt in Bhalla tehsil, Koda Pani forest in Assar tehsil and Kandhote forest belt in Thathri tehsil on left bank of river Chenab.

Major group: Montane Temperate Forests.

Group 12: Himalayan moist temperate forests.

Type 12/C1: Lower Western Himalayan temperate forests.

Sub-type 12/C1a: Ban Oak forest.

This type of forest is found at the elevations higher than that of forest Sub-type 12/C1a on hilly terrains of Doda district and is characterized by *Quercus leucotrichophora* associated with *Q. floribunda* and *Cedrus deodara*. This forest extends from Ramtund to Guldanda in Bhaderwah tehsil and also found in Bhalla, Thathri forests, Chiralla forest belt and Koda Pani forest. *Quercus floribunda* tree is lopped off for fodder and making traditional agricultural implements.

Sub-type 12/C1b: Moru Oak forest.

This forest is found at an elevation of 1700-2100 masl and is characterized by *Quercus floribunda*. Mostly, this tree does not grow gregariously and forms an understory in *Cedrus deodara* population. It extends as a narrow stretch from Dhamunda to Haddal village in Bhaderwah tehsil and is also found in Chinta valley, Chiralla, Kellar,

Thathri, Kilhotran and lower elevations of Jatota forest in Bhalessa region. *Quercus floribunda* is used as source of fodder and fuelwood during winter season.

Sub-type 12/C1c: Moist Deodar forest.

This forest is found at an elevation of 1700-2300 masl, which is higher than that of forest sub-type 12/C1b. The vegetation is characterized by *Cedrus deodara* trees which, most often, grow as pure patches but sometimes mixed with scattered species of *Aesculus indica*, *Parrotiopsis jacquemontiana*, *Pinus wallichiana*, *Abies pindrow*, *Picea smithiana*, *Toxicodendron succedaneum* and *Viburnum grandiflorum*. This is the most dominating forest type in district Doda and is found in slopes of surrounding hills of Bhaderwah valley, Chinta valley, Kellar valley, Lal Draman, Chiralla-Bhalara forest, Subar Dhar, Fagsu in tehsil Thathri, Kandolu village, Ghill Kunan of Jatota forest, Luddu Kansar in Bhalessa region. *Cedrus deodara* is highly exploited for obtaining fuelwood and timber in the study area.

Sub-type 12/C1d: Western mixed coniferous forest.

This type of forests are found at the elevations (2250-3000 masl) higher than those of moist deodar forests and is represented by different coniferous species viz. *Abies pindrow*, *Picea smithiana*, *Cedrus deodara*, and *Pinus wallichiana* mixed with scattered population of *Parrotiopsis jacquemontiana*, *Toxicodendron succedaneum*, *Betula utilis*, *Taxus baccata* and *Viburnum grandiflorum*. It is found in Dugban-Manthla forest and Zane-ro-Dal to near Seoj Dhar in Bhaderwah tehsil, Dessa forest in Doda tehsil, Shiv Garh Dhar in Assar tehsil, Bachh Dhar, Lalu Pani Dhar, Jantroon Dhar, and upper reaches of Kahaljugasar, Dhosa, Chilly and Samie villages in Bhalessa. This type of forests is heavily used for grazing of livestock.

Sub-type 12/C1f: Low level blue pine forests.

This type of forest is located at the lower elevations of forest sub-type 12/C1c, i.e., 1600-1800 masl. and characterized by *Pinus wallichiana* species which grows in association with *Cedrus deodara* species. It is found in Bhaderwah valley, Chinta valley.

Major group: Montane Temperate Forests.

Group 12: Himalayan moist temperate forests.

Type 12/C2: Upper West Himalayan temperate forests.

Sub-type 12/C2a: Kharsu Oak forest.

This type of forest is located at lower altitudinal range (1100 to 1300 masl.) and is characterized by *Quercus semecarpifolia*. This forest type is found in Pranoo area on left bank of Neeru stream.

Major group: Montane Temperate Forests.

Group 13: Himalayan dry temperate forests.

Type 13/C1: Dry broad-leaved and coniferous forest.

This type of forest is located in transitional zone between sub-tropical and temperate regions extending from Pranoo (1100 masl.) to Bhalla (1200 masl.) This forest is characterized by the growth of coniferous trees viz. *Pinus roxburghii*, *P. wallichiana* and *Cedrus deodara* as well as broad leaved species viz. *Ficus palmata*, *Alnus nitida* and *Quercus floribunda*.

Major group: Alpine forests.

Group 15: Moist-Alpine Scrub.

Type 15/C1: Birch/Rhododendron scrub forest.

This type of forests are found at much higher elevations (3000 masl to 3200 masl) along the tree line and are characterized by *Rhododendron arboreum*, *R. campanulatum*, *Cassiope fastigiata* associated with countable number of *Betula utilis* (birch), *Rosa macrophylla* and *Prunus cornuta* trees. This forest is found in Seoj Dhar in Bhaderwah and Bachh Dhar and Lalu Pani Dhar in Bhalessa.

Major group: Alpine forests.

Group 16: Dry-Alpine Scrub.

16/E1: Dwarf Juniper scrub.

This type of vegetation is found at the elevation (approx. 3300 masl) slightly higher than forest type 15/C1 and is characterized by *Juniperus communis* and *J. recurva* species. This forest is found in slopes of Ramtund, Bhaderwah.

3.2 Ethnology of Gaddi and Sippi tribes

A tribe may be defined as socially, educationally and economically underprivileged ethnic group which inhabits geographically isolated territory, have their own mother dialect and a distinct culture with primitive traits, observe certain socio-religious beliefs and taboos and feel shy on contact with community at large (Majumdar, 1961; National Commission for STs, n.d, 10th Annual Report, online).

3.2.1 Occupation

Gaddi and *Sippi* tribes are the two Himalayan tribes of UT of Jammu and Kashmir who have many social and cultural features common between them. The economic activities of *Gaddis* and *Sippis* revolve mainly around shepherding, which is their primary occupation, although they also depend on subsistence agriculture and traditional handloom weaving for their survival (Bhasin, 2011; Wagner, 2013; Pandey, 2015b; Thakur et al., 2016; Simmy, 2019, Malhotra et al., 2021; Sharma et. al., 2022). Most of the *Gaddi* and *Sippi* families raise a flock of 100-400 goats and sheep. These tribes undergo seasonal migration along with their flock from hills to plains and vice-versa during winters and summers respectively in order to facilitate grazing of their livestock and to avoid harsh weather conditions. These tribes are, therefore, semi-nomadic and transhumant Himalayan tribes by virtue of their occupation.

3.2.2 Etymology of the word Gaddi

Gaddis are shepherds by occupation and the word 'Gaddi' is derived from the Sanskrit word '*gadar*' which mean sheep and the term '*gadheran*' is used for the dwelling place of *Gaddis*. In Hindi the word '*Gadariya*' means a person who rears sheep and with the passage of time the word '*gadar*' would have modified to '*Gadri*', a person who tends sheep which got further modified to *Gaddi* (Singh et al., 2021c). According to Badri Nath, a Sippi social activist from tehsil Bhandarwah in the study area, Sippis are the descendents of Raetha Mahadev who was the son of Tirlochan Dev Maharaj of Bharmour (H.P), a staunch devotee of God Shiv ji. The word Shippi or Sippi means Shiv Pujari and

they were blessed by God Shiv ji to be the main priests of Chaurasi Shiv temple at Bharmour, Himachal Pradesh.

3.2.3 Costume

Both the *Gaddi* and *Sippi* tribes have a common mother dialect known as *Gaddi* language or *Gadyali* language and traditional costumes which are their main identification features. Gaddis are highly skilled in handloom weaving and this skill is directly linked with their occupation of raising flocks of goat and sheep which is the source of raw wool for handloom weaving. *Chola* (loose white woolen male gown) and *dora* (long black woolen rope) are the traditional costumes and identity of *Gaddi* shepherds (Sharma M, 2015). *Chola* is tied with *dora* around the waist with several rounds. Besides *chola* and *dora* the other traditional dresses of Gaddis include woolen coat (*unala coat*), woolen sleeveless jacket (*unali baskat*), woolen cap (*topi*), woolen pyjama (*unali suthan*) and woolen socks made from goats' wool. The first three dresses are worn only by males whereas the last two are unisex (Singh et. al., 2021c).

3.2.4 Religious beliefs

Gaddis and Sippis practice Hinduism. Gaddis were described by Chakravarty as “shepherds of the snowy ranges” (Kaul, 1998) as they inhabit high altitudinal mountainous tracts of NW Himalayas and it is believed that Himalayas are also the abode of God Shiva where He is known to be in a state of deep meditation without any disturbance of the material world (Kaul, 1998). Gaddis are Shaivites and have staunch belief that the blessings of God Shiva are always with them which provides protection to them and their flock of goat and sheep (Sharma, 2021).

A very famous religious ceremony known as '*nuala*' is devoted to God Shiva in which the community members chant the bhajans of God Shiva for the whole night and a sheep sacrifice is offered to God Shiva in the wee hours of the next morning which is served in the feast (Sharma M, 2015; Sharma, 2021).

3.2.5 Origin

Gaddi tribe is one of the most popular and oldest tribe of Himachal Pradesh (Saini, 2020) and a considerable population of this tribe is also found in UT of Jammu and Kashmir. The *Gaddi* tribe of Himachal Pradesh is not a single caste but it is a community which includes 4 isogamous castes namely Rajput, Thakur, Rana and Khatri (Newell, 1965; Verma, 1996). However some workers also included Brahmans and Rathis in this community (Sharma. D, 2021, online; Barnes, 1862).According to Axelby *Gaddis* are the upper caste (*swarn jati*) Hindus (Axelby, 2007).

The origin of *Gaddi* and *Sippi* tribes is obscure and different scholars have different opinions about their place of origin. Many scholars are of the view that *Gaddis* were originally the Rajputs of Rajasthan who have migrated to Bharmour in Himachal Pradesh. It is a popular belief that *Gaddis* were the staunch Hindus, mostly Rajputs, who had a strong faith and allegiance to Hinduism and never compromised their religion. Some scholars trace the origin of *Gaddis* to Aryans who migrated from plains of Punjab and Sindh and settled in Bharmour (H.P) to escape religious persecution and proselytization by Aurangzeb during late 18th century. (Sharma, 2015; Simmy, 2019, Pandey, 2015b). Bharmour is predominantly inhabited by *Gaddi* tribe and is thus known as *Gadhern* literary meaning a dwelling place of *Gaddis*. *Gaddis* of J&K are believed to have migrated from different villages of Bharmour tehsil of Himachal Pradesh in search of pastures for their livestock as evidenced by existence of *Gaddi* families with common *gotra* (clan) in Himachal Pradesh as well as in J&K. For example *bhayals* (families having common ancestors) of *Lalhal, Jaryal, Chauhan, Bersain, Kaudu and Heralu Gaddis* are found in both HP and J&K. Moreover, the locations of *Gaddi* settlements in a continuous geographical belt stretching from Kangra and Chamba districts of H.P through Kathua and Doda districts to Udhampur and Ramban districts in J&K further substantiates the fact that *Gaddis* of J&K have their origin in H.P.

As pointed by the informants, the Hadokar, Lalhal, Pranghelu, Nangal and Aerial *Gaddis* of J&K trace their origin to Malkauta, Lahal, Pranghala, Nangli and Aurah villages of Bharmour tehsil of H.P respectively. Newell is of the opinion that *Sippis*

inhabited Bharmour even before Gaddis (Newell, 1965). Sippis of Jammu and Kashmir are also believed to have migrated from Bharmour (H.P).

The Gaddis (Abraham, 2019) and Sippis have rich cultural heritage which is reflected in their costume, language, social and religious rituals etc. Keeping in view their social, educational and economic backwardness, Gaddis and Sippis of J&K were notified as scheduled tribes by government of India way back in 1991 vide the Constitution (Scheduled Tribes) Order (Amendment) Act, 1991.

3.3 Methodology

3.3.1 Field survey and collection of ethnobotanical data.

Doda district comprises of 18 tehsils and the population of *Gaddi* and *Sippi* tribes is confined to only 6 tehsils namely Doda, Bharat Bagla, Bhaderwah, Bhalla, Assar and Marmat. An extensive ethnobotanical survey was carried out in 14 randomly selected Gaddi and Sippi inhabited villages in the study area viz. Dhamunda, Kakol, Manthla, Dandi, Kansar, Bharie, Buttla, Banjla, Dalha, Bhagratha, Chadota, Bayota, Barshalla and Gadyari and their surrounding forests as well as in camps (locally known as *dera*) of migratory shepherds during March 2020 to March 2023. The information was collected on different traditional uses of plants e.g., i) as rudimentary drugs, ii) as foods iii) as plant derived utility products (PUPs), iv) in religious rituals and social life etc. The informants included elderly and knowledgeable persons of both the sexes, farmers, herdsman and shepherds (locally known as *palh*), who regularly visited the forests and who were highly knowledgeable and well versed with traditional use of plants.

The data was collected by interviews and group discussions among the informants in their local dialect known as *Gaddi or Gadyali* language. All the informants were briefed about the study and its objectives and prior informed consent (PIC) was obtained from each respondent. The information collected from one informant or a group of informants was further verified and cross checked for the reliability and accuracy by interacting with other knowledgeable informants and then the final inference was drawn. The information thus collected was recorded in a predetermined semi-structured

schedules which contained local name of the plant, plant habit, flower colour, flowering season, plant uses, plant-part used, method of use and any other information which may help in identification of the plants. Some information was also collected through direct observations of the daily chores of the community members involving the use of PUPs.

Table: 3.2. Demography of villages surveyed during present study.

S. No.	Name of the village	Alt. (masl)	App. Population (As reported by village elders)			
			Gaddi	Sippi	Others	Total
1	Dhamunda	2044	390	29	0	419
2	Kakol	2300	0	339	0	339
3	Manthla (U)	2140	182	0	0	182
4	Dandi	2000	991	0	91	1082
5	Kansar	2400	302	268	0	570
6	Bharie	2200	361	45	0	406
7	Buttla	1900	522	35	170	727
8	Banjla	2060	61	0	132	193
9	Dalha	1900	78	0	25	103
10	Bhagratha	1760	82	0	50	132
11	Chadota	2040	312	62	158	532
12	Bayota (U)	1150	380	0	1250	1630
13	Barshalla	1280	150	0	690	840
14	Gadyari	2660	320	0	430	750
		Total	4131	778	2996	7905

3.3.2 Collection of plant specimens

The plant explorations were carried out during different seasons for collection of plant species of ethnobotanical importance. Some of the learned informants, especially shepherds (*palh*) and herdsmen (*gowal*) were taken to the forests as guide during collection trips for the identification of the plants in their natural habitats based on their local tribal names. Photographs were taken of the plants' habit in flowering condition and activities of the community members related to traditional plant/plant product usage.

Small herbaceous plants were collected as a whole by uprooting while in case of large herbaceous plants, shrubs, and trees only flower bearing twigs of the size not exceeding 1 foot were collected. Field data was recorded in field notebook for every plant which included voucher No., date of collection, place of collection, altitude of the place, habitat type, flower colour, fragrance and other related characters which help in the identification of the plant.

3.3.3 Identification and preservation of plants.

The collected plant specimen were placed between the folds of the old newspapers by carefully arranging their different parts in desired position and then pressed by means of plant press, dried and then mounted on herbarium sheets following standard procedures. In order to avoid fungal attack and decaying of the plants, the newspaper sheets will be changed after about every 24 hours until the plant specimens become completely dry. Insect repellants like naphthalene balls were used for protecting dried specimen.

The collected plant specimens were identified with the help a field guide viz. 'Concise Flowers of the Himalaya' by Polunin & Stainton and by matching with the preserved specimen in Herbarium of Department of Botany, University of Jammu and online version of Janaki Amal Herbarium of IIIM, Jammu, <https://iiim.res.in/herbarium/herbarium.htm>. The identification of plants was confirmed with the help taxonomic experts from Department of Botany, University of Jammu. Only accepted names of the plant species have been used in the present study which were

confirmed from online database viz. plants of the world online (<https://powo.science.kew.org/>) and World Flora Online (<https://www.wfo.org/>). The voucher herbarium specimen were deposited in the Herbarium of Department of Botany, University of Jammu for maintenance and future reference and a unique accession number was assigned to each voucher specimen by the Herbarium.

3.4 Quantitative ethnobotanical data analysis.

The ethnobotanical data was subjected to quantitative analysis by using different quantitative indices like Informant consensus factor (Fic), Use Value (UV), and Fidelity level (FL).

3.4.1 Use value (UV)

Use value is a quantitative measure for the relative importance of the plant species. Its value helps in finding out how frequently a given plant species is used by the local people. It is calculated by using the equation given below (Phillips et al., 1994):

$$UV = \sum U/n$$

Where, U represents the number of use reports mentioned by each informant for a particular species and 'n' represents the total number of informants. Higher the number of use reports, higher will be the Use value and vice-versa.

3.4.2 Informant consensus factor (Fic)

This parameter tests homogeneity of knowledge about medicinal plants. Before performing the analysis, all the ailments were broadly classified into various categories. The calculations were made as per formula given by Trotter and Logan (1986):

$$Fic = n_{ur} - n_t / n_{ur} - 1$$

Where, n_{ur} represents the number of use reports in each ailment category, n_t represents the number of plant species used for a particular ailment category by all informants.

3.4.3 Fidelity level (FL)

Since a given disease can be cured by using different plant species. Fidelity level is a quantitative measure used to find out the most preferred plant species used to cure a particular disease and its value is obtained by using the equation given below.

$$FL (\%) = N_p / N \times 100$$

Where, N_p represents number of use reports mentioned for a particular species for a particular ailment and N represents total number of use reports mentioned for that particular species (Friedman et al., 1986).

3.5 Phytochemical analysis

3.5.1 Selection of plants for phytochemical analysis

Five plant species of ethnomedicinal importance were selected for qualitative detection and quantitative estimation of some important secondary metabolites as well as for evaluation of their oxidation potential. The selection of plants was based on following criteria;

- (i) Ethnobotanical significance of plants based on their use in both ethnomedicinal and ethnoveterinary practices.
- (ii) Plants were selected from amongst the top ten ethnomedicinal species as determined by high use value index.
- (iii) Lack of adequate published literatures.
- (iv) Local availability.

3.5.2 Preparation of plant extract.

Fresh plant material (leaves/aerial parts) were collected, washed and dried for few days under shade. The dried plant material was cut into small pieces and then grounded to fine powder under sterilized conditions. About 50 gms of this dried powder was

separately loaded in Soxhlet extractor and defatted with methanol for 6 hrs at 80 °C. The methanolic plant extracts thus obtained shall be collected, dried using rotatory evaporator, weighed and then stored for further use under sterilized conditions in capped vials at 4 °C (Parray et al., 2011).

3.5.3 Qualitative phytochemical analysis for detection of secondary metabolites.

Preliminary phytochemical tests were performed for detection of some important chemicals groups in methanolic extracts of selected 5 plant species by using the methods mentioned by Sofowora, 1993; Trease and Evans, 2002; Usman et al., 2009; Parray et al., 2011; Das et. al., 2014, and Suryawanshi and Vidyasagar, 2016 with slight modifications..

3.5.3.1 Test for alkaloids (Dragendroff's test)

A few mg of methanolic extract was dissolved in 5 ml of distilled water. Then 2 M HCl was added till an acidic reaction was observed which is followed by addition of 1ml of Dragendroff's reagent. The appearance of orange coloured precipitates indicated the presence of alkaloids (Sofowora, 1993; Usman et al., 2009).

3.5.3.2 Test for steroids (Libermann-Burchard's test)

2ml of acetic anhydride solution is added to 1ml of petroleum ether of the extract in chloroform. Then 1ml of conc. sulphuric acid is added and if a greenish color develops which turns to blue, it indicates presence of steroids (Parray et al., 2011).

3.5.3.3 Test for tannins (Ferric chloride test)

Few drops of 5% aq. Ferric chloride solution are added to 2ml of aqueous extract, a bluish black color develops. Then add a few ml of dil. sulphuric acid solution and if yellowish brown precipitates are formed, it indicates the presence of tannins (Trease and Evans, 2002; Usman et al., 2009).

3.5.3.4 Test for flavonoids (Shinoda's test)

Take 0.5 ml alcoholic extract in a test tube, add 5-10 drops of dil. HCl and a piece of magnesium or zinc. The solution is then boiled for few minutes, if a brown or pink or reddish pink colour develops it indicates the presence of flavonoids (Trease and Evans, 2002; Usman et al., 2009).

3.5.3.5 Test for phenols (Ferric chloride test)

A small quantity of aqueous or alcoholic extract is dissolved in 2ml of distilled water followed by addition of a few drops of 10% aqueous ferric chloride solution. If a green or blue color develops, it indicates the presence of phenols (Parray et al., 2011).

3.5.3.6 Test for saponins (Froth test)

A few drops of sodium bicarbonate are added to a small quantity of alcoholic extract and left for about 5 minutes. The formation of heavy froth indicates the presence of saponins (Parray et al., 2011).

3.5.3.7 Test for terpenoids (Salkowski test)

2 ml of chloroform was mixed with 5 ml of methanolic extract followed by addition of 3 ml of conc. sulphuric acid and shaken well. Formation of reddish brown colouration at the interface indicates presence of terpenoids (Das et. al., 2014).

3.5.3.8 Test for glycosides

A small quantity of dried alcoholic extract is dissolved in 1 ml of water followed by addition of NaOH solution. If a yellow color develops, it indicates the presence of glycoside (Parray et al., 2011).

3.5.4 Thin Layer chromatography

Spectrophotometric analysis of the plant samples was carried out using a UV-spectrophotometer (400- 800 nm). This method is used to determine the concentration of different phytochemicals present in the sample with different standardized protocols. The study was carried with 100mg/ml of test sample using 1100 LABMAN UV-VIS Spectrophotometer. The TLC analysis of plant extract was performed on 20 cm x 10 cm silica gel aluminium plate. Two micro liters of the extract was deposited and developed on mobile phase, in a glass twin-trough chamber previously saturated with mobile phase vapour for 20 min. Different mobile phases were used for determining different secondary metabolites. After development, the plates were dried with a hair dryer and then visualized under UV 254 nm, 366 nm and RF value were recorded (Ibrahim et al., 2016).

3.5.5 Phytochemical analysis for quantitative estimation of secondary metabolites.

Spectrophotometric analysis of the samples was carried out using a UV-spectrophotometer. This method is used to determine the concentration of different phytochemicals present in the sample with different standardized protocols.

Test Sample- 100mg/ml

UV-VIS Spectrophotometer 1100 LABMAN

Chemicals used – Himedia (Standards) & SD FINE chemicals (reagents).

3.5.5.1 Quantitative estimation of total alkaloid content (Chloroform method).

0.1 ml of the test sample having a concentration 100mg/ml was taken for the analysis. Various measured volumes (0.2, 0.4, 0.6, 0.8, 1ml) of atropine standard solution were placed in different separating funnels. Then 5 ml of pH 4.7 phosphate buffer and 5 ml of bromocresol green solution was taken and the mixture was shaken and extracted with 5 ml of chloroform. Then the extract was collected in a volumetric flask measuring 10 ml and diluted with chloroform to adjust the solution. The absorbance of the complex in chloroform was measured at a spectrum of 470 nm in a UV-Spectrophotometer (LABMAN-1100) against the blank prepared as above but without Atropine (Ajanal et al., 2012).

3.5.5.2 Quantitative estimation of total flavonoid content (Aluminium chloride method).

4 ml of distilled water was mixed with the test extract (1.0 ml) and subsequently 0.3 ml of NaNO₂ solution (10%) was added. This was followed by the addition of 2.0 ml of NaOH solution (1%) and 0.30 ml AlCl₃ solution (10%) to the mixture. The mixture was thoroughly mixed and the absorbance was then measured at 510 nm against a blank. A standard curve of quercetin ranging from 25 – 125 mg/ml was prepared and the results were expressed as quercetin equivalents (mg quercetin/ g dried extract) (Singh et al., 2015).

3.5.5.3 Quantitative estimation of phenolic content (Folin-Ciocalteu reagent method).

0.1 ml of sample extract was diluted to 1 ml with distilled water followed by addition of 0.8 ml of 7.5% Sodium carbonate and 1 ml of Folin-Ciocalteu reagent. The resulting mixture was incubated in the test tubes for 30 minutes and then its optical density was measured at 765 nm. Gallic acid was used as standard. The total phenolic content was expressed as milligrams of Gallic acid equivalents (GAE) per gram dry material (GAE/g) (Rina et. al., 2011).

3.5.5.4 Quantitative estimation of terpenoids content

100 mg of dried plant extract (Wi) was soaked in ethanol (9 ml) for 24 hour. After filtration, the extract was subjected to second extraction was extracted with petroleum ether (10 ml) using separating funnel. The ether extract was collected in a pre-weighed glass vial and allowed to dry completely (Wf). Ether was evaporated and the yield (%) of total terpenoids content was determined by using the formula $(Wf/Wi \times 100)$ (Malik, 2017).

3.5.5.5 Quantitative estimation of total saponin content

Standard saponin solution was prepared by mixing 4 ml of distilled water and 16 ml of methanol with 10 mg of diosgenin. Vanillin reagent (8%, 0.25 ml) was added to 0.5 ml of aqueous solution of the sample followed by pouring of sulphuric acid (72% v/v, 2.5 ml) gradually along the inner wall of test tube. After this, the mixture was heated in a water bath at 60°C for 10 min and subsequently cooled in ice-cold water. Absorbance for both the test and standard solutions was measured against the blank at 544 nm using UV spectrophotometer (Ngo et. al., 2017).

3.5.5.6 Quantitative estimation of Steriods

1 ml of the test extract was taken in a volumetric flask of 10 ml capacity. 2 ml each of Iron (III) chloride (0.5% w/v) and sulphuric acid (4N) were added to the extract followed by the addition of 0.5 ml of potassium hexacyanoferrate (III) solution (0.5%

w/v). The resulting mixture was heated in a water-bath at controlled temperature of 70⁰ C for half an hour with intermittent shaking and subsequently diluted with distilled water to the mark. The absorbance was measured at 780 nm against the reagent blank (Madhu et. al., 2017).

3.5.5.7 Quantitative estimation of total tannin content

Folin-Ciocalteu method was used for quantitative estimation of tannins. 1 ml of the sample extract was taken in a 10 ml volumetric flask. 0.5 ml of Folin Ciocalteu phenol reagent and 7.5 ml of distilled water was added to the extract followed by the addition of 1 ml 35% sodium carbonate solution. The volume of the mixture was raised to 10 ml by diluting it with distilled water. The resulting mixture was thoroughly shaken and left at room temperature for half an hour. A set of standard solutions of tannic acid ranging from 12.5 - 100 mg/ ml were prepared. Absorbance for both the test standard and test solutions was measured against the blank at 700 nm using a UV spectrophotometer (Madhu et. al., 2017).

3.5.5.8 Quantitative estimation of glycosides

2.5 ml of 15% lead acetate solution was mixed with 0.1 g of the test sample in test tube and then filtered. This was followed by the addition of 2 ml of chloroform to the filtrate and the resulting solution was mixed properly and allowed to settle. The lower settled portion was collected and then dried by evaporating to which 0.1ml of 5% ferric chloride, 0.25 ml concentrated H₂SO₄ and 3 ml of glacial acetic acid was added. The resulting solution is mixed thoroughly and left to stand for 3 hours. The absorbance was measured using spectrophotometer at 568 nm and a standard graph was prepared using standard cardiac steroidal glycosides.

3.5.6 Evaluation of antioxidant potential

ABTS Free Radical Scavenging Method was employed for determination of antioxidant activity. The antioxidant activity of the selected plant extracts against ABTS was determined. Radical ABTS^{•+} was prepared through oxidation of ABTS by potassium

persulfate. A mixture (1:1; *v/v*) of ABTS (7 mM) and potassium persulfate (4.95 mM) was prepared and kept in the dark for 16 h at room temperature. Then, the mixture was diluted with methanol until it reached absorbance values of 1–1.5 at 734 nm. Aliquots of 0.1 mL of methanolic extract of each sample (at 4 different concentrations: 0.1, 0.5, 1, and 2 mg/mL; two replicates per sample and concentration) had 3.9 mL of the ABTS^{•+} dilution added. The absorbance decrease was measured at 734 nm in a UV-30 spectrophotometer. The blank was prepared with ABTS^{•+}. The results were expressed in milligram equivalents of quercetin per milligram of dry weight. The calibration line was established using different concentrations of quercetin ranging between 0.625 – 10 mg/mL (Katalinic et al., 2006).

Chapter 4

Results and Discussion

The findings of the present study revealed that the Gaddi and Sippi tribes of the study area sustainably use different plant based ecosystem services for their sustenance. The present research work documented total 236 plant species spread across 183 genera and 77 families which were traditionally used by the Gaddi and Sippi tribes of Doda district, UT of J&K, for multifarious purposes in their daily chores. Angiosperms with 215 species were the most used plant group followed by fungi, gymnosperms and pteridophytes which were represented by 9, 7 and 5 species respectively. Rosaceae with 20 species was the most represented family closely followed by Asteraceae (18 spp.) and Fabaceae (16 spp.). Herbs represented by 142 species were the most utilized habit and leaves (26.5%) were the most utilized plant parts.

For the convenience of study, the ethnobotanical use of plants by the twin tribes under investigation was categorised into six major use categories viz. ethnomedicinal practices (155 spp.), ethnoveterinary practices (72 spp.) edible purpose (88 spp.), socio-magico-religious practices (62 spp.), fodder/forage purpose (70 spp.) and for making plant derived utility products (60 spp.).

4.1. Ethnomedicinal Plants

4.1.1. Diversity and characteristics of Ethnomedicinal plants.

A total of 210 informants were interviewed. The present study recorded 155 plant species of ethnomedicinal importance belonging to 124 genera and 63 families out of which 138 species were angiosperms whereas gymnosperms, pteridophytes and fungi were represented by 7, 5 and 5 species respectively (Table 4.1, Annexure-I). The number of dicots and monocots species was 132 and 6 respectively. The largest genera were *Aconitum*, *Artemisia*, *Euphorbia*, *Malva*, *Mentha*, *Rumex* and *Solanum* having 3 species each.

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Herbs were the most used life-forms with 65.0 % contribution whereas the contribution of trees, shrubs, climbers, ferns and mushrooms was 16.0%, 12.0%, 1.0%, 3.0% and 3.0% respectively (Fig. 4.1). These results are by and large in conformity with the general distribution of medicinal plants (1020 herbs, 335 shrubs, and 330 trees) in Indian Himalayan Regions (Samant et al., 1998). A number of other workers (Bhatia et al., 2014; Kumar et al., 2015; Lulekalet al., 2013; Maleki & Akhiani, 2018) have also reported the dominance of herbs in the medicinal floras of their respective study areas.

The most represented family was Asteraceae (14 sps.) followed by Poygonaceae, Rosaceae (10 sps. each), Lamiaceae (9 sps.), Apiaceae, Ranunculaceae (6 sps. each), Solanaceae, Pinaceae (5 sps. each), Brassicaceae, Fabaceae (4 sps. each), Ericaceae, Euphorbiaceae, Malvaceae, Plantaginaceae and Urticaceae (3 sps. each) (Fig. 4.2). Rest of the families were represented by 1 or 2 species each. The dominance of Asteraceae, Polygonaceae, Rosaceae and Lamiaceae has also been reported in the neighbouring regions of Udampur (Bhatia et al., 2014), Kathua (Rao et. al., 2015) and Kishtwar (Thakur et. al., 2020). Abundance of herbal plant species belonging to these families may be ascribed to their wide distribution, higher availability in the study area and predominant herbaceous habit (Bhatia et al., 2014).

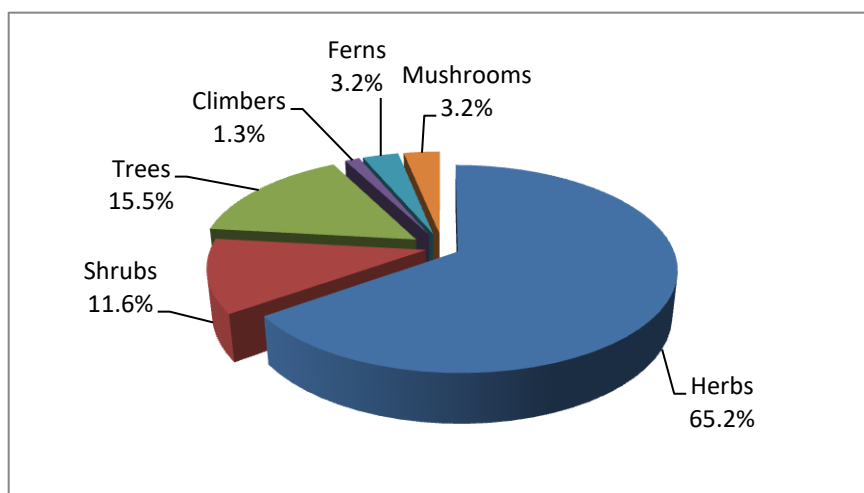


Fig. 4.1 Percentage representation of various plant habits of ethnomedicinal plants.

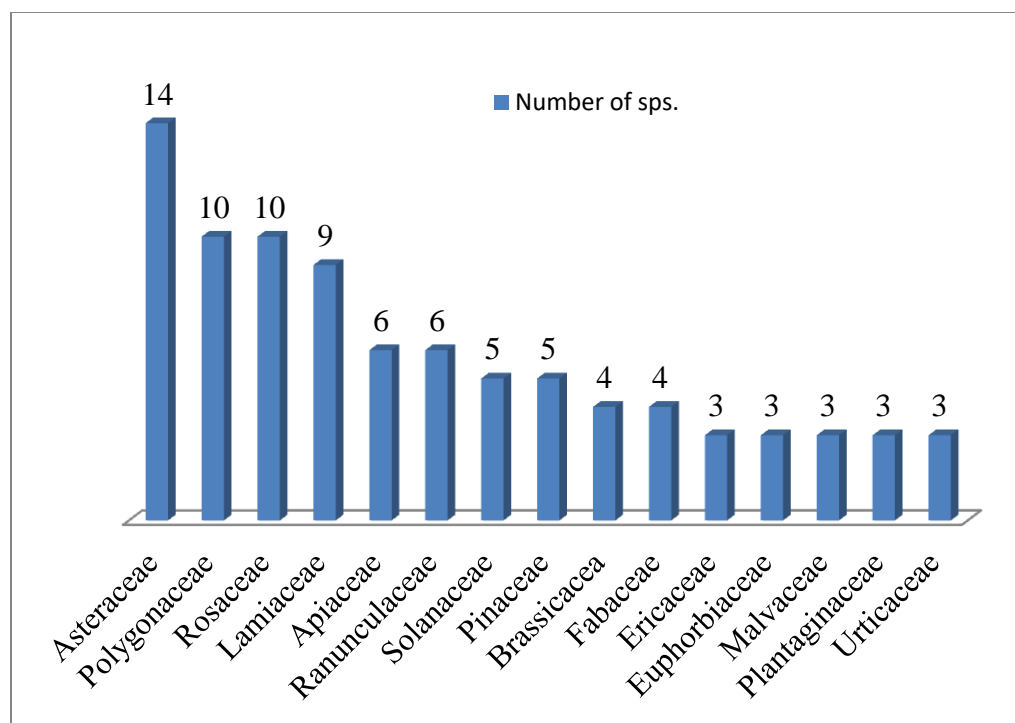


Fig. 4.2 The most represented families of ethnomedicinal plants.

These plant species were found growing in diverse habitat and ecosystem along altitudinal gradient of Himalayan mountains in the study area and the altitude of their habitat ranges from 1000 to 4400 masl. Most of the ethnomedicinal plant species were found growing between an altitude of 1900 to 2400 masl., whereas a few species including *Aconitum heterophyllum* Wall. Ex Royle, *Aconitum ferox*, Wall.ex Ser., *Aconitum hookeri* Stapf., *Cassiope fastigiata* (Wall.) D.Don., *Dactylorhiza hatagirea* (D.Don) Soo., *Rhododendron arboreum* Sm, *R. campanulatum* D.Don., *Dolomiaea costus* (Falc.) Kasana & A.K. Pandey, *Dolomiaea macrocephala* DC. Ex Royle., *Rheum australe* D.Don., *Picrorhiza kurroa* Royle ex Benth and *Prunus cornuta* (Wall. ex Royle) Steud. were collected from Seoj meadows or its vicinity near alpine region at an altitude of more than 3000 masl.

Thirteen different plant-parts/exudates were used by Gaddi and Sippi tribes of the study area for treatment of various human ailments. Leaves with 33.7% contribution were the most used plant-part. Other plant parts/exudates used as crude medicine were roots

(22.7%), seeds (8.1%), aerial parts (7.0%), branches (5.2%), flowers, fruits (4.7% each), bark, resin, fruiting bodies, latex (2.9% each), rhizome (1.7%) and stem (0.6%) (Fig. 4.3). The results are in agreement with the studies carried out in other Himalayan regions (Chandra et al., 2013; Bhatia et al., 2014; Kumar et al., 2015; Rao et al., 2015) and Rajaji Tiger Reserve, Uttarakhand (Akasha et al., 2021). According to Lee et al., (2019) and Panmeiet al., (2019), leaves are the most used plant part because they are available in relatively larger quantity and can be rapidly regenerated. Thus their use for ethnomedicinal purpose does not have any adverse affect on their availability (Namukobeet al., 2011; Rao et al., 2015) and on survival of the plant species (Singh et al., 2022). Moreover, leaves possess comparatively larger number of secondary metabolites in much higher concentrations (Baidya et al., 2020).

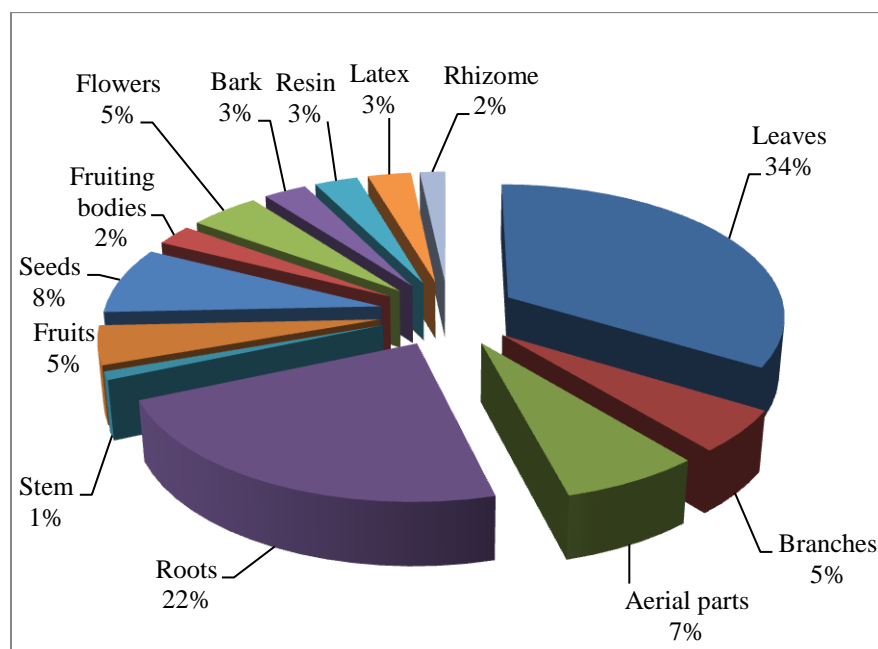


Fig. 4.3 Percentage contribution of different plant parts/exudates used in ethnomedicinal preparations.

Sixteen types of crude drug preparations/dosage forms were used and these were paste (26.4%), raw form (14.7%), cooked vegetables (11.2%), crushed form (10.7%), powder (10.2%), decoction, juice (6.1% each), teeth/gum cleaners (4.6%), spices & condiments (3.0%), tea (2.5%), oil (2.0%), infusion, roasted form, pickle, smoke

fumigation and water soaked form (0.5% each) (Fig. 4.4). Paste, with 44.0% contribution, has also been reported to be the most used dosage form in Hasanur Hills, Tamil Nadu (Revathi and Parimelazhagan, 2010). However in some other studies decoction was the most used crude drug form (Bhatia et al., 2014; Thakur et al., 2020; Akasha et al., 2021) because it contains higher concentration of flavonoids, phenols and other nutraceutical components (Silva & Soysa, 2011).

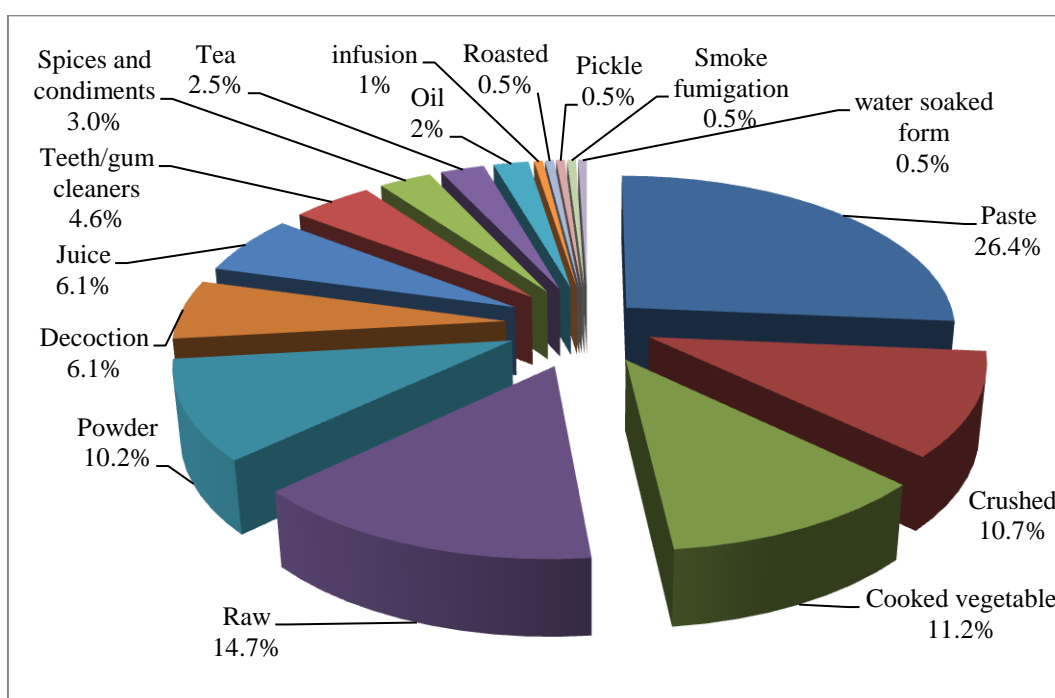


Fig. 4.4 Percentage contribution of various modes of preparation/dosage forms of ethnomedicines.

Out of 155 reported medicinal plants, 127 plant species were used singly for preparation of crude drugs whereas 28 species viz. *Aconitum heterophyllum* Wall. Ex Royle., *Ajuga parviflora* Benth., *Anethum graveolens* L., *Artemisia maritima* L., *A. scoparia* Waldst. & Kitam., *A. vestita* Wall. Ex Besse., *Berberis lyceum* Royle., *Brassica juncea* (L.) Czern., *Calotropis procera* (Aiton) Dryand., *Cedrus deodara* (Roxb.) G. Don., *Dactylorhiza hatagirea* (D.Don) Soo., *Dolomiaea costus* (Falc.) Kasana & A.K. Pandey, *Fumaria parviflora* Lamk., *Galium aparine* L., *Girardinia diversifolia* (Link)

Friis., *Isodon rugosus* (Wall. ex Benth.) Codd., *Nardostachys jatamansi* (D.Don) DC., *Oxalis corniculata* L., *Picrorhiza kurroa* Royle ex Benth., *Plantago lanceolata* L., *Prunus armeniaca* L., *Punica granatum* L., *Rosa macrophylla* Lindl., *Skimmia anquetilia* N.P.Taylor & Airy Shaw., *Swertia purpurascens* (D.Don) C.B.Clarke., *Urtica dioica* L., *Viola canescens* Wall. And *Xanthium strumarium* L. were used in combination with one or more species. Using two or more species in combination with one another for preparing crude drug enhances the effectiveness of the drug and may also neutralize the detrimental effects, if any, of other plants (Bhat et al., 2012a).

4.1.2. Categories of ailments treated.

Remedy for a total of about 76 diseases was suggested by the informants. *Muhari*, a specific local ailment of infants, is characterised by the appearance of a whitish thin layer (*tikri*) on tongue, loose motions and uneasiness. Two plant species viz. *Selinum vegeatum* Clarke and *Adiantum capillus-veneris* L. were used for treatment of this disease. For the convenience of study all the 76 diseases/disorders were grouped into 12 ailment categories as per the classification of ICPC-2 (Table 4.2, Fig. 4.5).

Table 4.2 — Ailment categories of human beings and No. of ethnomedicinal plant species used for their treatment.

S. No.	Ailment category (ICPC-2)	Diseases/disorders included	Sps. used
1	Digestive	Loss of appetite, indigestion, loose motions, flatulence, vomiting, abdominal cramps, abdominal pain, dysentery, diarrhoea, constipation, dyspepsia, jaundice, mouth sores, bitterness of mouth, xanthosis, liver heat, helminthics, toothache, gum bleeding, muhari.	65
2	Musculoskeletal	Orthopedic pain, rheumatic pain, arthritis, bone weakness.	17
3	Respiratory	Cough, pulmonary congestion, throat irritation, sore throat.	7
4	Skin	Skin rashes, itching, skin allergy, ringworm, warts, itchy bumps, boils and furuncles, scabies, skin eruptions, swellings, shingles, cold sore, cracked hands and feet.	36

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5	Urological	Burning micturition, difficulty in urinating, kidney stone.	5
6	Neurological	Head ache, vertigo.	8
7	Eye	Weak eye sight, cataract, eye pain, redness, swelling, irritation and burning sensation in eyes.	4
8	Endocrine, metabolism and nutrition	Hypothyroidism, diabetes.	19
9	Cardiovascular	Syncope	1
10	Male genital	Lower sperm count, decreased libido	1
11	Pregnancy, child bearing and family planning (women)	Abortions, mastitis, post-partum weakness.	4
12	General and unspecified	Snake bite, dandruff, hair fall, grey hair, cold, fever, injury and blood clots, wounds, alopecia areata, piles, fire burns, tiredness, bee and wasp sting, for cooling effect.	53

As far as the number of plant species used for treatment of different disease categories is concerned, digestive problems (2429 UR) treated with 65 species and general and unspecified problems (1183 UR) treated with 53 species take the lead followed by skin problems (1238 UR) treated with 36 sps. It is, therefore, obvious that the digestive and skin diseases are most common in the study area. These two diseases have been reported to be most prevalent in many parts of the Indian Himalayan region (Chandra et al., 2013; Bhatia et al., 2014; Kumar et al., 2015; Rao et al., 2015) and some other regions of India (Panmei et al., 2019) because of lack of proper hygiene in and around the homes, consumption of meat, alcohol and fibre deficient food (Panmei et al., 2019).

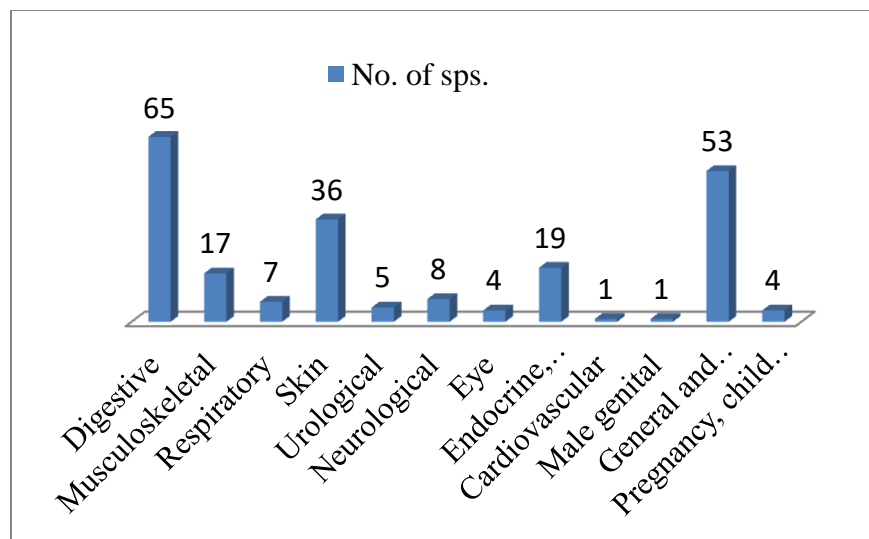


Fig. 4.5 Ailment categories of human beings and the number of ethnomedicinal plant species used for their treatment.

4.1.3 Quantitative analysis.

4.1.3.1 Use Value (UV).

In the present study, the highest Use value (UV) for ethnomedicinal plants was observed for *Ajuga parviflora* Benth. (UR, 110, UV=0.5). Other significant species as per FC values were *Isodon rugosus* (Wall. ex Benth.) Codd. (UR,=108, UV=0.5), *Indigofera heterantha* Brandis. (UR=106, UV=0.5), *Artemisia maritima* L., *Dysphania ambrosioides* (L.) (UR=104, UV=0.5), *Pilea umbrosa* Wedd. ex Blume (UR=104, UV=0.5 each) and *Skimmia anquetilia* N.P. Taylor & Airy Shaw (UR=103, UV=0.5). High value of UV indicates that the plant species have great cultural significance (Namukobe et al., 2011).

4.1.3.2 Informant consensus factor (F_{ic}).

The informant consensus factor (F_{ic}) values of all the ailment categories varied between 1.0 (cardiovascular disorders, male genital disorders) and 0.93 (neurological disorders). The higher values of F_{ic} indicate high degree of knowledge sharing and homogeneity of knowledge among the respondents and also offer scope for future ethnopharmacological studies which may lead to drug discovery (Bhatia et al., 2014; Rao

et al., 2015). Digestive disorders with highest UR (2429) and plant species used (65) was the most common ailment category of the region along with skin problems (UR 1238 and 36 species), general and unspecified ailments (UR 1183 and 53 species) and musculoskeletal disorders (UR 487 and 17 species).

Table 4.3 Ailment categories and Informant Consensus Factor (Fic) for ethnomedicinal plants

S. No.	Disease category (ICPC-II)	No. of sps. used (nt)	No. of use reports (nur)	Fic value (nur-nt/ nur-1)
1	Digestive	65	2429	0.97
2	Musculoskeletal	17	487	0.96
3	Respiratory	7	245	0.97
4	Skin	36	1238	0.97
5	Urological	5	103	0.96
6	Neurological	8	117	0.93
7	Eye	4	192	0.98
8	Endocrine, metabolism and nutrition	19	361	0.95
9	Cardiovascular	1	19	1
10	Male genital	1	6	1
11	General and unspecified	53	1183	0.95
12	Pregnancy, child bearing and family planning (women)	4	115	0.97

4.1.3.3 Fidelity level (FL%)

The disease categories were analysed using Fidelity Level (FL%) to determine the most preferred or most important species for treatment of particular disease category. From Table 4.4, it is clear that many species have 100% FL value for one or the other disease category. For example *Hymenolaena candollei*, *Silene edgeworthii*, *Robinia pseudoacacia* etc have 100 % FL for digestive ailments. *Boletus edulis*, *Stellaria media*,

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Diplazium maximum etc. have 100% FL for Endocrine, metabolic and nutritional problems. *Dipsacus inermis*, *Calendula officinalis*, *Verbascum thapsus* etc. have 100% FL for eye diseases. *Aconitum hookeri*, *Potentilla nepalensis*, *Meconopsis aculeata* etc. have 100% FL for General and unspecified disease category. *Juniperus communis*, *populous albs*, *Ranunculus scleratus* etc. have 100% FL for Musculoskeletal disease category.

Table 4.4 Fidelity Level (FL%) values of ethnomedicinal Plants for different disease categories.

Name of the species	Disease category	Use-reports	FL(%)
<i>Oxalis corniculata</i>	Cardiovascular	19	19.2
<i>Hymenolaena candollei</i>	Digestive problems	7	100
<i>Crataegus songarica</i>	Digestive problems	8	100
<i>Silene edgeworthii</i>	Digestive problems	9	100
<i>Robinia pseudoacacia</i>	Digestive problems	10	100
<i>Geranium wallichianum</i>	Digestive problems	11	100
<i>Raphanus sativus</i>	Digestive problems	14	100
<i>Malva parviflora</i>	Digestive problems	16	100
<i>Malva sylvestris</i>	Digestive problems	18	100
<i>Desmodium elegans</i>	Digestive problems	22	100
<i>Olea ferruginea</i>	Digestive problems	22	100
<i>Rumex acetosella</i>	Digestive problems	22	100
<i>Ainsliaea latifolia</i>	Digestive problems	24	100
<i>Mentha spicata</i>	Digestive problems	24	100
<i>Adiantum capillus-veneris</i>	Digestive problems	28	100
<i>Koenigia polystachya</i>	Digestive problems	28	100
<i>Malva neglecta</i>	Digestive problems	28	100
<i>Quercus leucotrichophora</i>	Digestive problems	34	100
<i>Tagetes minuta</i>	Digestive problems	37	100
<i>Rhododendron arboreum</i>	Digestive problems	39	100
<i>Mentha longifolia</i>	Digestive problems	40	100
<i>Erigeron bonariensis</i>	Digestive problems	42	100
<i>Selinum vegeatum</i>	Digestive problems	42	100
<i>Cydonia oblonga</i>	Digestive problems	44	100
<i>Mentha arvensis</i>	Digestive problems	44	100
<i>Zanthoxylum armatum</i>	Digestive problems	46	100
<i>Chenopodium album</i>	Digestive problems	48	100
<i>Punica granatum</i>	Digestive problems	48	100
<i>Rumex hastatus</i>	Digestive problems	50	100
<i>Nardostachys jatamansi</i>	Digestive problems	58	100
<i>Oxyria digyna</i>	Digestive problems	82	100
<i>Fagopyrum cymosum</i>	Digestive problems	90	100
<i>Angelica glauca</i>	Digestive problems	98	100
<i>Artemisia maritima</i>	Digestive problems	104	100
<i>Boletus edulis</i>	Endocrine, metabolic and nutritional problems	10	100

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<i>Diplazium maximum</i>	Endocrine, metabolic and nutritional problems	10	100
<i>Sparassis crispa</i>	Endocrine, metabolic and nutritional problems	11	100
<i>Sparassis radicata</i>	Endocrine, metabolic and nutritional problems	11	100
<i>Stellaria media</i>	Endocrine, metabolic and nutritional problems	24	100
<i>Geopora sumneriana</i>	Endocrine, metabolic and nutritional problems	26	100
<i>Diplazium esculentum</i>	Endocrine, metabolic and nutritional problems	48	100
<i>Geopora arenicola</i>	Endocrine, metabolic and nutritional problems	60	100
<i>Dipsacus inermis</i>	Eye problems	42	100
<i>Calendula officinalis</i>	Eye problems	96	100
<i>Verbascum thapsus</i>	Eye problems	10	55.6
<i>Plantago lanceolata</i>	Eye problems	44	53.7
<i>Aconitum hookeri</i>	General and unspecified	7	100
<i>Dicliptera sps.</i>	General and unspecified	7	100
<i>Potentilla nepalensis</i>	General and unspecified	8	100
<i>Meconopsis aculeata</i>	General and unspecified	10	100
<i>Orobancha sps.</i>	General and unspecified	10	100
<i>Parnassia nubicola</i>	General and unspecified	10	100
<i>Portulaca oleracea</i>	General and unspecified	10	100
<i>Pteris biaurita</i>	General and unspecified	10	100
<i>Rubus ellipticus</i>	General and unspecified	10	100
<i>Rubus niveus</i>	General and unspecified	10	100
<i>Asplenium trichomanes</i>	General and unspecified	11	100
<i>Pinu sroxburghii</i>	General and unspecified	11	100
<i>Viburnum cotinifolium</i>	General and unspecified	11	100
<i>Persicaria nepalensis</i>	General and	16	100

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	unspecified		
<i>Cassiope fastigiata</i>	General and unspecified	17	100
<i>Solanum tuberosum</i>	General and unspecified	22	100
<i>Atropa acuminata</i>	General and unspecified	24	100
<i>Pyrus pashia</i>	General and unspecified	24	100
<i>Taxus baccata</i>	General and unspecified	25	100
<i>Cynoglossum wallichii</i>	General and unspecified	30	100
<i>Anaphali smargaritacea</i>	General and unspecified	32	100
<i>Ziziphus oxyphylla</i>	General and unspecified	43	100
<i>Fragaria vesca</i>	General and unspecified	44	100
<i>Sinopodophyllum hexandrum</i>	General and unspecified	48	100
<i>Curcuma longa</i>	General and unspecified	54	100
<i>Pinus wallichiana</i>	General and unspecified	84	100
<i>Dysphania ambrosioides</i>	General and unspecified	104	100
<i>Indigofera heterantha</i>	General and unspecified	106	100
<i>Polygonatum verticillatum</i>	Male genital problems	6	42.9
<i>Juniperus communis</i>	Musculoskeletal problems	10	100
<i>Populus alba</i>	Musculoskeletal problems	10	100
<i>Ranunculus sceleratus</i>	Musculoskeletal problems	10	100
<i>Xanthium strumarium</i>	Musculoskeletal problems	10	100
<i>Datura stramonium</i>	Musculoskeletal problems	14	100
<i>Inula racemosa</i>	Musculoskeletal problems	20	100
<i>Quercus floribunda</i>	Musculoskeletal problems	24	100
<i>Prinsepia utilis</i>	Musculoskeletal problems	25	100
<i>Dactylorhiza hatagirea</i>	Musculoskeletal problems	44	100
<i>Dolomiaea costus</i>	Musculoskeletal problems	98	100
<i>Rheum australe</i>	Neurological	44	44.0

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	problems		
<i>Rhododendron campanulatum</i>	Neurological problems	20	23.3
<i>Solanum villosum</i>	Neurological problems	16	18.8
<i>Berberis lycium</i>	Neurological problems	12	12.2
<i>Swertia purpurascens</i>	Neurological problems	10	11.6
<i>Picrorhiza kurroa</i>	Neurological problems	6	11.5
<i>Anethum graveolens</i>	Neurological problems	5	11.4
<i>Taraxacum officinale</i>	Pregnancy, child bearing and family planning	87	100
<i>Galium aparine</i>	Pregnancy, child bearing and family planning	18	52.9
<i>Prunus armeniaca</i>	Pregnancy, child bearing and family planning	8	14.8
<i>Ocimum tenuiflorum</i>	Respiratory problems	26	100
<i>Viola canescens</i>	Respiratory problems	49	100
<i>Viola odorata</i>	Respiratory problems	97	100
<i>Bistorta amplexicaulis</i>	Respiratory problems	30	71.4
<i>Prunus armeniaca</i>	Respiratory problems	10	18.5
<i>Skimmia anquetilia</i>	Respiratory problems	17	16.5
<i>Aconitum heterophyllum</i>	Respiratory problems	16	16.3
<i>Abies pindrow</i>	Skin problems	10	100
<i>Euphorbia heterophylla</i>	Skin problems	10	100
<i>Euphorbia pilosa</i>	Skin problems	10	100
<i>Picea smithiana</i>	Skin problems	10	100
<i>Euphorbia helioscopia</i>	Skin problems	11	100
<i>Delphinium roylei</i>	Skin problems	13	100
<i>Nasturtium officinale</i>	Skin problems	20	100
<i>Parrotiopsis jacquemontiana</i>	Skin problems	24	100
<i>Chrysojasminum humile</i>	Skin problems	27	100
<i>Solanum pseudocapsicum</i>	Skin problems	32	100
<i>Celtis australis</i>	Skin problems	35	100
<i>Prunella vulgaris</i>	Skin problems	36	100
<i>Chaerophyllum villosum</i>	Skin problems	38	100
<i>Allium sativum</i>	Skin problems	40	100
<i>Dolomiaea macrocephala</i>	Skin problems	44	100
<i>Plantago major</i>	Skin problems	44	100
<i>Brassica oleracea</i>	Skin problems	48	100
<i>Girardinia diversifolia</i>	Skin problems	84	100
<i>Persicaria hydropiper</i>	Skin problems	88	100
<i>Pilea umbrosa</i>	Skin problems	104	100
<i>Rubia cordifolia</i>	Skin problems	78	95.1

<i>Cynoglossum lanceolatum</i>	Skin problems	78	92.9
<i>Macrotyloma uniflorum</i>	Urological problems	15	100
<i>Melia azedarach</i>	Urological problems	50	100
<i>Allium stracheyi</i>	Urological problems	14	58.3
<i>Ocimum basilicum</i>	Urological problems	16	28.6
<i>Rosa macrophylla</i>	Urological problems	8	26.7

4.1.4 Current status of ethnomedicinal knowledge and ethnomedicinal plants used by the Gaddi and Sippi tribes of Doda district.

The present study reveals that Gaddis and Sippis of the study area in general and the shepherds (*palh*) of these tribes in particular are highly knowledgeable about traditional use of medicinal plant species because their inhabitations are distantly located on mountainous tracts amid forests or along the fringes of forests. Moreover the semi-nomadic Gaddi and Sippi shepherds have to move through difficult mountainous tracts and passes during seasonal migration of their livestock and thus they are highly acquainted with high altitudinal medicinal plants and their utility which are hardly known to the modern society. But an erosion of traditional knowledge possessed by the tribes under investigation has been observed during recent past because of their dissociation from the forests mainly due to an abrupt and sharp decline in their profession of shepherding and a boost in employment of Gaddi and Sippi youth in government jobs. The invasion of modern culture on tribal traditions of these tribes and inclination of younger generation towards modern way of lifestyle has further contributed to the dwindling of their pastoral profession and traditional knowledge. Since this highly valuable ethnomedicinal knowledge possessed by Gaddi and Sippi tribes of the study area is transmitted orally in a scriptless *Gadyali* language, it is recommended that this knowledge should be documented and preserved before it is lost once forever and the present work is an attempt in this direction. Not only the traditional knowledge has faded away but the population of some of the most important ethnomedicinal plants has also been depleted during recent past due to over-exploitation and/or habitat loss. Such locally endangered ethnomedicinal plants include *Aconitum ferox*, *Aconitum heterophyllum*, *Angelica glauca*, *Atropa acuminata*, *Dactylorhiza hatagirea*, *Dolomiaea costus*,

Dolomiaea macrocephala, *Picrorhiza kurroa*, *Rheum australe*, and *Sinopodophyllum hexandrum*.

Bhaderwah valley, located in the study area, also known as *Chhota Kashmir* (Directorate of Tourism, J&K Govt.) is fast emerging as an alternate tourist destination to Kashmir valley due to its fascinating scenic beauty and is attracting large number of tourists every year who spend days and nights in camping sites in and around the forests. This growing tourism in the study area is posing threat to the rare and endangered plant species of medicinal importance. Religious tourism is also growing fast in the study area and the local pilgrimages to the high altitudinal forest areas like Kailash Yatra to Holy Kaplas lake (14700 feet asl) in alpine Himalayas, Nagni Mata yatra, Subar Dharyatra, Rheushera Mata yatra and Malni Mata yatra are also posing a serious threat to high altitudinal medicinal plants. It is recommended that sWEPs should be taken for sustainable utilization and systematic conservation of threatened plant species having high medicinal potential. Eco-tourism should also be promoted in the study area. Traditional medicinal plants with high UV and FL are highly important and most preferred plant species and are recommended for conservation (Rokaya et al., 2010, Saravanan et al., 2018). Such plant species should be replenished in their natural habitat. Domestication of such species by establishing ethnomedicinal herbal gardens by local communities, which will act as repositories of potential medicinal plants, is also recommended. Tribals should also be transformed from minor forest produce collector to minor forest produce grower.

4.1.5 Ethnomedicinal plants vis-à-vis other tribes and rural communities of UT of Jammu and Kashmir.

Rural and tribal communities are known as the pacesetters of ethnobotany. In UT of Jammu and Kashmir, ethnobotanical studies conducted on tribals mainly revolved around Gujjar and Bakerwal tribes, whereas other tribes have not received required attention of ethnobotanists. Review of published literature reveals that tribals of Jammu and Kashmir use 22 to 80 species of ethnomedicinal plants (Abdullah and Andrabi, 2021a; Ahmed & Ajaz, 2017; Bano et al., 2017; Bhat et al., 2012b; Dangwal & Singh,

2013; Dar et al., 2015; Dar et al., 2018; Jan and Khare, 2015; Hassan et al., 2021; Kanta et al., 2018; Khan et al., 2022; Khan and Kumar, 2012; Khan & Wani, 2017; Khanday & Singh, 2017; Kumari et al., 2013; Lone et al., 2012; Lone & Bhardwaj, 2013; Mir, 2014a; Mir, 2014b; Mir et al., 2021; Rajoriya et al., 2016; Rashid, 2012; Rashid, 2013; Riaz & Bhandari, 2015; Sarad et al., 2017; Shah et al., 2012; Shah et al., 2015a; Shah et al., 2015b; Singh & Khanday, 2017a; Singh & Khanday, 2017b; Trak & Giri, 2017). However, ethnomedicinal explorations carried out on tribals of J&K by Abdullah and Andrabi (2021b), Bhat et al. (2014) and Dutt et al. (2015) have documented 112, 132 and 190 species of ethnomedicinal plants respectively. Hence, the present research work with an inventory of 155 plant species of ethnomedicinal importance used by Gaddi and Sippi tribes is one of the largest ethnomedicinal plant explorations carried out on tribals of UT of J&K.

Apart from ethnomedicinal studies on tribals of J&K, several similar studies have already been conducted on non-tribal rural communities of this region. These studies have reported 37 to 139 plant species of ethnomedicinal importance (Farooq et al., 2022; Kumar et al., 2009; Kumar et al., 2015; Kumar and Bhagat, 2012; Lone and Jain, 2022; Malik et al., 2011; Singh et al., 2020; Singhal and Sharma, 2020; Thakur et al., 2020; Wani et al., 2021; Yaqoob et al., 2017). However, Bhatia et al., 2014, Kumar and Sharma, 2013 and Rao et al., 2015 have documented 132, 295 and 197 ethnomedicinal plant species respectively from UT of Jammu and Kashmir.

4.1.6 Novelty and future prospects of ethnomedicinal plants.

Based on literature survey of 51 research publications, it has come to the fore that out of total 155 ethnomedicinal plants documented in the present research work, 17 plant species are new records from UT of Jammu and Kashmir as far as their usage in ethnomedicinal practices is concerned. These species include *Artemisia vestita* Wall. ex Besser., *Allium stracheyi* Baker., *Euphorbia heterophylla* L., *Geopora sumneriana* (Cooke) M. Torre., *Geopora arenicola* (Lev.) Kers., *Koenigia polystachya* (Wall. ex Meisn.) T.M.Schust. & Reveal., *Rumex acetosella* L., *Macrotyloma uniflorum* (Lam.) Verdc., *Pilea umbrosa* Wedd. ex Blume, *Parnassia nubicola* Wall. ex Royle., *Solanum*

villosum Mill., *Quercus floribunda* Lindl. ex A.Camus., *Sparassis radicata* Weir., *Sparassis crispa* (Wulf.), *Swertia purpurascens* (D.Don) C.B.Clarke., *Pteris biaurita* L. and *Boletus edulis* Bull. 113 new use reports of 84 ethnomedicinal plants have also been reported in the present study from UT of J&K. The new use reports are denoted by the asterisk mark (*) in Table 4.1. New use reports and new records of ethnomedicinal plants offer scope for future ethnopharmacological and clinical research and provide potential leads for drug discovery.

4.2. Ethnoveterinary Plants

4.2.1. Diversity and characteristics of Ethnoveterinary plants.

A total of 210 informants were interviewed. The present study documented 72 ethnoveterinary plant species belonging to 62 genera spread across 33 families and is a pioneering work on ethnoveterinary practices of Gaddi and Sippi tribes of UT of Jammu and Kashmir (Table 4.1, Annexure-I). The angiosperms were represented by 66 species out of which 58 were dicots and 8 monocots. The number of species belonging to gymnosperms and pteridophytes were 4 and 2 respectively. The largest genera were *Aconitum*, *Bergenia*, *Fagopyrum*, *Ipomoea*, *Persicaria*, *Quercus*, *Rhododendron*, *Rumex*, *Trifolium* and *Pinus* each having two species. Herbs represented by 45 species were the most used life forms followed by trees (13 spp.), shrubs (10 spp.), climbers and ferns (2 spp. each).

The maximum number of plant species belonged to family Polygonaceae and Fabaceae (9 spp. each) followed by Pinaceae, Poaceae, Rosaceae (4 spp. each), Lamiaceae, Urticaceae (3 spp. each), Amaranthaceae, Apiaceae, Asteraceae, Convolvulaceae, Ericaceae, Fagaceae, Ranunculaceae, Sapindaceae, Saxifragaceae and Berberidaceae (2 spp. each). All other families were having only one species each.

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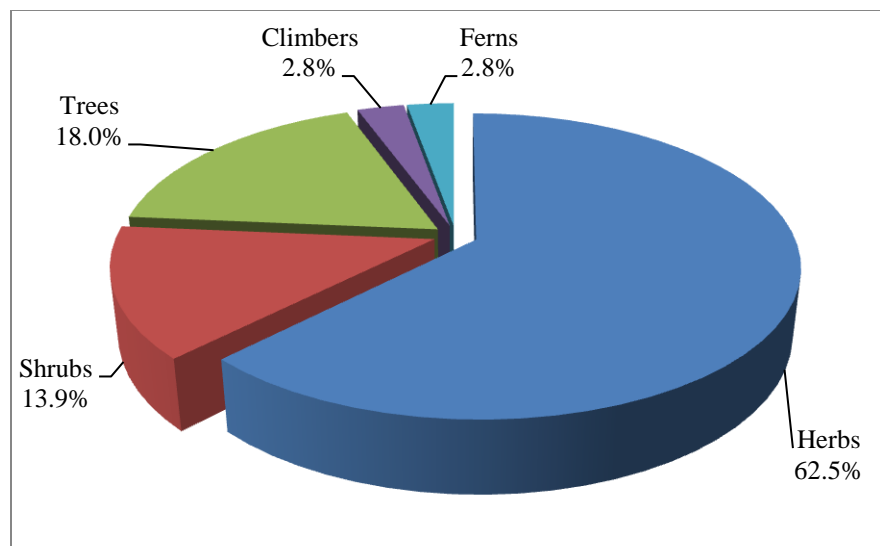


Fig. 4.6 Percentage contribution of various plant habits of ethnoveterinary

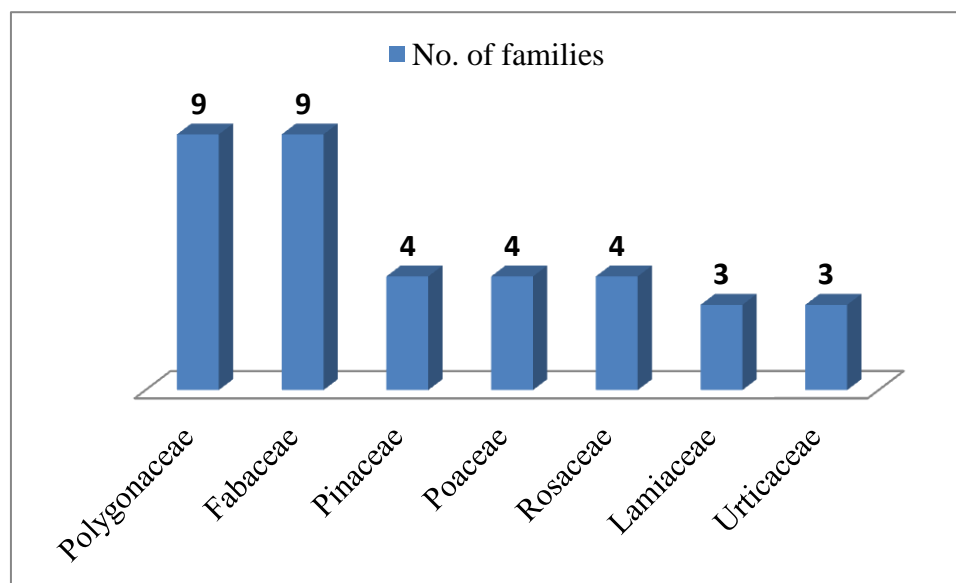


Fig. 4.7 The most represented families of ethnoveterinary plants.

Roots (23.7%) were the most used plant parts/exudates followed by aerial parts (22.4%), leaves (14.5%), seeds (10.6%), fruits (7.9%), flowers (5.3%), bark, branches, rhizome, resin (3.9% each). Many other workers have also reported herbs as the main

source of ethnoveterinary drugs from Jammu and Kashmir (Sharma et al., 2012; Bhardwaj et al., 2013; Dar et al., 2018; Sultan et al., 2022).

Ten types of crude drug preparations were used for ethnoveterinary purposes and these were crushed form (27.1%), paste, raw form (19.8% each), decoction (12.3%), boiled from (7.4%), others (6.2%), juice, powder (2.5% each), ash and oil (1.2% each). Crude drug preparations under the category ‘others’ include absorption of moisture by the seeds of *Brassica juncea* (L.) Czern. which are kept overnight outside the house during winter season when they absorb moisture due to dew formation and given next morning to cows as a remedy for cough, mustard oil cakes given to cows as a galactagogue, chewing of fruits of *Pyrus pashia* Buch.-Ham. ex D.Don. by a person which are then sprinkled forcefully out of mouth along with saliva into the eyes of cattle as a treatment for partial or complete blindness, cakes (*roti*) prepared out of mixed corn (*Zea mays* L.) and wheat (*Triticum aestivum* L.) flour which is given with jaggery and *ghee* to cows for postpartum recovery after calving.

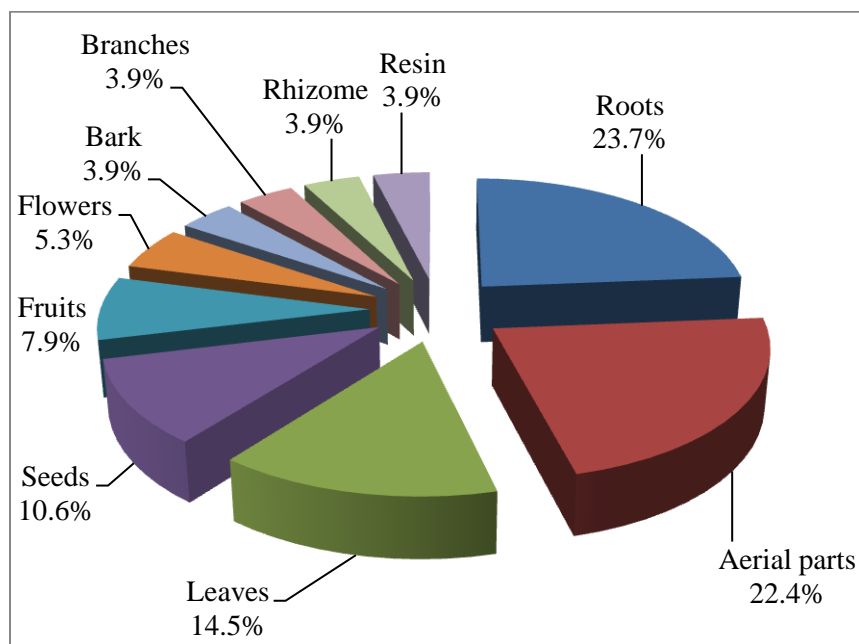


Fig. 4.8 Percentage contribution of different plant parts/exudates used in ethnoveterinary drug preparations.

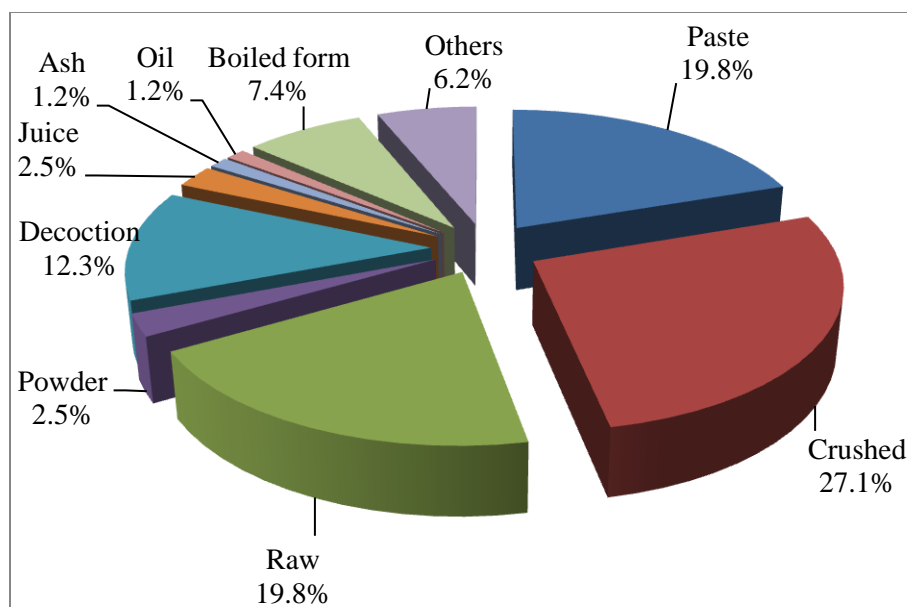


Fig. 4.9 Percentage contribution of various modes of preparation/dosage forms of ethnoveterinary medicines.

4.2.2. Categories of diseases/ailments treated.

In the present study, the informants reported treatment for 29 diseases of livestock which were categorized into nine disease categories viz. digestive, foot and mouth disease, respiratory, pregnancy and calving, musculoskeletal, skin, eye, urological and general.

Table 4.5 Ailment categories of livestock and No. of ethnoveterinary plant species used for their treatment.

S. No.	Ailment category (ICPC-2)	Diseases/disorders included	Sps. used
1	Digestive	Loss of appetite, indigestion, loose motions, flatulence, colic pain, dysentery, diarrhoea, helminthics, abdominal swelling.	19
2	Musculoskeletal	arthritis, bone fractures.	4
3	Respiratory	Cough, lung infection, pneumonia.	7
4	Skin	Mange.	3
5	Urological	Hematuria.	5
6	Foot and Mouth	FMD	8

	disease		
7	Eye	Weak eye sight, cataract.	3
8	Pregnancy and calving	Retained placenta, post-partum weakness.	6
9	General	Fever, injury, wounds, fire burns, For body heat, galactagogue, mastitis, general weakness.	34

As far as the number of plant species used for treatment of different disease categories is concerned, the highest number of plant species (34 sps.) is used for treatment of General diseases followed by digestive diseases (19 species), FMD (8 sps.) and Pregnancy and calving (6 sps.).

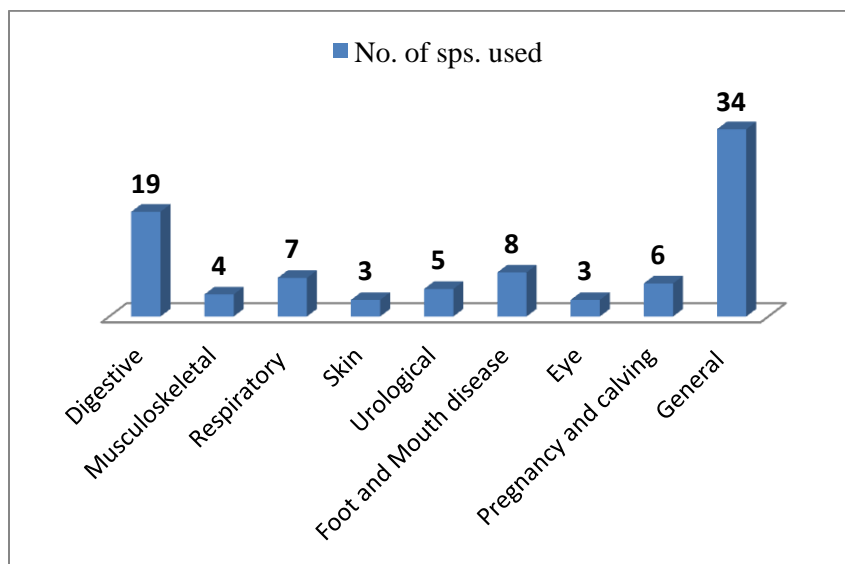


Fig. 4.10 Ailment categories of livestock and the number of ethnoveterinary plant species used for their treatment.

4.2.3 Quantitative analysis

4.2.3.1 Use value (UV).

The highest UV for ethnoveterinary plants was observed for *Angelica glauca* (UR=160, UV=0.8), followed by *Aconitum ferox* (UR=158, UV=0.8), *Aesculus indica* (UR=157,

UV=0.8) and *Acorus calamus* (UR=155, UV=0.7). The plant species with high UV have relatively more cultural importance.

4.2.3.2 Informant Consensus Factor (Fic).

The Fic values of all the ethnoveterinary disease categories were found to be very high which indicates that the communities share ethnoveterinary knowledge among themselves. The value of Fic ranged between 0.98 for ‘Pregnancy and calving’, ‘respiratory’ and ‘General’ disease categories and 0.99 for all other disease categories (Table 4.6).

Table 4.6 Ailment categories and Informant Consensus Factor (Fic) for ethnoveterinary plants.

S. No.	Veterinary Disease category	No. of sps. used (nt)	No. of use reports (nur)	Fic value (nur-nt/nur-1)
1	Digestive	19	1624	0.99
2	Musculoskeletal	4	408	0.99
3	Respiratory	7	339	0.98
4	Skin	3	354	0.99
5	Urological	5	553	0.99
6	Eye	3	351	0.99
7	FMD	8	812	0.99
8	General	34	1717	0.98
9	Pregnancy and calving	6	261	0.98

4.2.3.3 Fidelity Level (FL%).

The FL% values were found to be 100% for many ethnoveterinary plant species for curing different disease categories (Table 4.7). Such species are the most preferred species for treatment of particular disease. For example *Aconitum heterophyllum*, *Berberis lyceum*, *Cassia fistula* etc. showed 100% FL values for treatment of Digestive problems. *Fagopyrum cymosum*, *Koenigia polystachya*, *Oxalis corniculata* etc. showed 100% FL values for treatment of FMD. *Persicaria nepalensis*, *Prunella vulgaris* and *Pyrus pashia* showed 100% FL values for treatment of eye diseases.

Table 4.7 Fidelity Level (FL%) values of ethnoveterinary plants for different disease categories.

Name of the plant species	Use category	Use-reports	Fl(%)
<i>Aconitum heterophyllum</i>	Digestive problems	145	100
<i>Berberis lycium</i>	Digestive problems	56	100
<i>Cassia fistula</i>	Digestive problems	100	100
<i>Diplazium esculentum</i>	Digestive problems	70	100
<i>Dysphania ambrosioides</i>	Digestive problems	80	100
<i>Ficus palmata</i>	Digestive problems	40	100
<i>Pteris biaurita</i>	Digestive problems	68	100
<i>Rhododendron campanulatum</i>	Digestive problems	128	100
<i>Rumex nepalensis</i>	Digestive problems	111	100
<i>Skimmia anquetilia</i>	Digestive problems	102	100
<i>Sorbaria tomentosa</i>	Digestive problems	154	100
<i>Thymus serphyllum</i>	Digestive problems	76	100
<i>Persicaria nepalensis</i>	Eye problems	96	100
<i>Prunella vulgaris</i>	Eye problems	117	100
<i>Pyrus pashia</i>	Eye problems	138	100
<i>Fagopyrum cymosum</i>	Foot & Mouth disease	148	100
<i>Koenigia polystachya</i>	Foot & Mouth disease	107	100
<i>Oxalis corniculata</i>	Foot & Mouth disease	120	100
<i>Oxyria digyna</i>	Foot & Mouth disease	56	100
<i>Persicaria hydropiper</i>	Foot & Mouth disease	119	100
<i>Rumex hastatus</i>	Foot & Mouth disease	112	100
<i>Tamarindus indica</i>	Foot & Mouth disease	127	100
<i>Abies pindrow</i>	General and unspecified	9	100
<i>Ajuga parviflora</i>	General and unspecified	40	100
<i>Bupleurum falcatum</i>	General and unspecified	36	100
<i>Curcuma longa</i>	General and unspecified	127	100
<i>Fagopyrum esculentum</i>	General and unspecified	49	100
<i>Galium aparine</i>	General and unspecified	142	100
<i>Indigofera heterantha</i>	General and unspecified	20	100
<i>Ipomoea purpurea</i>	General and unspecified	32	100
<i>Oryza sativa</i>	General and unspecified	18	100

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<i>Phaseolus vulgaris</i>	General and unspecified	12	100
<i>Pilea umbrosa</i>	General and unspecified	50	100
<i>Pinus roxburghii</i>	General and unspecified	130	100
<i>Pinus wallichiana</i>	General and unspecified	150	100
<i>Prinsepia utilis</i>	General and unspecified	84	100
<i>Quercus floribunda</i>	General and unspecified	27	100
<i>Quercus leucotrichophora</i>	General and unspecified	44	100
<i>Rheum australe</i>	General and unspecified	137	100
<i>Robinia pseudoacacia</i>	General and unspecified	12	100
<i>Sinopodophyllum hexandrum</i>	General and unspecified	47	100
<i>Trifolium pratense</i>	General and unspecified	55	100
<i>Trifolium repens</i>	General and unspecified	54	100
<i>Trigonellafoenum-graecum</i>	General and unspecified	10	100
<i>Viburnum grandiflorum</i>	General and unspecified	70	100
<i>Vigna mungo</i>	General and unspecified	8	100
<i>Achillea millefolium</i>	General and unspecified	142	95.9
<i>Dodonaea viscosa</i>	Musculoskeletal problems	100	100
<i>Girardinia diversifolia</i>	Musculoskeletal problems	120	100
<i>Acorus calamus</i>	Musculoskeletal problems	114	73.5
<i>Dolomiaea costus</i>	Musculoskeletal problems	74	50.7
<i>Amaranthus viridis</i>	Pregnancy and calving	51	100
<i>Ipomoea batatas</i>	Pregnancy and calving	23	100
<i>Polygonatum verticillatum</i>	Pregnancy and calving	62	100
<i>Triticum aestivum</i>	Pregnancy and calving	10	100
<i>Ulmus wallichiana</i>	Pregnancy and calving	111	100
<i>Zea mays</i>	Pregnancy and calving	4	44.4
<i>Picrorhiza kurroa</i>	Respiratory/pulmonary	117	100

	problems		
<i>Angelica glauca</i>	Respiratory/pulmonary problems	33	20.6
<i>Arisaema jacquemontii</i>	Respiratory/pulmonary problems	83	100
<i>Spiraea canescens</i>	Respiratory/pulmonary problems	44	78.6
<i>Dolomiaea costus</i>	Respiratory/pulmonary problems	36	24.7
<i>Nicotiana tabacum</i>	Skin problems	151	100
<i>Verbascum thapsus</i>	Skin problems	108	69.7
<i>Cedrus deodara</i>	Skin problems	95	62.5
<i>Bergenia ciliata</i>	Urological problems	130	100
<i>Bergenia stracheyi</i>	Urological problems	130	100
<i>Hordeum vulgare</i>	Urological problems	127	100
<i>Rhododendron arboreum</i>	Urological problems	76	100
<i>Urtica dioica</i>	Urological problems	90	100

4.2.4 Current status of ethnoveterinary knowledge of Gaddi and Sippi tribes of Doda district.

Gaddis and Sippis are semi-nomadic, pastoral tribes and their economic activities revolve primarily around shepherding. Most of the households possess a large flock of about 100 – 400 goats and sheep and a few horses. These tribes have settled at higher elevations of NW Himalayas, in the close vicinity of forests and grazing lands in order to facilitate grazing of their livestock. According to Haq et al. (2012), livestock rearing is the main source of livelihood in high altitude regions, where people primarily depend on ethnoveterinary practices for treatment of their livestock. One or two male members of the family who are devoted to shepherding spend most of their time in the remote forests and grazing lands where they graze their livestock. Moreover, the shepherds of the Gaddi and Sippi tribes also undergo seasonal migration along with their flock from hills of Himalayas to plains and vice-versa during winters and summers respectively in order to facilitate grazing of their livestock and to avoid harsh weather conditions. These shepherds live a very hard life and face many problems while grazing their livestock in the forests and during their seasonal migration as they are not having any facility available to them. They sleep under the open sky even during torrential rains. Since these

shepherds are intimately associated with the forests and forest products they are highly knowledgeable about the traditional use of plants for ethnoveterinary purpose. Thus in the absence of any modern ethnoveterinary facility available to them, shepherds of Gaddi and Sippi tribes use a good number of ethnoveterinary plants for treatment of their livestock. They are familiar with the traditional use of some high altitudinal ethnoveterinary plants which are unknown to the modern society, e.g., *Abies pindrow* (Royle ex D.Don) Royle., *Aconitum ferox* Wall. ex Ser., *Koenigia polystachya* (Wall. ex Meisn.) T.M.Schust. & Reveal, *Oxyria digyna* (L.) Hill., *Rhododendron arboreum* Sm. and *R. campanulatum* D.Don.

However, it was pointed out by most of the informants that a sharp decline in the profession of shepherding has been observed during recent past as the younger generations were not interested in carrying forward this strenuous and arduous occupation. Modernisation, education, government employment, militancy and associated away movement from villages are some of the factors responsible for diminishing of the profession of shepherding and the concomitant ethnoveterinary knowledge possessed by the Gaddi and Sippi tribes of the study area. It is therefore recommended that the invaluable ethnoveterinary knowledge possessed by Gaddi and Sippi tribes, which is transmitted orally in scriptless language, should be documented and conserved before it is lost forever.

4.2.5 Ethnoveterinary plants vis-a-vis other tribes and rural communities of UT of J&K.

As far as tribal ethnoveterinary practices in UT of Jammu and Kashmir are concerned, a few ethnoveterinary studies have already been carried out on Gujjar and Bakerwal tribes of this region who use 10 – 47 plant species for treatment of their live stock (Khuroo et al., 2007; Rashid et al., 2007; Mahmud and Shah, 2009; Bhardwaj et al., 2013; Ahmed et al., 2017; Khan and Paul, 2017; Kirmani et al., 2020; Dar et al., 2018; Dutt et al., 2021 and Mir, 2014). Some other non tribal communities of J&K utilize 18 – 56 plant species of ethnoveterinary importance (Sharma and Singh, 1989; Jamwal and Kant, 2007; Khan and Kumar, 2012; Khateeb et al., 2015; Khateeb et al., 2017; Sharma

and Manhas, 2015; Manzoor and Ali, 2017; Sofi et al., 2019; Singh et al., 2022; Sultan et al., 2022; Wani et al., 2022; Haq et al., 2022; Ahmad et al., 2017). However, Sharma et al., 2012, Manzoor and Ali, 2017 and Haq et al., 2022 reported 72, 72 and 109 ethnoveterinary plant species respectively from UT of Jammu and Kashmir. Hence, the present study with 72 ethnoveterinary plant species is one of the major ethnoveterinary surveys carried out in UT of J&K and is the first such study on Gaddi and Sippi tribes of this region.

4.2.6 Novelty and future prospects of ethnoveterinary plants.

Based on review of 24 research articles pertaining to the ethnoveterinary practices carried out in UT of J&K, 24 plant sps. have been reported as new records in ethnoveterinary practices from UT of J&K. These species are *Abies pindrow* (Royle ex D.Don) Royle., *Aconitum ferox* Wall. ex Ser., *Fagopyrum cymosum* (Trevir.) Meisn., *Indigofera heterantha* Brandis., *Ipomoea batatas* (L.) Lam., *Ipomoea purpurea* (L.) Roth., *Koenigia polystachya* (Wall. ex Meisn.) T.M. Schust. & Reveal., *Oxyria digyna* (L.) Hill., *Persicaria nepalensis* (Meisn.) Miyabe., *Phaseolus vulgaris* L., *Pteris biaurita* L., *Quercus floribunda* Lindl. ex A.Camus., *Rhododendron arboreum* Sm., *Rhododendron campanulatum* D.Don., *Robinia pseudoacacia* L., *Rumex hastatus* D. Don., *Sorbaria tomentosa* (Lindl.) Rehder., *Spiraea canescens* D. Don., *Ulmus wallichiana* Planch., *Viburnum cotinifolium* D.Don., *Pilea umbrosa* Wedd. ex Blume., *Bergenia stracheyi* (Hook.f. & Thomson) Engl., *Quercus leucotrichophora* A.Camus. and *Diplazium esculentum* (Retz.) Sw. Such plants with new records in the field of ethnoveterinary uses from UT of J&K should be subjected to further scientific research and may provide potential leads for the discovery of novel ethoveterinary drugs.

4.3 Wild Edible Plants (WEPs).

4.3.1 Diversity and characteristics of Wild Edible Plants (WEP).

The present research work is the first and only study on WEPs consumed by Gaddis and Sippis of UT of Jammu and Kashmir. The outcome of the present research work reveals that Gaddi and Sippi tribes are highly skilled in identifying and consuming a large number of forest foods. A total of 248 informants were interviewed. In present study, 88 species of edible plants belonging to 65 genera and spread across 42 families have been reported (Table 4.1). Out of total 88 plant species, angiosperms dominated

with 74 species, whereas fungi, gymnosperms and pteridophytes were represented by 9, 3 and 2 species respectively. Most of the WEPs were obtained from wild sources.

The number of dicot and monocot species was 71 and 3 respectively. The largest genera were *Amaranthus*, *Malva*, *Mentha*, *Prunus*, *Pyrus*, *Rumex*, *Morchella* (3 sps. each), *Chenopodium*, *Morus*, *Rosa*, *Rubus*, *Trifolium*, *Pinus*, *Viola*, *Diplazium*, *Geopora* and *Sparassis* (2 sps. each).

Herbs with 46 species were the most utilized habit followed by trees (21 sps.), mushrooms (9 sps.), shrubs (8 sps.), climbers and ferns (2 sps. each). (Fig.4.11). Thakur *et al.* (2020) also reported herbs (29 sps.) and trees (10 sps.) as the major sources of forest foods consumed by the Gaddi tribe of Himachal Pradesh. Herbs have also been reported to be the main source of forest foods consumed by *Gujjar* and *Bakarwal* tribes of district Rajouri, J&K (Rashid *et al.*, 2008; Dangwal *et al.*, 2014), *Garo* tribe of Meghalaya (Singh *et al.*, 2012), *Sheena* tribe of Kashmir (Singh and Bedi, 2018), *Galo* tribe of Arunachal Pradesh (Doni and Gajure, 2020), and studies carried out on some other communities of the world (Liu *et al.*, 2018; Nanagulyan *et al.*, 2020; La Rosa *et al.*, 2021; Al-Fatimi, 2021). However, on the contrary, Maroyi, 2011, Ojelel *et al.*, 2019 and Rao *et al.*, 2021 reported trees as main source of forest foods in Midlands Province of Zimbabwe, Karamoja region of Uganda and *Guttikoya* and *Koya* tribes of Telangana respectively, whereas, Balemie and Kebebew, 2006 reported shrubs as the main WEPs in south Ethiopia.

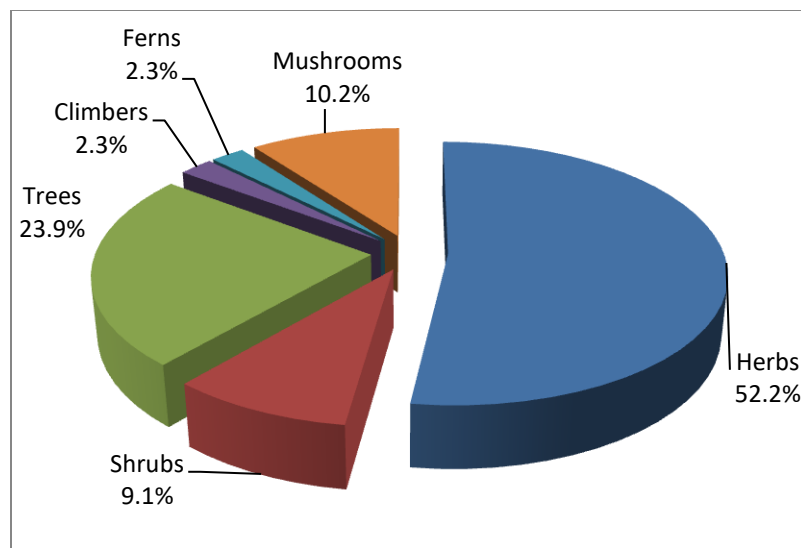


Fig. 4.11 Percentage contribution of various plant habits of Wild edible plants.

Rosaceae, represented by 15 species, was the largest family (Fig. 4.12). The other most represented families include Polygonaceae (7 species), Amaranthaceae (5 spp.), Lamiaceae, (4 spp.), Apiaceae, Asteraceae, Fabaceae, Malvaceae, Moraceae and Morchellaceae (3 species, each). Rest of the families were represented by one or two species each. Rosaceae has also been reported as the dominant family in other similar studies conducted in Himalayan region (Sundriyal and Sundriyal 2001; Dangwal *et al.*, 2014; Singh and Bedi, 2019; Singh *et al.*, 2016; Prasad and Sharma, 2018; Mir *et al.*, 2020; Thakur *et al.*, 2020; Abdullah and Andrabi, 2021; Singh *et al.*, 2021). The temperate climate of the study area supports the growth and dominance of Rosaceous plants (Hussain, 2019) and fruits of most of the rosaceous plants are edible which facilitates the spread and propagation of these plants through seed dispersal.

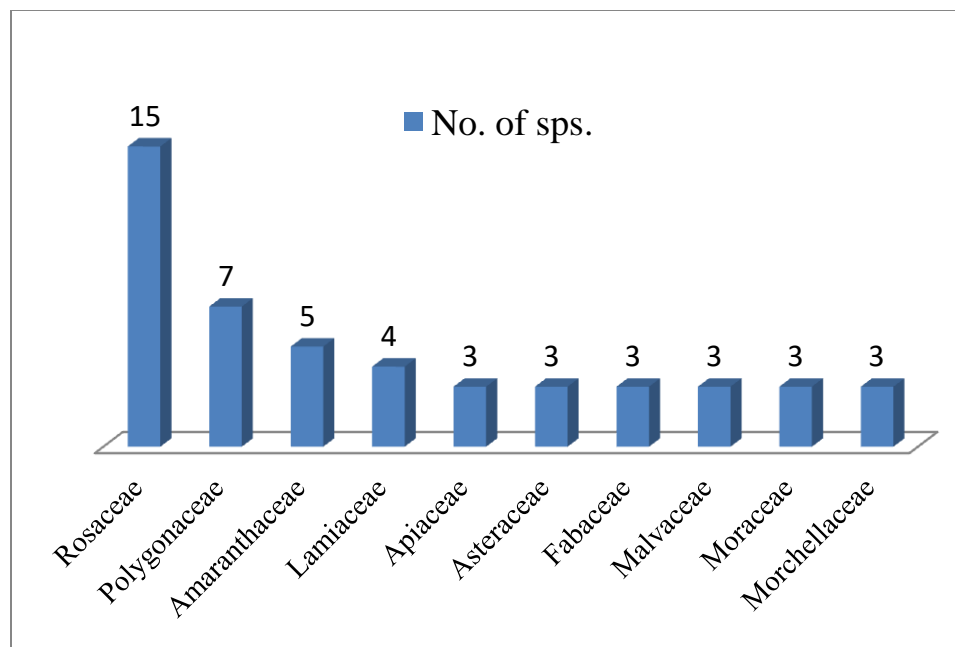


Fig. 4.12 The most represented families of Wild edible plants.

Eleven different parts of edible plants were used by Gaddi and Sippi tribes of the study area (Fig.4.13.) Leaves with 32.6% contribution were the most used plant parts followed by fruits (27.2%), seeds (11.9%), fruiting bodies of fungi (9.8%), roots (5.4%), flowers (4.3%), aerial parts (3.3%), branches (2.2%), bark, rhizome and leaf galls (1.1% each).

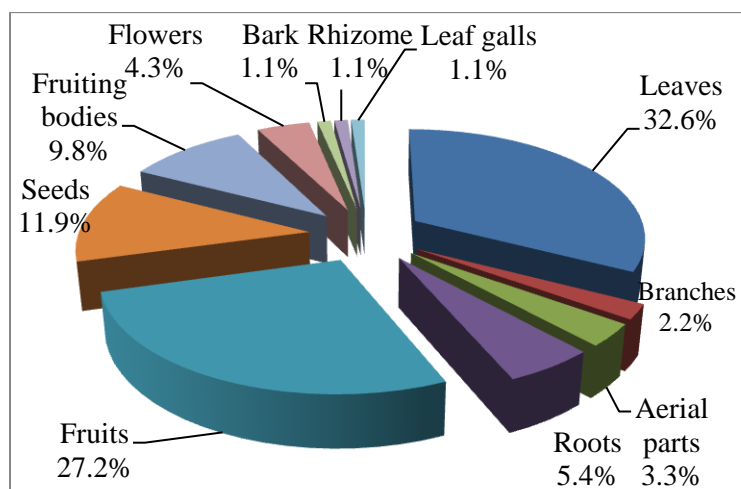


Fig. 4.13 Percentage contribution of different parts of Wild edible plants.

4.3.2 Role of Wild edible plants in local diet.

Gaddi and Sippi tribes of Doda district use a large number of WEPs for meeting their dietary and nutritional requirements. For the convenience of study, all the 88 documented edible plants were classified into nine usage categories as mentioned below.

4.3.2.1 Vegetables.

Thirty one plant species are cooked and consumed as vegetables. This category includes following five sub categories.

4.3.2.1.1 Leaves cooked as vegetable

This is the biggest sub-category of vegetables with 22 species belonging to it. The most commonly used species include *Diplazium esculentum* (Retz.) Sw. (UV=0.6), *Diplazium maximum* (UV=0.6), *Malva sylvestris* L.(UV=0.5), *Amaranthus spinosus* L.(UV=0.4), *Amaranthus viridis* L. (UV=0.4) and *Chenopodium album* L. (UV=0.4).

4.3.2.1.2 Mushrooms cooked as vegetable

Fruiting bodies of mushrooms cooked as vegetable constitute the second largest sub-category of vegetables represented by five fungal species. The highest UV were recorded for *Geopora arenicola* (UV=0.7), *Geopora sumneriana* (UV=0.6), *Sparassis radicata* Weir. (UV=0.4), *Sparassis crispa* (Wulfen) Fr. (UV=0.4), and *Boletus edulis* Bull. (UV=0.3).

4.3.2.1.3 Fruits cooked as vegetable

Only one species viz. *Solena heterophylla* Lour. belongs to this sub-category of vegetables.

4.3.2.1.4 Aerial parts cooked as vegetable

Only two species viz. *Stellaria media* (L.) Vill. and *Capsella bursa-pastoris* (L.) Medik. belong to this sub-category of vegetables.

4.3.2.1.5 Roots cooked as vegetable

Only one species viz. *Koenigia polystachya* (Wall. ex Meisn.) T.M. Schust. & Reveal. belongs to this sub-category.

4.3.2.2 Raw

Edible parts of thirty nine plant species are consumed raw. This category is further sub divided into following nine sub categories.

4.3.2.2.1 Leaves consumed raw

Leaves of three species viz. *Berberis lycium* Royle., *Poa calliopsis* Litv. ex Ovcz. And *Oxalis corniculata* L. are consumed raw.

4.3.2.2.2 Fruits consumed raw

Gaddi and Sippi tribes are closely associated with the forests as they spend most of their time in the forests while grazing their cattle or collecting different forest produce. They collect and consume wild fruits while doing their day to day activities in the forests. 26 different types of fruits were eaten raw by these tribes. Fruits of *Juglans regia* L. (UV=0.4), *Prunus persica* (L.) Batsch. (UV=0.4), *Viburnum grandiflorum* Wall. ex DC. (UV=0.4), *Rubus ellipticus* Sm. (UV=0.4), and *Morus alba* L. (UV=0.3) were the most commonly consumed fruits.

4.3.2.2.3 Seeds consumed raw

Six species belong to this sub-category. The most commonly used species include *Vicia sativa* L., *Impatiens glandulifera* Royle., *Pinus roxburghii* Sarg., and *Pinus wallichiana* A.B. Jacks. (UV= 0.2 each).

4.3.2.2.4 Branches consumed raw

The branches of two species namely *Berberis lycium* Royle. and *Rosa brunonii* Lindl.were consumed raw.

4.3.2.2.5 Seed kernel eaten raw

Seed kernel of only one species viz. *Juglans regia* L. was eaten raw.

4.3.2.2.6 Roots eaten raw

Only one plant species viz. *Jurinea heteromalla* (D.Don) N.Garcia, Herrando & Susanna falls in this category.

4.3.2.2.7 Leaf galls eaten raw

Leaf galls of only one species viz. *Quercus floribunda* Lindl. ex A.Camus. were eaten raw.

4.3.2.2.8 Flowers eaten raw

Only *Rhododendron arboreum* Sm. falls in this category.

4.3.2.2.9 Fruiting bodies of fungi eaten raw

Only *Rhizopogon roseolus* falls in this category.

4.3.2.3 Flavouring agents

This category includes spices and condiments which are the edible plant parts used for flavouring and seasoning the food. Seven species fall under this category. The most preferred species include *Mentha arvensis* C.Presl. (0.6), *Angelica glauca* Edgew. (UV=0.5), *Mentha longifolia* L. (UV=0.5) and *Allium stracheyi* Baker. (UV=0.4).

4.3.2.4 Beverages

This category is represented by seven species and generally includes hot drinks. For example roots of *Bistorta amplexicaulis* (D.Don) Greene and *Fragaria vesca* L, leaves of *Cannabis sativa* L, aerial parts of *Thymus serpyllum* L., flowers of *Viola canescens* Wall. and *V. odorata* L. and stem bark of *Taxus baccata* Thunb. are brewed to tea or hot drink.

4.3.2.5 Chutney (sauce)

Eight species belong to this category. Leaves of *Mentha spicata* L. were the most used species for making chutney, closely followed by *Mentha arvensis* C. Presl. and *Mentha longifolia* L. Seeds of *Punica granatum* L. and leaves of *Rumex hastatus* D. Don., *Allium stracheyi* Baker. and *Oxalis corniculata* L. were the other species used for

making chutney. Flowers of *Rhododendron arboreum* Sm. were also used in this category.

4.3.2.6 Preserved Foods

This category includes pickle and *murabba* and four species belong to this category. Pickle is food preserved in oil, salt or vinegar forenhancing its flavour andfacilitating its long time storage. Rhizomes of *Arisaema propinquum* Schott. and young coiled leaves of *Diplazium maximum* (D.Don) C.Chr. and *Diplazium esculentum* (Retz.) Sw. were preserved as pickle and the flowers of *Rosa macrophylla* Lindl. (0.19) were utilised for making *murabba*.

4.3.2.7 Pulao (Rice dish cooked with vegetables)

The fruiting bodies of only three fungal species viz. *Morchella conica* Pers., *M. crassipes* (Vent.) Pers. and *M. esculenta* (L.) Pers. were used in this category.

4.3.2.8 Nutraceuticals

Nutraceutical plants are those plant species which are consumed as food or part of food for meeting nutritional requirements and they also help in prevention and treatment of diseases as they possess medicinal values. Although *Gaddi* and *Sippi* tribes rely on WEPs mainly for their dietary requirements, however, 36 reported Traditional food plants were consumed as nutraceuticals because of their medicinal values (Table.4.1). The most preferred nutraceutical plant species were *Fagopyrum cymosum* (Trevir.) Meisn., *Malva parviflora* L., *Malva neglecta* Wallr., *Mentha arvensis* C.Presl., *Rumex hastatus* D. Don, *Taraxacum officinale* F.H. Wigg., *Viola odorata* L. and *Juglans regia* L.

4.3.2.9 Miscellaneous uses

This category is represented by 7 plant species which could not be clustered under any of the aforementioned categories. For example, rhizomes of *Arisaema propinquum* Schott.,leaves of *Cannabis sativa* L.and seeds of *Amaranthus viridis* L.were used for making fried bread (*babru*), sedative snacks (*pakora*) and sweet milky dish (*kheer*) respectively. Seeds of *Prinsipia utilis* D. Don. and *Prunus armeniaca* L.were used as

source of edible oil. Fruiting bodies of *Boletus edulis* Bull. and leaves of *Allium stracheyi* Baker. are consumed after roasting and as a constituent of cooked dishes respectively.

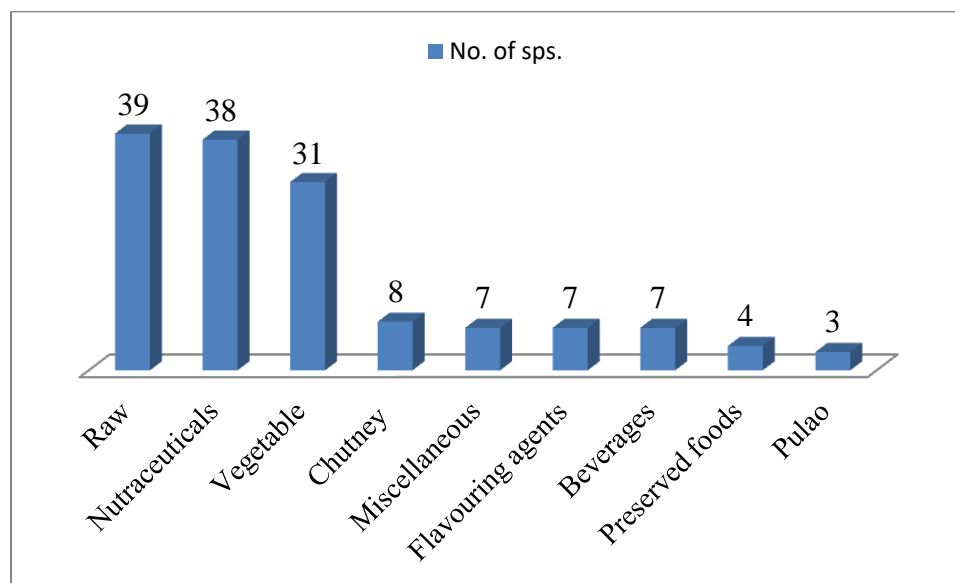


Fig. 4.14 Different modes of consumption of edible plants and number of plant species used.

4.3.3 Quantitative analysis

Use Value (UV)

The most important species of traditional edible plants on the basis of Use value were *Geopora arenicola* (Lev.) Kers. (UV=0.7), *Geopora sumneriana* (Cooke) M. Torre. (UV=0.6), *Diplazium esculentum* (Retz.) Sw. (UV=0.6), *Diplazium maximum* (D.Don) C.Chr. (UV=0.6), and *Mentha arvensis* C. Presl. (UV=0.6).

4.3.4 Knowledge of WEPs with respect to age and education level of informants

Gender of the informants influences the distribution of traditional knowledge, because gender is linked to some critical socio-cultural factors like occupation, education level, income class, social networks etc. The male informants of Gaddi and Sippi tribes of district Doda were more knowledgeable about traditional uses of WEPs than the female informants. These results are in consonance with findings of studies carried out in China (Kang *et al.*, 2013), Poland (Kotowski *et al.*, 2019) and Africa (Yorouand De Kesel,

2002; Kristensen and Balslev, 2003). On the contrary, some of the previous studies reported women to be more knowledgeable about traditional uses of WEPs because they were unemployed and engaged themselves in household and pastoral activities (Bhatia *et al.*, 2018; Singh *et al.*, 2021c; Bhagat *et al.*, 2022), however, in a few other studies the male and female informants were found to be at parity w.r.t their traditional knowledge on WEPs (Joshi *et al.*, 2016; Khakurel *et al.*, 2021). In the present research work, the higher knowledge of male informants about consumption of WEPs may be attributed to their occupation of shepherding and semi-nomadic life style as in contrast to females, the male members exhibit seasonal migration along with their flock of goats and sheep and move across difficult mountains and passes. They spend most of their time in the different types of forests, grazing their livestock and are thus highly reliant as well as well-versed with the WEPs.

4.3.5 Current status of traditional knowledge of Gaddi and Sippi tribes on WEPs.

The inhabitations of the tribes under survey are located at higher elevations of the Himalayas and are not suitable for agricultural practices because of steep slopes, uneven topography and harsh weather conditions. These tribes, therefore, rely heavily on WEPs for their dietary requirements, which are readily available to them. The increased dependence of the twin tribes in question on WEPs is also ascribed to some other factors like poverty, location of their villages along fringes of the forests, remoteness of their settlements, lack of market access and pastoral life style.

However, the younger generations of Gaddi and Sippi tribes are moving away from traditional gastronomic practices which have resulted in a decline in the consumption of WEPs by these tribes. The various reasons attributed for erosion of traditional food knowledge are road connectivity to rural areas, education, government employment, associated away movement from the villages, urbanization and invasion of modern culture on the tribal culture.

Some of the wild vegetables like *Phytolacca acinosa*, *Rumex hastatus*, *R. nepalensis* and *Urtica dioeca* and edible seed oil of *Prinsipia utilis* and *Prunus*

armeniaca which were the most common food items for Gaddis and Sippis since long are now completely missing from their menu due to erosion of traditional knowledge. It has been observed that the erosion of traditional knowledge on plant usage is accompanied with the depletion of population of some of the wild edible plants in the study area like *Solena heterophylla*, *Solanum villosum*, *Bistorta amplexicaulis*, *Phytolacca acinosa* and *Stellaria media* due to habitat loss and over exploitation.

The rich traditional knowledge possessed by the Gaddi and Sippi tribes has not been documented so far and is transmitted orally by the community members from one generation to the next in their scriptless tribal language, known as Gaddyali language. Keeping in view the perceptible future threat to the traditional knowledge, there is a need for documentation and conservation of plant based traditional knowledge before it is lost forever. Community based conservation methods involving cultivation of wild edible plants and sustainable harvesting methods should be encouraged for conservation of threatened species of wild edible plants.

4.3.6 Wild edible plants vis-à-vis other tribes and rural communities of UT of J&K and the Himalayas.

The present study documented 88 WEPs consumed by Gaddi and Sippi tribes of district Doda, UT of J&K. Most of the similar studies already conducted in UT of J&K have documented 26-75 species of WEPs (Dhar and Dhar, 2000; Rashid *et al.*, 2008; Kumar and Hamal, 2009; Khan *et al.*, 2009; Dad and Khan, 2011; Mir, 2014; Dangwal *et al.*, 2014; Singh and Bedi, 2017; Lalotra *et al.*, 2018; Pandita and Dutt, 2018; Showkat and Akhtar, 2018; Sarwar and Nigam, 2020; Mir *et al.*, 2020; Khajuria, 2021; Abdullah and Andrabi, 2021; Mahmood and Farooq, 2021; Singh *et al.*, 2021b; Farooq, 2021; Peerzada *et al.*, 2022; Sheikh and Modi, 2022; Bagal *et al.*, 2022; Bhagat *et al.*, 2022) whereas Bhatia *et al.* (2018), Khan and Hussain (2014), Fayaz *et al.* (2018); Srivastava (1988), Singh *et al.* (2016) and Thakur and Dutt (2020) have documented 90, 97, 108, 109, 111 and 130 WEPs, respectively. The only other study conducted in India exclusively on WEPs consumed by *Gaddi* tribe by Thakur *et al.* (2020) has reported only 49 WEPs from Chamba and Kangra districts of Himachal Pradesh. The present research

work on ethnic forest foods consumed by Gaddi and Sippi tribes is the first of its kind from UT of J&K. Therefore, the present study with 88 species of WEPs is one of the largest surveys on WEPs carried out in UT of Jammu and Kashmir and nearby regions.

Most of the WEPs reported in the present survey have also been reported to be consumed by the *Gujjar* and *Bakerwal* tribes of UT of J&K (Rashid *et al.*, 2008; Dad and Khan, 2011; Dangwal *et al.*, 2014; Mir, 2014; Mir *et al.*, 2020; Abdullah and Andrabi, 2021; Mahmood and Farooq, 2021) and some other indigenous communities of UT of J&K, NW Himalayas (Singh *et al.*, 2016; Showkat and Akhtar, 2018; Singh and Bedi, 2018; Singh *et al.*, 2021b) in the UT of J&K. Most of the aforementioned WEPs also form an important component of the diet of some pastoral communities of Garhwal, Sikkim and Himachal Himalayas (Sundriyal and Sundriyal, 2001; Radha *et al.*, 2018; Prasad and Sharma, 2018; Thakur *et al.*, 2020). It has been observed that communities with different socio-cultural backgrounds show different food habits and dietary patterns (Alonso, 2015). The consumption of a large number of common wild food plants by different communities in different parts of Indian Himalayas points out similarity in vegetation type in their areas and their gastronomic heritage.

4.3.7 Novelty and future prospects of WEPs.

Although majority of the plant species documented in the present study find their mention in similar studies carried out earlier in different parts of UT of Jammu and Kashmir and other neighbouring regions. The review of published literature shows that nine species of WEPs viz. *Jurinea heteromalla*, *Chenopodium foliosum*, *Koenigia polystachya*, *Poa calliopsis*, *Sageretia thea*, *Viola canescens*, *Quercus floribunda*, *Pinus wallichiana* and *Morchella crassipes* are new records of WEPs from UT of J&K to the best of my knowledge.

The survey of published literature further revealed that species like *Arisaema propinquum*, *Anethum sowa*, *Diplazium maximum*, *Elaeagnus umbellata*, *Dipsacus inermis*, *Elwendia persica*, *Impatiens glandulifera*, *Geopora sumneriana*, *Morchella crassipes*, *M. conica*, *Sageretia thea*, *Prinsepia utilis*, *Thymus serphyllum*, *Solanum*

villosum and *Ziziphus oxyphylla* lack exhaustive pharmacological, toxicological and nutritional studies, which could be attempted in future.

4.3.8 Discussion.

Out of the total 88 reported edible plants, 14 species find their use in two different edible usage categories. For example, leaves of *Allium stracheyi* were used for making chutney and as condiment, rhizomes of *Arisaema propinquum* were used for making pickle and leavened fried bread, fruiting bodies of *Boletus edulis* were used as vegetable and also eaten after roasting, young leaves of *Diplazium esculentum* and *D. frondosum* were used as vegetable and for making pickle, leaves of *Mentha arvensis*, *M. spicata* and *M. longifolia* were used for making chutney and as condiment, aerial parts of *Oxalis corniculata* were used for making chutney and also eaten raw, fruits of *Prunus armeniaca* were eaten raw and its seeds are used as source of edible oil, seeds of *Punica granatum* and flowers of *Rhododendron arboreum* were eaten raw and also used for making chutney, ripe fruits of *Solena heterophylla* were consumed raw and unripe fruits were cooked as vegetable and aerial parts of *Thymus serpyllum* were brewed to tea and also used as condiment.

Majority of the reported plants are the source of only one edible part, however, two edible parts are obtained from *Rosa brunonii* (tender twigs and fruits) and *Prunus armeniaca* (seeds and fruits) and three from *Berberis lyceum* (leaves, tender twigs, fruits).

Gaddi and Sippi tribes consume nine species of wild mushrooms, 8 species as vegetable and one species consumed raw, and thus these tribes could be more aptly called as mycophilic tribes. The number of reported fungal species fall within the range of 5-41 wild species of wild fungi reported by Kumar and Sharma (2011) from Bhaderwah valley (J&K), India, Liu *et al.* (2018) from Yunnan, China, Nanagulyan *et al.* (2020), from Armenia, La Rosa *et al.* (2021) from Aegadian Islands and Sharma *et al.* (2022) from Jammu, J&K., India. Gaddi and Sippi tribes consume comparatively larger number of wild fungi than consumed by other tribal groups of NW Himalayas, who consume either

one fungal species (Rashid *et al.*, 2008; Radha *et al.*, 2018) or two fungal species (Mir *et al.*, 2020) or do not eat any wild fungi (Rana *et al.*, 2012; Dangwal *et al.*, 2014; Singh and Bedi, 2019). Thus a wide variety of WEPs is consumed by Gaddi and Sippi tribes for meeting their dietary requirements.

Boletus edulis, *Chenopodium album*, *Diplazium esculentum*, *Diplazium frondosum*, *Fagopyrum cymosum*, *Geopora arenicola*, *G. sumneriana*, *Malva neglecta*, *M. sylvestris*, *Solena heterophylla* and *Taraxacum officinale* were the most preferred vegetables consumed by the tribes under investigations. These vegetables have also been reported to be consumed in some other regions of Himalayas (Rashid *et al.*, 2008; Bhatia *et al.*, 2018; Radha *et al.*, 2018; Devi, 2020; Thakur *et al.*, 2020).

Wild edible plants are highly nutrient rich. According to Seal (2012), the leaves of *Diplazium esculentum* are rich in crude protein content (143.8 g) and have high nutritional value (3413.2 Kcal per Kg). The findings of Gqaza *et. al.* (2013) suggested that branches of *Chenopodium album* are rich in proteins (29.2 g per 100g), carbohydrates (7.0 g per 100g), potassium (4.9 g per 100g), calcium (1.8 g per 100g), magnesium (1.4 g per 100g) and fibre content (36.5 g per 100g) and hence could be consumed as highly nutritive diet against malnutrition. *Malva sylvestris* has high content of vitamins and could be consumed in case of digestive ailments (Mousavi *et al.*, 2021).

Although, majority of the vegetables are derived from fresh plant parts, some are obtained from fresh as well as sun dried plant parts e.g., *Diplazium esculentum*, *D. maximum*, *Fagopyrum cymosum*, *Morchella esculenta*, *Geopora arenicola*, *G. sumneriana*, *Oxyria digyna*, *Sparassis crispa*, *S. radicata*, *Phytolacca acinosa* and *Taraxacum officinale*. The practice of sun drying of the vegetables is also common in other Himalayan regions (Thakur *et al.*, 2017; Bhatia *et al.*, 2018; Singh *et al.*, 2021) and eaten during winters when fresh vegetable are not available (Kang *et al.*, 2013; Bhatia *et al.*, 2018).

Fruits with high use values include *Prunus persica*, *Rubus niveus*, *Morus alba*, *Pyrus communis*, *Pyrus pashia*, *Solanum villosum*, *Solena heterophylla* and *Viburnum grandiflorum*. Fruits of *Prunus cornuta* are consumed by the semi-nomadic shepherds of

the tribes under survey as this plant grows at much higher elevation (3200 masl) near alpine zone where they graze their livestock. The most commonly used fruits reported from neighbouring regions of Udhampur by Bhatia et al., (2018) were *Phyllanthus emblica*, *Cordia dichotoma* and *Punica granatum* whereas the most preferred fruits consumed in Padder valley, district Kishtwar include *Berberis lyceum*, *Elaeagnus umbellata* and *Vitis vinifera* (Singh et al., 2021). Tribals and other rural communities consume wild fruits for their nutritional and organoleptic properties as they are delicious and nutrient rich (Shirsat and Koche, 2020). The micronutrient content like Cu, Zn, Fe, Mn, Mg of certain wild fruits was found to be relatively higher than cultivated fruits (Seal et al., 2014). All the fruits reported in the present research work were eaten fresh by the tribes under survey, however, some of them were also consumed in dried form e.g., *Malus domestica*, *Cydonia oblonga*, *Ziziphus oxyphylla*, *Prunus armeniaca*, *P. persica* and *Diospyros lotus*. Sun drying of fruits help in their preservation and long term storage and dried fruits are eatenduring winter season when there is non availability of fresh fruits. Besides drying, pickling and making *murabba* are the other methods of preserving WEPs. Pickling helps in preservation of antioxidant capacities and phenolic acids in vegetables (Sayin and Alkan, 2015). Preservation of foods ensures round the year availability of food particularly during the period of food scarcity.

Young leaves of *Diplazium esculentum* havealso been reported to be preserved by pickling in some other parts of Himalayas (Sharma et al., 2009; Devi, 2020). The cost of pickle of young fronds of *Diplazium esculentum* is about Rs. 300 to 350 per kg, whereas its fresh fronds are sold at about Rs. 40 to 75 per kg. Therefore, traditional pickling of WEPs should be promoted for socio-economic upliftment of Gaddi and Sippi tribes.

The outcome of different studied have shown that WEPs contain larger quantities of nutrients than their cultivated species, e.g., the quantity of some important minerals like Na, Ca and Se and proteins in the seeds of *Fagopyrum cymosum* was found to be comparatively higher than in its cultivated counterpart. Hence, WEPs should be brought under cultivation so as to increase the quality of crops and to ensure food security (Singh et al., 2020).

Keeping in view the harmful effects of increased use of pesticides and fertilizers in agricultural crops, there is an increasing awareness among the urban populations about importance of organic foods. Hence, wild edible plants, being purely organic, are gaining importance among urban population but such plants should be subjected to scientific investigations for determining their toxicity and detrimental health effects so as to ensure their safe consumption (Saad *et al.*, 2006). Some WEPs are highly toxic and their consumption may prove fatal for the humans as well as live stock (Guil *et al.*, 1997), however, Gaddi and Sippi tribes are highly learned to identify and exclude such plants from their food.

These tribes have expertise in identifying, processing and safely consuming some of the poisonous wild plants. Presence of raphide – the calcium oxalate crystals in rhizomes of *Arisaema propinquum* makes it highly toxic and unfit for consumption (Ali and Yaqoob, 2021). Gaddi and Sippi tribes have developed an indigenous technique for neutralizing the toxic effect of rhizomes of this plant by boiling them in water along with tamarind fruits (*imli*) or alum for 6-7 hours, which are then used for making pickle. Bitterness and foul smell is removed from the leaves of *Urtica dioeca* and *Phytolacca acinosa* by boiling them in water before cooking as vegetable.

Some plants possess dietary as well as medicinal values and such plants are referred to as nutraceutical plants or food medicines. The nutraceutical properties of some of the WEPs documented in the present research work are in conformity with the findings of some previous studies. For instance, leafy vegetable of *Malva parviflora*, *Phytolacca acinosa* and *Urtica dioeca* are consumed by the Gaddi and Sippi tribes for curing constipation. The strong antioxidant properties possessed by the stem and leaves of *Malva parviflora* have been reported to be responsible for anticarcinogenic, antiaging and antimutagenic activities (Farhan *et al.*, 2012).

The Gaddis and Sippis consume leafy vegetables of *Oxyria digyna* and *Fagopyrum cymosumas* a remedy for mouth blisters, digestive problems and as liver tonic. The leaves of *Oxyria digyna* are rich in vitamin C and useful in treatment of gum

inflammations and scurvy (Ibadullayeva *et al.*, 2021). *Mentha spp.* are consumed by the tribes under survey in the form of chutney and flavouring agents in case of loose motions and gastric troubles. *Mentha longifolia* contains a number of bioactive compounds which are considered to be responsible for anti-diarrhea, antidiabetic, antiparasitic, antioxidant, neuroprotective and antimutagenic properties of this plant (Farzaei *et al.*, 2017). The flowers of *Viola spp.* are brewed in milk to form a hot drink which is taken internally by the informants for alleviating throat pain. The aerial parts of *Viola odorata* have been reported in other studies to be used in treatment of respiratory tract infections (Gautam and Kumar, 2012). The bark of *Taxus baccata* is brewed to tea which is consumed by the informants as refreshing and energy drink. *Taxus baccata* is known for its anti-cancerous properties which find its mention in Tibetan medicinal system and Ayurveda (Saqib *et al.*, 2006) and also in studies carried out in Pauri district of Uttarakhand (Khajuria *et al.*, 2021). The present study reported that the edible oil derived from the seeds of *Prunus armeniaca* is given with jaggery and chapatti as postpartum tonic to the women after giving birth to the baby. The leaves of *Taraxacum officinale* were cooked as vegetable by the respondents and also given as postpartum diet for fast recovery of convalescing mothers as it is considered to be light, easy to digest and nutritious food. *Taraxacum officinale* has also been used as postpartum food for women by the indigenous people of Srinagar (Kumar *et al.*, 2015) and Udhampur (Bhatia *et al.*, 2014) regions of UT of Jammu and Kashmir. The therapeutic properties of *Taraxacum officinale* have been attributed, inter alia, to high content of inulin in it which functions as prebiotic and promotes the growth of beneficial intestinal microflora (Hobbs, 1998). The fruits of *Pyrus pashia*, relished by the Gaddi and Sippi tribes, have also been reported to be eaten by some other Himalayan communities for alleviating blood related problems, gastrointestinal and respiratory problems (Jambaz *et al.*, 2015). Studies have shown that the rhizomes of *Arisaema propinquum* were used in curing helminthic diseases as they possess anthelmintic properties (Mir *et al.*, 2020). *Rubus niveus* fruits are rich in polyphenols which exhibit gastroprotective properties and were, thus, used for treatment of gastric ulcers (Nesello *et al.*, 2017).

Some wild edible mushrooms reported in the present study e.g., *Geopora arenicola*, *Boletus edulis* and *Sparassis crispa* are rich in phenolic compounds which confer free radical scavenging properties and thus antioxidant properties to them (Ferreira *et al.*, 2007; Elmastas *et al.*, 2007; Keles *et al.*, 2011; Lalotra *et al.*, 2018). Edible mushrooms are low in fat content and are thus consumed in case of high blood cholesterol and high blood pressure (Gunc Ergonul *et al.*, 2013). *Sparassis crispa* has been reported to exhibit anti-fungal, anti-diabetic, anti-cancer, oxidative and anti-inflammatory properties and could be a potential candidate for future drug development (Ngoc *et al.*, 2018).

It is now clear that nutraceutical plants were consumed by the twin tribes under survey not only for meeting their dietary requirements but also for curing different diseases and maintaining good health.

4.4 Plants used for making Plant derived Utility Products (PUPs).

4.4.1 Diversity and characteristics of plants used for making PUPs.

A total of 276 informants were interviewed. Present study is the pioneering work on the plants traditionally used for making utility products of day to day use by the Gaddi and Sippi tribes of UT of Jammu and Kashmir. Gaddi and Sippi tribes of district Doda use 96 PUPs (Table 4.8) made from 60 plant species spread across 53 genera and 30 families. Angiosperms represented by 52 species were the most used plants followed by gymnosperms (7 spp.) and pteridophytes (1 spp.). Dicots were represented by 44 species and monocots by 8 species. The most represented genera were *Quercus*, *Prunus* (3 spp. each), *Anaphalis*, *Pinus* and *Morus* (2 spp. each). Rosaceae with 8 species was the most represented family closely followed by Poaceae and Pinaceae having 7 and 5 species respectively. Other dominant families include Asteraceae, Fabaceae (4 spp. each), Fagaceae and Oleaceae (3 spp. each), (Fig 4.16). Trees with 29 species were the most used life form followed by herbs (16 spp.), shrubs (11 spp.), climbers (3 spp.) and fern (1 spp.) (Fig 4.15).

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All the 96 PUPs were made by using 10 different plant parts. Branches (40.0%) were the most used plant parts followed by stem, leaves and aerial parts having 24.0%, 14.6% and 8.0% contribution respectively. Other plant parts used include fruits, roots, fibre, flowers (2.7% each), rhizome and bark (1.3% each) (Fig. 4.17).

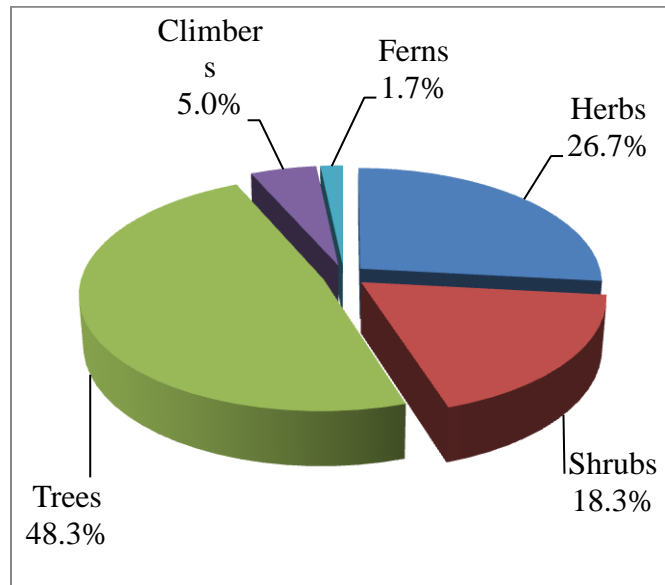


Fig. 4.15 Percentage contribution of different habits of plants used for making PUPs. .

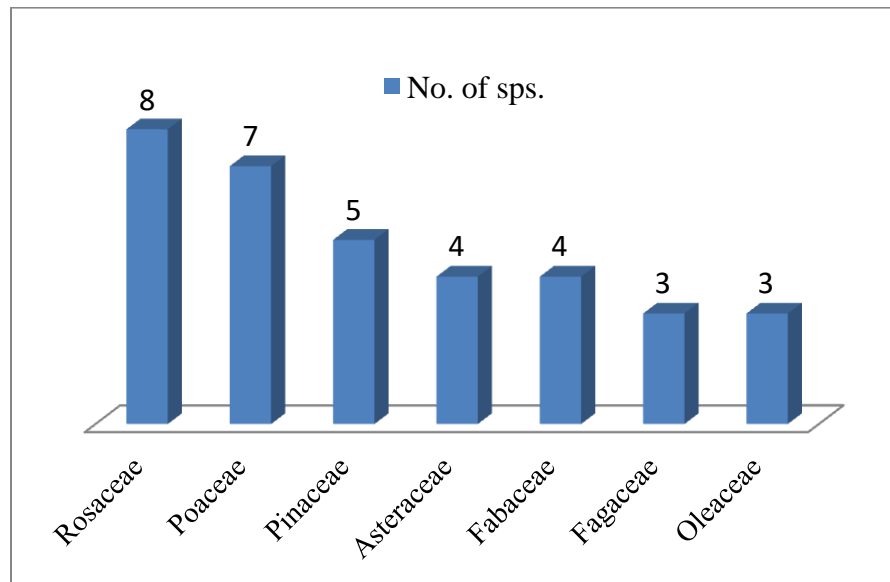


Fig. 4.16 The most represented families of plants used for making PUPs.

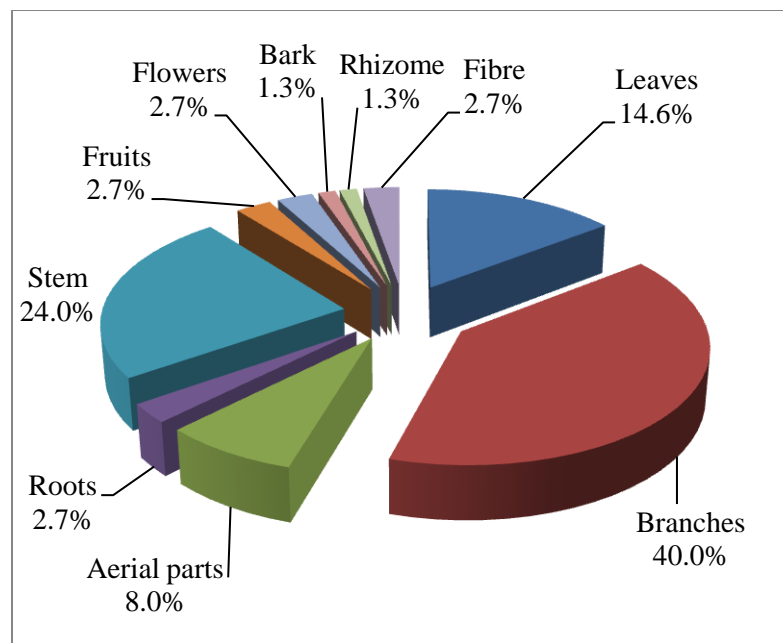


Fig. 4.17 Percentage contribution of different plant parts used in making PUPs.

‘Tools’ was the major usage category of PUPs. Total 34 plant species were utilized for making traditional tools, out of which the number of species used for making agricultural tools, tools used for making woolen products and miscellaneous tools were 26, 12 and 20 respectively. The other usage categories of PUPs and the number of species used for making them were container/storage products (7 species), construction products (6 species), artefacts (10) species and miscellaneous products (28 species).

4.4.2 Plant-derived utility products (PUPs)

The present research work documented 96 traditional plant-derived utility products (PUPs) (Table 4.8) made from 60 plant species (Table 4.1) which were used by Gaddi and Sippi tribes of district Doda in their daily chores. The most used plant species for making PUPs were *Cedrus deodara* (36 PUPs) and *Quercus floribunda* (23 PUPs). These were followed by *Parrotiopsis jacquemontiana*, *Fraxinus excelsior*, *Pinus wallichiana* and *Aesculus indica* which were used for making 16, 15, 14 and 12 PUPs respectively.

For the convenience of study, all the reported plant products were grouped into 5 major usage categories viz. tools, containers/storage products, construction products, artefacts, and miscellaneous products.

4.4.2.1 Tools

A tool is a hand held device which is used for doing a particular task. The present study reported total 50 tools which accounts for 52.1% of the total reported PUPs. These tools were derived from 34 plant species. All the reported tools were clustered into 3 usage sub-categories namely agricultural tools (22 No., 22.9% of total PUPs), tools for making woolen products and miscellaneous tools (14 No., 14.6% of total PUPs each). Agricultural tools used by the tribes under survey include *hal* (plow), *daa* (soil leveler), *jungla* (yoke), *bongadi* (hoe), *chindri* (large sickle), *dingar* (threshing stick), *dhaleran* (mallet), *darati* (sickle) etc. Tools used for making woolen products include *khaddi* (handloom), *unsan* (spinning top), *charkha* (spinning wheel), *kaanghi* (comb for wool), *aernoti* (frame for arranging warp fiber), *jandri* (frame for making double threads), *tarnethi* (weft loading stick), etc. The tools which could not be grouped under any of the above mentioned two sub-categories were included under the sub-category miscellaneous tools. Miscellaneous tools include *loath* - a shrub broom used for sweeping lawns of the houses, *dabotan* - a cloth washing bat, *padetri* - a vegetable cutting sickle, *kuranu* - snow clearing shovel, *maandh* - the buttermilk churner etc.

4.4.2.2 Containers/Storage Products

This category includes wooden containers of small and large size which were used by the twin tribes under survey for storing or holding household articles. Nine products (9.4%) belong to this category, which were made from seven different plant species. These products are *toon* - a large moveable grain storage compartment, *kuthar* - a large fixed grain storage compartment, *ganarh* - a honey barrel for bee keeping, *koolhi* - a flour storage bin, *kutroshu* - a dog feeding utensil, *kunala* - a large cattle feeding trough, *charh* - a long, fixed outdoor cattle watering trough, *kund* - a large fixed

outdoor tub used for washing blankets and woolen clothes and *sandook* – a storage box for storing household objects.

4.4.2.3 Construction products.

The products belonging to this category were utilized in construction works. The present research work documented eight such products (8.3%) which were made from six different plant species. Most of these products find their use in construction of houses or other types of shelters, e.g., *tapri* – a small security shed in crop fields for human monitoring of the fields for protecting crops against wild animals, *gaien* – an indoor cattle compartment with series of vertical wooden posts for tying the cattle, *oda* – an temporary, small outdoor lamb shelter with roof made from small and rough wooden planks of *Cedrus deodara*, *othan*– leaves of *Pinus wallichiana* and *Pteris biaurita*, used as roofing material for houses, and *faantu* - the rough wooden shafts used for making ceilings of the houses. Construction products were used not only for making shelters but also some other outdoor structures like *tarangdi* – a narrow, temporary log foot-bridge over small rivulets, *gaali* – an outdoor hay rack, consisting of a series of multiple vertical racks made up of very long wooden poles and used for storing dried grass bales and *baad*– the wooden farm fencing around agricultural fields.

4.4.2.4 Artefacts

Artefacts are the objects of cultural interest made manually by human beings as a work of art. Eight products (8.3%) belong to this category, which were made by using ten plant species. These products include *chakotu* – a rug made from paddy straw, *pand* – a carpet made from paddy straw, both used for sitting purposes, *Jodi* – rope made traditionally from stem fibre of *Gerardinia diversifolia* and *Cannabis sativa* and used for making traditional cot known as *manja*, *poola* – traditional slippers made from paddy straw which were put on in the kitchen and at pooja place in the house etc.

4.4.2.5 Miscellaneous products

All those PUPs which could no be categorized in any of the aforementioned categories were placed under the category of miscellaneous products. This category

includes 21 PUPs (21.9%) which were made from 28 plant species. For example *palak* (palanquin), *ker* (cattle bedding), *kaathi* (saddle), *goon* (fruit of *Aesculus indica* used as an alternative to soap for washing woolen clothes), *pichkari* (water gun) etc.

PUPs are environment friendly, cost effective, easy to handle and are extensively used by the pastoral *Gaddi* and *Sippi* tribes of Union Territory of Jammu and Kashmir (JKUT) for their subsistence.

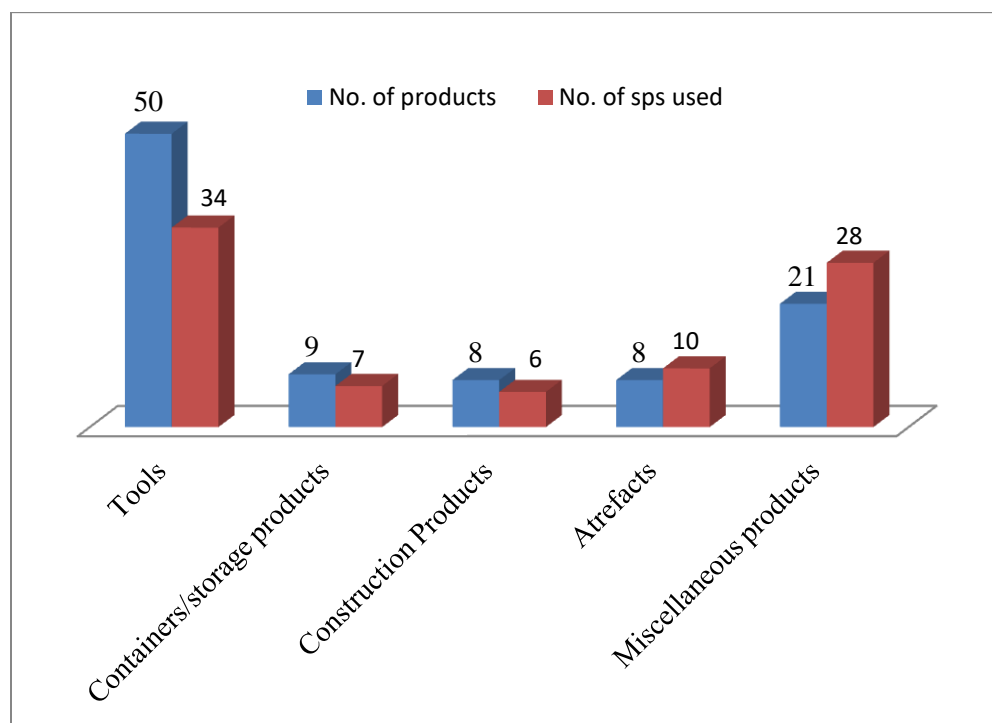


Fig. 4.18 Different usage categories of PUPs and number of plant species used for making them.

Table 4.8 Description of plant based traditional products (PUPs) used by the *Gaddi* and *Sippi* tribes.

S.No	Plant Product Local name (English name)	Description and uses
		(A) Agricultural Tools
1	<i>Baela</i> (Small hand hoe)	It is a small hoe like tool with wooden handle and sharp iron base. It is used for shaping wood for making tools, doors, windows etc.
2	<i>Bongdi</i> (Hoe)	This tool consists of a broad piece of iron (7×4 inches approx.) fitted with a long (3 ft.) wooden handle. It is used for varied purpose like digging soil, making shallow trenches, sowing seeds, removing weeds etc.
3	<i>Chindri</i> (Large sickle)	It consists of a long iron blade with bent terminal end as functional part attached to a wooden handle. It is used for cutting branches of fodder trees and shrubs for feeding to cattle.
4	<i>Daa</i> (Soil leveler)	<i>Daa</i> is a traditional agricultural implement, which is pulled by a pair of bulls and is used for loosening, leveling and smoothening the soil surface by breaking soil clods after plowing. Its functional part consists of a thick rectangular wooden blade (3 ft × 1 ft approx.) connected to a long (7 ft approx) wooden beam at the middle of its longer side. The operator rides on blade of the <i>Daa</i> to put extra weight on it for effective leveling.
5	<i>Darati</i> (Sickle)	It consists of a crescent shaped iron blade, with a small wooden handle. It is used for reaping crops and cutting grass for feeding to cattle.
6	<i>Dhaleran</i> (Mallet)	It is hammer like tool that consists of a small wooden head, attached to a wooden handle. It is used for breaking soil clods after plowing the agricultural fields.
7	<i>Ddikhra/Aeta</i> (Chopping block)	It is a heavy-duty cross section of tree trunk, which is used as hard surface for chopping meat as well as grass.
8	<i>Dingar</i> (Maize threshing stick)	It is a long (approx. 5 ft) slightly curved thick wooden stick, which is used for beating the dehusked and dried maize cobs for detaching grains from them.
9	<i>Hal</i> (Plough/plough beam)	Plough is an agricultural implement that is used for turning and loosening the top soil before sowing seeds. It is drawn by a pair of bulls. The components of a plough are beam, handle, shoe and share. All parts of the plough except share are made up of wood. Plough beam is a long wooden pole, which is bent at one end where it is attached with the shoe whereas its other end connects with the yoke.
10	<i>Haladi</i> (Plough handle)	It is the handle of plough used for steering and maneuvering the plough by ploughman.

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11	<i>Halotra</i> (Plough shoe)	It is the basal functional part of plough. Its tapering and pointed end penetrates into the soil and cuts the furrow.
12	<i>Jungle</i> (Yoke)	It is a wooden bar with a pair of wooden staves on either side and is placed over the necks of a pair of bulls, which together pull the plough attached to yoke.
13	<i>Keeli</i> (De-husking pin)	Maize is one of the major crops grown by <i>Gaddi</i> and <i>Sippi</i> tribes. The maize crop is harvested and dried, the outer sheath of cob is removed by manual de-husking of cobs. A small pencil shaped wooden pin, known as <i>keeli</i> , is used by <i>Gaddi</i> and <i>Sippi</i> tribes for manually stripping away the leaf sheath from corn cob.
14	<i>Khangu</i> (Rake)	It consists of a row of 7 – 9 iron teeth fixed in a small wooden strip as working part, which is attached to a long wooden handle. It is used for gathering hay, needles of <i>Cedrus</i> and <i>Pinus</i> and spreading cattle dung in agricultural fields.
15	<i>Kuradu</i> (Axe)	It is a cutting tool which consists of a sharp edged iron head as working part attached with a long wooden handle. It is used for felling trees, cutting and splitting wood.
16	<i>Lath</i> (Farm tick)	It is a handheld stick which is made from delicate branches. It is used for controlling movement of cattle i.e. to make them move fast and in a desired direction while taking them out for grazing or during grazing by striking them. It is also used for making bulls to move fast during plowing by poking and striking them.
17	<i>Latha</i> (Paddy threshing sticks)	These are very long (about 8 feet) fresh and flexible wooden sticks, which are used for beating harvested and dried paddy crop to separate grains from the stalks.
18	<i>Maandh</i> (Churner)	It consists of a wooden rod/pole fitted at its base with a thick wooden disc with deeply dissected margins. A rope is circled around the rod for 5 -6 turns in such a way that both its ends are free. The churner is forcibly rotated clockwise and anticlockwise alternately by pulling the two free ends of rope alternately with hands for churning the buttermilk.
19	<i>Mach</i> (Harrow)	It consists of an elongated (about 3 feet) and narrow wooden piece with a series of 8-10 holes in which hard wooden sticks are fixed and is connected to a long (about 6 feet) wooden pole. It is drawn by a pair of bulls in watered paddy fields for making top soil smoother and finer by breaking the clods before transplanting paddy saplings.
20	<i>Molh</i> (De-husking pestle)	It is a thick wooden rod, about 3 feet long, which is slightly narrow in the middle and is used for pounding the barley and paddy grains in a big stone mortar for removing the husk.
21	<i>Shangi</i> (Forked stick)	It is a hard and strong Y-shaped forked stick. It is used for gathering cut down bushes growing as weed along with grass in grazing lands, which are either burnt or used for making fence around the agricultural fields to protect crops from animals.
22	<i>Toka</i> (Hand held chopper)	It is a small handy tool with a small wooden handle and a sharp chopping iron blade. It is used for chopping hay for cattle.

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B. Tools for making woolen products		
23	<i>Aernoti</i> (Frame for arranging warp fiber)	It is a rectangular wooden frame (about 4 ×3 feet) with series of about 10-15 wooden pegs arranged on each of the two shorter sides of rectangular frame. It is used for arranging warp fibers before weaving.
24	<i>Belnu</i> (Take up roll)	It is a part of <i>khaddi</i> . It is a wooden roll around which fabric is wound and collected.
25	<i>Charkha</i> (Spinning wheel)	Spinning involves twisting of wool into yarn. <i>Charkha</i> is a wooden device that is used for spinning thread from wool. The operator turns the drive wheel with the help of crank with one hand whereas the other hand draws the fiber spun off the sharp tip of spindle shaft.
26	<i>Firki-aeti bali</i> (Wheel for making yarn loops)	A cop (<i>kukri</i>) of thread formed by twisting two threads together with the help of spinning top (<i>unsan</i>) is made into thread loop (<i>aeti</i>) with the help of wheel for making yarn loop (<i>firki-aeti bali</i>) and Frame for making double thread (<i>jandri</i>), which are made to work simultaneously. The iron needle of <i>jandri</i> bearing a cop (<i>kukri</i>) around it is inserted through the holes of <i>jandri</i> and the thread from cop is girdled around the wheel of <i>firki-aeti bali</i> by manually turning the <i>firki</i> wheel with the help of crank, which results in formation of yarn loop. Yarn loops are then washed, coloured and used as warp thread.
27	<i>Firki-dagdu bali</i> (Wheel for making thread balls)	The washed and coloured warp thread loops are made into thread balls (<i>dagdu</i>) by placing the thread loop around the wheel of <i>firki</i> (<i>dagdu bali</i>) and the thread from loop is wound by hands into thread balls as the wheel of <i>firki</i> rotates.
28	<i>Hatha</i> (Reed/ hand beater)	It is a large comb like part of handloom with vertical slits through which the warp threads pass and is used to press the weft against the fell (part of fabric that is not rolled yet on take up roll) during weaving.
29	<i>Jandri</i> (Frame for making double thread)	It is a small tool that consists of two horizontal wooden pieces each having one hole at each end, which is interconnected at their mid point by a vertical piece of wood and supported by a slanting stand. Two long iron needles, each bearing a cone shaped cop (<i>kukru</i>) of thread around it, are inserted through the holes at each side of this tool. It is used for making a ball of double thread (<i>dagdu</i>) by joining two threads from two cops.
30	<i>Kaanghi</i> (Comb for wool)	It is a small L-shaped wooden tool used for smoothening and straightening the wool by combing it. Its functional part bearing a series of teeth is fixed vertically at one end of horizontal supporting wooden strip which rests on the ground and which is pressed under the feet while combing the wool. The wool is placed on the teeth of comb which is then pulled apart into two bunches with both hands. These two bunches are combined together and the same action is repeated several time until woolen fibers are aligned almost in the same direction. Combing also separates the short fibers from long fibers and removes any unwanted matter. The fibers, which are now cleaner, stronger,

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		finer, and lustrous, are ready for spinning.
31	<i>Khadavan</i> (Treadles/foot pedals)	These are wooden pedals located at the base of handloom, which are pressed with the feet by the weaver to control the formation of warp sheds. A shed is the space between lower and upper warp threads through which weft is made to pass during weaving.
32	<i>Khaddi</i> (Handloom/ main frame)	It is a traditional weaving machine operated by hands and feet. It is used for weaving different types of woolen blankets (<i>chitru, fadki, chadar</i>) and fabric (<i>taani</i>). <i>Taani</i> is used for making woolen clothes like coat, <i>kurta</i> and <i>pyjama (suthan)</i> . Different parts of <i>Khaddi</i> are mainframe, weaver seat, harnesses, shuttle, reed, foot pedals, and take up roll.
33	<i>Naal</i> (Weaving shuttle)	It is a hollow small cylindrical wooden tool having one end open whereas other end is closed and pointed. It carries weft yarn in its cavity and is thrown forcibly by the weaver from one side to the other through the warp shed while weaving on <i>khaddi</i>
34	<i>Rachh</i> (Shaft/harness)	It is a wooden frame of <i>khaddi</i> used for holding warp threads. The up and down movement of the shaft with the help of treadles facilitates the passage of weft across the warp to create desired pattern.
35	<i>Tarnethi</i> (Weft loading stick)	It is a thin and long wooden stick used for loading weft fibre into the cavity of <i>naal</i> (weaving shuttle) before weaving.
36	<i>Unsan</i> (Hand spindle or drop spindle)	It is a small tool that consists of a straight wooden rod or shaft, which has an attached wooden disc or conical object at its base and a notch at its top to guide the thread during spinning. It is used in hand spinning to twist and spin two threads from ball (<i>dagdu</i>) of untwisted double threads into a single strong thread wound around the base of the spindle shaft to form a small cone shaped cop (<i>kukri</i>) or cone shape ball. <i>Unsan</i> is allowed to drop down and suspended in the air while the thread is spun after rotation has been started by twisting its shaft forcibly by both hands. The twisted yarn is used as warp fiber.
		(C) Other/miscellaneous tools.
37	<i>Balli</i> (Carrying rods)	It is a long and strong wooden pole, which is used for carrying water in large urn-shaped brass vessels called <i>baltoi</i> from water source particularly during marriages or other community functions. Water filled <i>baltoi</i> is hanged down in the middle of <i>balli</i> with the help of a rope and the <i>balli</i> is carried on shoulders by two persons, one at each end. It is also used for carrying <i>palak</i> (Palanquin).
38	<i>Boukari</i> (Grass broom)	It is a common broom in every household which made up of a grass and is used for sweeping inside of the house.
39	<i>Dabotan</i> (Roof compressing bat)	It is a bat shaped heavy wooden tool with a small handle and thick heavy body. It is used to compress roof top soil of <i>kuchha</i> houses during rainy seasons by repeated forceful beating, which makes the soil compact and prevents water leakage into the house.

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40	<i>Dabotan</i> (Washing bat)	It is a bat shaped wooden device with a rectangular frame and a short handle. It is used for washing clothes by repeatedly beating wet clothes after applying soap.
41	<i>Jandra</i> (Noodle making tool)	It is a sheep shaped wooden structure having a wide vertical cylindrical hole with an iron sieve at the base of the hole. It is used for making <i>satrole</i> (noodles like dish) out of boiled wheat flour balls. Flour balls are placed in the hole and pressed hard against the sieve with a wooden pestle by using a long, thick and strong wooden pole or iron-digging bar as a lever to press the pestle.
42	<i>Konkdi</i> (Fiber twisting hook)	It is a small hooked stick, which is used for twisting plant fibres together for making rope.
43	<i>Kuranu</i> (Snow shovel)	It is a shovel like tool used for lifting and removing snow from the roof of <i>kutch</i> houses, lawns, maize haycocks (<i>kundu</i>) etc. It consists of a broad rectangular wooden blade at its base having a long pole like handle.
44	<i>Loath</i> (Shrub broom)	It is a hard broom made from the stem of the shrub. It is used for sweeping lawns and roofs of the house.
45	<i>Maanj</i> (Wooden ladder)	It is a multipurpose portable wooden ladder. Its side rails are made up of long wooden poles whereas its rungs are made up of small wooden crossbars.
46	<i>Masheen</i> (Snow clearing frame)	It is a tool used for removing snow from roofs of <i>kutch</i> houses. It has a triangular base made by joining three small wooden poles connected to a long pole like handle. The triangular base has a network of ropes made from hay of <i>Oryza sativa</i> .
47	<i>Naadu</i> (Wood channel water spring)	A <i>naadu</i> consists of a piece of curved bark of tree or a small carved out wooden channel which is placed at front of water source (spring or a small stream) on a raised support at a certain height above ground level. The water is made to fall from the wooden channel and is used for drinking purpose.
48	<i>Padetri</i> (Sickle for cutting vegetables)	<i>Padetri</i> is a traditional sickle with stand used for cutting vegetables. Its front part consists of a slightly curved iron blade attached vertically to one end of basal horizontal wooden support which rests on the ground and which is pressed under the feet while cutting vegetables with both hands.
49	<i>Paroulu</i> (Tiny broom)	It is a tiny broom made from the needles of <i>chir</i> -pine. It is used for sweeping cooking area of kitchen. It is swiftly moved to-and-fro repeatedly for blowing air into the burning coal in a small earthen pot, locally known as <i>Daeru</i> , in which incense (<i>dhoop</i>) is burnt during pooja.
50	<i>Randa</i> (Wood shaving plane)	It is a wooden tool with flat bottom and sharp iron blade which is used for shaping and smoothening wood surface for making wooden tools, doors and windows etc.
51	<i>Sooti</i> (Walking stick)	The hard straight branches are used as walking sticks, which are generally used by old aged and infirm persons as support while walking especially in hilly areas.

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(D) Containers/storage products.		
52	<i>Charh</i> (Cattle watering long trough)	It is a much longer and fixed outdoor trough made from hollowed out wooden log and is approximately 10 feet long, 1.25 feet wide and 1 foot deep. It is placed near the continuous source of water from where the continuous supply of water is maintained into the <i>charh</i> , which keeps on overflowing all the time. It provides fresh drinking water to the cattle.
53	<i>Ganarh</i> (Honey barrels)	It is a wooden barrel (about 2.5 ft long and 1.25 ft in diameter) made from old tree trunk with decaying core. It is used for bee keeping and honey extraction. The tree trunk is hollowed out by removing the decaying core, the two open ends of the barrel are closed with wooden sheets and a small hole is made in the centre of the barrel surface for entry and exit of honeybees.
54	<i>Koolhi</i> (Flour storage bin)	It is a barrel shaped fixed mud bin housed in the kitchen and used for storing corn flour. It is made from mud mixed with wheat and barley straw, locally known as <i>kinyarhi</i> , which prevents shrinkage cracks in it.
55	<i>Kunala</i> (Cattle feeding trough)	It is a long wooden trough made from hollowed out wooden log. It is about 3-4 feet long, 1.25 feet wide and 8 inches deep. It is used for feeding animals.
56	<i>Kund</i> (Large fixed tub)	It is an outdoor, fixed, large round tub with sloping inner wall and narrow bottom made from hallowed out wooden block. It is used for washing clothes especially woolen blankets with feet by jumping alternately from one leg to another.
57	<i>Kuthar</i> (Grain storage fixed compartment)	This is a large wooden compartment, which is fixed with the wall in the room and used for storing large quantities of grains. It may be single chambered or may consist 2 or 3 chambers for storing different types of grains. Each chamber has an opening on its roof for pouring grains and a small outlet at base of its front part for taking out grains.
58	<i>Kutroshu</i> (Dog feeding container)	It is small rectangular wooden container carved out of small wooden block used for feeding and watering dogs.
59	<i>Sandook</i> (Storage box)	It is a wooden box for storing blankets, clothes and other household articles. <i>Sandook</i> is generally gifted to the brides by their parents.
60	<i>Toon</i> (Grain storage moveable compartment)	It is <i>Kuthar</i> like storage structure used for storing grains. It is generally smaller than <i>Kuthar</i> , single chambered, not fixed and can be moved within the house.
(E) Construction products		
61	<i>Baad</i> (Farm fencing)	Wooden poles, dry bushes and thorny branches are used to form a protective obstruction, known as <i>Baad</i> , along the borders of agricultural fields to protect crops from wild and stray animals.
62	<i>Faantu</i> (Roof shafts)	These are small wooden shafts (about 5 ft long), which are obtained by longitudinally slitting the wooden logs with the help of axe. These are closely arranged in a series on wooden beams of

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		the roof and a thick layer of <i>othan</i> (dry <i>Pinus</i> needles) is placed on it followed by a soil layer, which is compacted with the help of <i>Dabotan</i> to prevent water leakage during rainy season.
63	<i>Gaali</i> (Hay rack)	It is an outdoor structure, which consists of a series of multiple vertical racks made up of very, long wooden poles (about 15 feet long) and used for holding and storing dried grass bales off the ground for feeding to cattle.
64	<i>Gaien</i> (Cattle compartment)	It is a cattle compartment within the house, which consists of a series of 10-15 vertical wooden posts fixed on two horizontal wooden beams one at its each end. The vertical posts are about 4 feet in height and the distance between two successive posts is about 1 foot. The cattle are tied to the vertical posts by means of a rope known as <i>Daan</i> .
65	<i>Oda</i> (Lamb shelter)	<i>Oda</i> is a small (approx. 7×4 ft.) temporary shelter made in the forest or agricultural fields near forests for protecting lambs from harsh weather conditions and wild animals. It consists of four walls of small height (3-4 feet) made up of stones with a roof covering made up of small rough wooden planks with bark (<i>Shaata</i>) derived from outermost layers of the trunk of large trees. <i>Oda</i> has a covered opening in the roof for entry and exit of lambs.
66	<i>Othan</i> (Roofing material)	The fallen dry needles of <i>Pinus wallichiana</i> and aerial parts of <i>Pteris biaurita</i> , collectively known as <i>othan</i> , are collected from the forest and are used as roofing material for making <i>kutch</i> (mud) houses. A layer of <i>othan</i> is placed under the roof soil of <i>kutch</i> house that binds with soil particles and keeps the soil in position and thus helps in preventing trickling of rain water down the roof into the house during rainy season.
67	<i>Tapri</i> (Field security shed)	<i>Tapri</i> is a small and open security shed in the agricultural fields for human surveillance of wild animals to keep them away from crop fields.
68	<i>Tarangdi</i> (Log foot-bridge)	It is a temporary footbridge made by placing two or three long wooden logs with flattened upper surface close to one another across the stream. It is used by pedestrians and cattle to cross small water streams.
		(F) Artifacts
69	<i>Chakotu</i> (Circular straw rug)	It is a small circular (about 1.5-2 feet in diameter) grass rug made out of paddy straw (<i>panoli</i>) and outer sheath of maize cob (<i>pochal</i>) and is used for sitting of only a single person.
70	<i>Jaabu</i> (Cattle mouth guard or muzzle)	It is a cup shaped structure used to cover the snout of bulls while plowing the field to prevent them from eating nearby standing crop or grass. It is made by splitting and shredding the delicate twigs of the plants and the shreds are then weaved.
71	<i>Jodi</i> (Rope)	<i>Jodi</i> is a rope prepared from plant fiber, locally known as <i>shegar</i> . The stem bundles of <i>Gerardiana diversifolia</i> are submerged in a water source like ponds, pools, streams etc. by placing them under the weight of a big stones for 4-5 days for retting which softens the bark. After retting the bark of individual stems is

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		peeled off manually and the <i>shegar</i> (plant fibers) thus obtained are twisted together with the help of a hooked stick known as <i>Konkdi</i> to form <i>Jodi</i> (rope). <i>Jodi</i> is also prepared from paddy straw and stem fibre of <i>Cannabis sativa</i> without retting. <i>Jodi</i> are used for collecting fuel wood and fodder, tying cattle with wooden posts in cattle sheds, making <i>manja</i> (woven bed) and carrying belts of <i>Keed</i> (conical basket).
72	<i>Keed</i> (Conical carry basket)	It is a conical basket with two sling straps, which is carried on back of the person. It is made by weaving intact or longitudinally split shreds of branches of plants and used in day to day life for carrying <i>ker</i> (<i>Cedrus</i> needles), cattle dung, grasses, water pitcher etc.
73	<i>Manja</i> (Woven bed)	It is a traditional wooden cot. It consists of a frame of strong wooden posts with interwoven network of <i>jodi</i> (ropes) made from paddy straw and <i>Gerardina heterophyllum</i> . It is used for sleeping as well for sitting purpose.
74	<i>Pand</i> (Straw carpet)	It is a hand knitted carpet made from paddy straw (<i>panoli</i>) and outer sheath of maize cob (<i>pochal</i>) and is used for sitting purpose in homes and for eating food during marriage other social functions.
75	<i>Poola</i> (Straw slippers)	These are soft slippers made out of paddy straw that are used as footwear inside homes particularly in kitchens.
76	<i>Tareda</i> (Round pot stand)	It is a multipurpose ring like structure made by intertwining delicate and tender twigs of plants. It is used for keeping cooking pots in kitchen like cauldron, earthen pots, steel pots etc., tying cattle with wooden posts in the <i>gaien</i> (cattle house), and holding <i>maandh</i> (<i>churner</i>) in position while churning buttermilk.
		(G) Miscellaneous products
77	<i>Beedi</i> (Tooth brush)	Small tender twigs are chewed at one end and used as brush for cleaning teeth.
78	<i>Chhonka</i> (Palanquin dome)	The fresh, long and delicate twigs used for making dome of <i>palak</i> (palanquin).
79	<i>Chubdi</i> (Tying cord)	These are soft twigs used for tying freshly cut grass into grass bales.
80	<i>Jangli dhoop</i> (Incense)	Dry roots of <i>Dolomiaea macrocephala</i> and dry leaves of <i>Juniperus communis</i> are burnt over charcoal as dhoop.
81	<i>Kaathi</i> (Saddle)	It is a wooden seat for rider, which is fastened on horseback.
82	<i>Ker</i> (Cattle bedding)	The fallen dry needles of <i>Cedrus deodar</i> and <i>Pinus wallichiana</i> locally known as <i>ker</i> , are gathered by women from the forest floors with the help of <i>Khangu</i> (Rake) and carried to home in <i>Keed</i> (conical basket carried on back). <i>Ker</i> is stored outside in the close vicinity of the house in the form of large conical heaps known as <i>roodh</i> and is spread on the floor of <i>gaien</i> (cattle house) as bedding for comfortable sitting of cattle.
83	<i>Kins</i> (Rhizomes of	The rhizomes of <i>Dioscorea deltoidea</i> (<i>kins</i>) are rubbed on a

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	<i>Dioscorea deltoidea</i>	grater to form small shreds, which are used as soap substitute for washing clothes. Grated rhizomes are mixed with hot water in <i>kund</i> (large wooden tub) in which the clothes are washed.
84	<i>Palak</i> (Palanquin)	It consists of a wooden box having a dome shaped top covered by a maroon cloth, and is used for carrying brides. Its dome is made by bending and fixing 4-5 fresh long and delicate twigs (<i>chhonka</i>) on the box. It is carried by four persons on wooden poles (<i>balli</i>) which rest on their shoulders.
85	<i>Pichkari</i> (Water gun)	The hollowed out branches of the plant are used for making pichkari, which is used by children for splashing colours on one another during celebration of <i>Holi</i> festival.
86	<i>Shota</i> (Scrubber)	The outer sheath of maize cob is used as scrubber for washing utensils. The leaves of <i>Pteris biaurita</i> are used as scrubber for cleaning pots used for storing milk, butter-milk, curd and ghee because of their abrasive property due to rough texture.
87	<i>Goon</i> (Fruit of <i>Aesculus indica</i>)	Fruit of <i>Aesculus indica</i> , locally known as <i>goon</i> , is used as soap substitute for washing woolen clothes. The crushed fruit kernel is added in warm water and stirred with a rod it gives lather and used for washing woolen clothes.
88	<i>Shidh</i> (Corpse structure) carrying	A small wooden ladder like structure, which is used for carrying the body of dead person to cremation ground on shoulders.
89	<i>Pernahni</i> (Insect repellent)	Dried roots of <i>Nardostachys jatamansi</i> (<i>Pernahni</i>) are placed in boxes containing woolen clothes and used as insect repellent to protect clothes from insects.
90	<i>Bhujli</i> (Leaves for lighting fire)	Dried leaves of <i>Anaphalis margaritacea</i> and <i>A. triplinervis</i> , commonly known as <i>bhujli</i> , are used for lighting a fire by <i>Gaddi</i> shepherds when they are in the forests for grazing their livestock. The dried leaves (<i>bhujli</i>) are placed on a small hard white lint stone, known as <i>shukrah</i> , and a small iron piece known as <i>runka</i> is made to strike against this stone to generate a spark when the dried leaves (<i>bhujli</i>) catch fire.
91	<i>Hallu</i> (Hand dye)	The crushed fresh leaves and tender branches of young plant are rubbed between both hands for 5-10 minutes for skin decoration when it leaves red colour on the hands.
92	<i>Mushkanda</i> (rat repellent)	Aerial parts bearing prickly thorns (<i>mushkanda</i>) are kept around the openings of rat burrows around the house to get rid of rats.
93	<i>Keeda-ri-dawa</i> (pesticide)	Flowers are crushed, mixed with water which is sprayed as as pesticide (<i>keeda-ri-dawa</i>) in the kitchen gardens.
94	<i>Kalam</i> (pen)	Pen made from stem of <i>Drepanostachyum falcatum</i> .
95	<i>Keeda-ri-dawa</i> (insect repellent)	Leaves and flowers of <i>Tagetes minuta</i> are placed in the stored grains and flour to repel insect pests.
96	<i>Ganpatri</i> (honey bee attractant)	Leaves of <i>Rhododendron anthopogon</i> are crushed and rubbed around on the outer surface of traditional honey barrel around its opening for attracting honey bees.

4.4.3 Quantitative analysis

4.4.3.1 Use Value (UV)

The maximum use value was recorded for *Cedrus deodara* (4.3). The top three major contributors were miscellaneous tools, container/storage products and tools used for making woolen products. *Quercus floribunda* (1.8) was the next most important plant in the Gaddi and Sippi culture, mainly used for making agricultural tools. Other important species with more than 1 UV were *Pinus wallichiana* (1.7), *Juglans regia* (1.6) and *Aesculus indica* (1.1).

4.4.3.2 Informant Consensus Factor (Fic).

The informant consensus factor (F_{ic}) values for all PUP usage categories ranged from 0.963 for miscellaneous products to 0.993 for construction products. Thus F_{ic} values were very high and had a narrow range. High F_{ic} values may be attributed to effective knowledge sharing regarding making and usage of PUPs and a high degree of agreement among the respondents regarding plant species utilized for making a particular PUP (Rao et al., 2015; Kumar et al., 2015; Bhatia et al., 2018). Large number of citations (3041) received from the Gaddi and Sippi informants for tools category is the reflection of their agro-pastoral occupation of shepherding, practicing subsistence agriculture and traditional handloom weaving.

The tools category had the highest citation (3041) and the highest number of species used (34 sps.) Another important category was artifacts with 479 citations and 10 species.

Table 4.9 PUPs categories and Informant Consensus Factor for PUPs.

S. No.	PUP category	No. of use reports (nur)	No. of sps. used (nt)	Fic value (nur-nt/nur-1)
1	Tools	3041	34	0.989
2	Containers/storage products	725	7	0.991
3	Construction Products	765	6	0.993
4	Artefacts	479	10	0.981
5	Miscellaneous Products	736	28	0.963

4.4.4 Traditional Knowledge w.r.t age and education.

The study reveals that there was a positive correlation between the age of the respondents and traditional knowledge possessed by them about use of plants for making PUPs. In other words, an increase in traditional knowledge about PUPs with age of informants has been observed in the present study. Thus, the older people were found to be more knowledgeable than younger generations of the tribes under investigations as the latter were exposed to modern way of life and were least interested in using traditional products.

A significant decrease in traditional knowledge about PUPs has been observed with an increase in education of the respondents. The younger generations of Gaddi and Sippi tribes were more educated than the older people of these tribes and many of them were employed in government services, working in urban areas and some of them were permanently settled in towns and cities. It has resulted in intermingling of their tribal culture with modern culture which is one of the main reasons for significant decrease in usage of PUPs by these tribes. These results are in consonance with the findings of other similar studies (Pandey, 2015; Zhang et al., 2016).

4.4.5 Current status of traditional knowledge of Gaddi and Sippi tribes on PUPs.

As an outcome of the present study, it has been observed that occupation of tending flocks of goats and sheep by the Gaddi and Sippi tribes of the study area has sharply declined during recent past consequent upon which the wool production has also decreased. Hence, the practice of traditional handloom weaving of woollen clothes has declined and the associated tools involved in traditional weaving have also started disappearing from the life of Gaddis and Sippis. Besides the tools used in handloom weaving, a decline in the use of other PUPs has also been observed among the Gaddi and Sippi tribes. Twenty PUPs which were commonly used by the Gaddi and Sippi tribes during recent past are disappearing from the life of these tribes at a faster pace. These include *dabotan* - washing bat, *tarnethi* - weft loading stick, *aernoti* - frame for arranging warp fiber), *khadi* - handloom, *hatha* - reed), *belnu* - take up roll, *jandri* - frame for

making double thread, *jandra* - noodle making tool, *khadavan* - foot pedal, *naal* - weaving shuttle, *masheen* - snow clearing frame, *kuranu* - snow shovel, *koolhi* - flour storage bin, *naadu* - wood channel water spring, *kuthar* - grain storage fixed compartment, *poola* - straw slippers, *jodi* - rope, *toon* - grain storage moveable compartment, *kunala* - cattle feeding trough, and *unsan* - hand spindle. Five PUPs viz. *goon* - *Aesculus indica* fruit, *rethde* – fruit of *Sapindus mukorossi*, *kins* - rhizome of *Dioscorea deltoidea*, all used as an alternative to washing soap, *kutroshu* - dog feeding container, *shota*- scrubber derived from *Pteris biaurita* and *Zea mays* have recently been disappeared completely from the life of Gaddi and Sippi tribes. Some of the PUPs are being replaced by market alternatives as a result of recently established motorable road connectivity to Gaddi and Sippi settlements, accessibility to local markets, education, employment, modernization and boost in economy of these tribes.

These PUPs include *rethde* – the fruit of *Sapindus mukorossi*, *goon* – the fruit of *Aesculus indica*, *kins*– the rhizomes of *Dioscorea deltoidea* all of which generate foam with water and were thus used for washing clothes, have been replaced by detergents and soaps. *Shota* - leaves of *Pteris biaurita* and maize cob sheath used as scrubber for cleaning utensils has been replaced by steel and nylon scrubbers and *Kutroshu*- dog feeding container, has been replaced by metal and plastic containers. A sharp decline in the use of PUPs has been observed due to use of their market alternatives (Sharma et al., 2019). Similar outcomes have also been observed in some other research studies (Byg and Balsev, 2001; Pardo-de-Santayana and Macia, 2015). Although the settlements of these tribes are located on high altitudinal and difficult terrains of Himalayas, it was only recently that most of their settlements were connected with motorable roads. Increased road connectivity in the rural areas has been attributed as one of the factors for decrease in traditional use of plants by rural communities (Atreya et al., 2018).

Keeping in view a sharp decline in use of PUPs by Gaddi and Sippi tribes during recent past and significance of PUPs in sustenance of tribal and rural communities, it is strongly recommended that conservation of traditional knowledge without

compromising socio-economic development of the rural communities should be prioritised.

4.4.6 Novelty and future prospects

9 out of total 60 plant species used for making PUPs in the present study have already been reported by Singh et al.(2021) from district Doda of Jammu and Kashmir used for making tools. These species are *Aesculus indica*, *Cedrus deodara*, *Berberis lyceum*, *Fraxinus excelsior*, *Pinus wallichiana*, *P. roxburghii*, *Juglans regia*, *Quercus floribunda* and *Prunus armeniaca*. Hence, remaining 51 plant species (Table 4.1) reported in the present study are the new records from UT of J&K to the best of my knowledge with regard to their usage in making PUPs.

The traditional usage of certain plant species for making PUPs is exclusively known to tribals, which could be exploited for making value added plant based products on modern lines for mainstreaming their use. Setting up of cottage industries like carpet industry, basketry, broom making and wood containers industries in tribal areas in collaboration with District Industries Centre, Doda and SC, ST, OBC Corporation, J&K government is recommend for improving socio-economic conditions of the tribals and other rural communities.

4.4.7 Discussion

District Doda is located in the Western Himalayan region with an altitudinal variation of 1000 to 4400 masl and harbours rich phytodiversity. Different types of dominant trees found growing in this region include *Pyrus pashia*, *Pinus roxburghii* and *Quercus floribunda* upto 2000 masl. *Aesculus indica*, *Pinus wallichiana*, *Cedrus deodara*, *Quercus leucotrichophora* and *Q. semecarpifolia* upto 3000 masl and *Abies pindrow*, *Taxus baccata*, *Betula utilis* and *Picea smithiana* up to 3300 masl. The *Gaddi* and *Sippi* tribes utilize all these trees and other locally growing plants for making different types of PUPs. The rich phytodiversity and intimate association of the tribes under survey with the forests promoted invaluable ethnobotanical heritage among *Gaddi* and *Sippi* tribes of the

study area as indicated in present study by the use of a large number (96) of PUPs made from 60 plant species.

The results of the present study in terms of number of plant species used for making PUPs are higher than those of many other studies performed in India (Karthikeyan et al., 2009; Sarkar et al., 2015; Sharma et al., 2019). However, in similar studies, Salernao et al. (2005) and Kang et al. (2017) have documented 60 and 84 plant species from Basilicata, Italy and Heihe, China respectively.

The Gaddi and Sippi tribes of district Doda use a large number of PUPs and are highly knowledgeable about making and using traditional PUPs. Some of the important factors considered responsible for use of large number of PUPs by these tribes are location of their inhabitation in the close vicinity of forests, remoteness of their settlements, semi-nomadic and pastoral lifestyle, lack of road connectivity, lack of market access and poverty.

High dependence of Gaddi and Sippi tribes of district Doda on PUPs shows that (i) these tribes are directly connected with the forests as they spend most of their time in forests grazing their livestock, (ii) these tribes are highly familiar with the local vegetation, (iii) these tribes effectively transmit traditional knowledge from one generation to the next and (iv) traditional practices are still prevalent among these tribes.

In contrast to market products of utility which are by and large made of plastic and metals, PUPs are eco-friendly and cost affective and thus help not only in environmental protection but also in coping with the poverty.

The Himalayan tribal communities have a complex relationship with wild plants which form an indispensable part of their cultural and religious life (Rana et al., 2019). The reliance of Gaddi and Sippi tribes on considerable number tools used for traditional handloom practices and agricultural practices is the reflection of their pastoral profession of rearing goats and sheeps and subsistence agriculture respectively. Since PUPs constitute an integral part of rich cultural heritage of Gaddi and Sippi tribes of the study

area, conservation of PUPs and concomitant traditional knowledge would also promote the conservation of their tribal culture.

The food containers made from different types of timber yielding trees did not exhibit any harmful effect on human health and have been used safely by the human beings for hundreds of year (Mensah et al., 2012). In rural areas indigenous people have expertise in making large traditional granaries (Nagnur et al., 2006) which were mostly made up of wooden material (Kanwar and Sharma, 2006). The twin tribes under survey use two wooden grain storage structures viz. *toon* and *kuthar*. Farmers prefer to use such storage structures for storing grains as they are eco-friendly, cost effective, provide high shelf life and protection to stored grains against insect pests (Moblade et al., 2019).

The Gaddis and Sippis are well informed about the wood properties of locally growing trees and their expediency for making PUPs. The cultural importance value index (CI) indicates that *Cedrus deodara*, *Quercus floribunda*, *Juglans regia*, *Aesculus indica* and *Pinus wallichiana* were the culturally most preferred species for Gaddis and Sippis for making PUPs. *Cedrus deodara* used for making 37.5% PUPs tops the list of most preferred species used by Gaddi and Sippi tribes for making PUPs. Its long and straight branches and smooth surfaced, durable and insect resistant wood makes it most used species for making PUPs. The wood of *Cedrus deodara* has been found to be stronger than that of *Pinus wallichiana* and *Abies pindrow* (Siddiqui et al., 1989) as well as that of other Indian conifer species (Singh et al., 2002).

The wood of *Quercus semecarpifolia*, *Q. floribunda* and *Parrotiopsis jacquemontiana* is preferred for making tools used in agricultural practices like *hal*, *baela*, *halotra*, *chindri*, *bongadi*, *dingar*, *dabotan*, *dhaleran* etc. This is because the wood of these species has been reported by the informants to be strong, hard and durable and thus used for making such tools which require application of large force while using them.

The wood of *Juglans regia* is also reported to be highly durable and is used by the informants for making tools used in traditional handloom weaving like *charkha*, *rachh*,

hatha and some other PUPs like *palak*, *kuranu* and *randa*. In Himachal Himalayas, the wood of *Juglans regia* is also used for making tools used in traditional weaving by the Bhangali tribe of Chhota Bhangal (Sharma et al., 2019), whereas, it is used for varied purposes in Greece e.g., for making furniture, aesthetic objects, music instruments, construction works, sports items etc. (Vassiliou and Voulgaridis, 2005). The strength, quality and durability of *Juglans regia* wood has also been mentioned by Vassiliou and Voulgaridis (2005). Most of the informants have pointed out that the wood of *Pinus wallichiana* is highly durable and insect resistant due to presence of high content of resin in it but moderately strong. The wood of this species is commonly used as timber for making furniture and construction purpose in Himalayan regions (Bhat et al., 2015). The *Aesculus indica* wood is used by the informants for making 12 PUPs and it has been known for unbreakability, durability and strength (Sharma et al., 2019).

The traditional flour storage bin, locally known as *koolhi*, was made by the tribes under survey from mud blended with small quantity of barley and wheat straw (*kinyahri*), which prevents development of cracks in it. This method of formation of *koolhi* is in conformity with the findings of studies carried out by Ashour and Wu (2010) who mentioned that an increase in proportion of fibre in mud causes a decrease in crack formation in mud plaster whereas an increase in proportion of soil increase the crack formation.

4.5 Socio-magico-religious (SMR) plants.

4.5.1 Diversity and characteristics of SMR plants.

A total of 180 informants were interviewed. A total of 62 plant species belonging to 55 genera spread across 28 families have been documented. These values are well within the range of 20 to 78 species reported from Jammu and Kashmir (Dutt and Kant, 2008; Ayub et al., 2014; Trak et al., 2017; Wani et al., 2017; Bhushan and Khajuria et al., 2018; Thakur et al., 2021a, b), the Himalayas (Chhetri et al., 2019; Sharma et al., 2020; Sharma et al., 2022; Thakur et al., 2023), other parts of the India (Sharma et al., 2012; Gupta et al., 2022), the World (Luximon et al., 2019; Jigme and Yangchen, 2022), and tribal

communities of India (Kumar et al., 2004; Sharma and Pegu, 2011; Sahu et al., 2013; Pangging et al., 2018; Pangging et al., 2019; Pangging et al., 2021).

Angiosperms and gymnosperms were represented by 59 and 3 species respectively. The number of dicot and monocot species was 47 and 12 respectively. The largest genera was *Pyrus* represented by 3 species followed by *Amaranthus*, *Ocimum*, *Rosa*, *Vigna* and *Pinus* (2 spp. each). Herbs with 32 species were the most common life forms followed by trees (19 spp.), shrubs (6 spp.) and climbers (5 spp.). These findings are in corroboration with other studies (Wani et al., 2017; Chhetri et al., 2019; Thakur et al., 2021; Sharma et al., 2022; Thakur et al., 2023) carried out in the region, and the other Himalayan sites. However, tree is the most prevailing life-form among the Kampti tribe of Assam (Pangging et al., 2018), and in Butan (Jigme and Yangchen, 2022).

The most represented families were Poaceae and Rosaceae (10 spp. each) followed by Fabaceae (5 spp.), Brassicaceae, Pinaceae and Solanaceae (3 spp. each). Rest of the families were represented by 1 or 2 species each. A number of studies (Sharma and Pegu, 2011; Pangging et al., 2018; Pangging et al., 2019; Chhetri et al., 2019; Pangging et al., 2021; Takur et al., 2021a; Jigme and Yangchen, 2022) have also reported the maximum usage of Poaceae in socio-magico-religious ceremonies due to the importance of cereals in the religious activities, also plants like *Cynodon dactylon* (L.) Pers., *Hordeum vulgare* L., *Dendrocalamus strictus* (Roxb.) Nees, and *Themeda anathera* (Nees ex Steud.) Hack. are used as mark of purity during these rituals. Takur et al. (2021a) have also reported the Poaceae and Rosaceae as the most used families from Doda district.

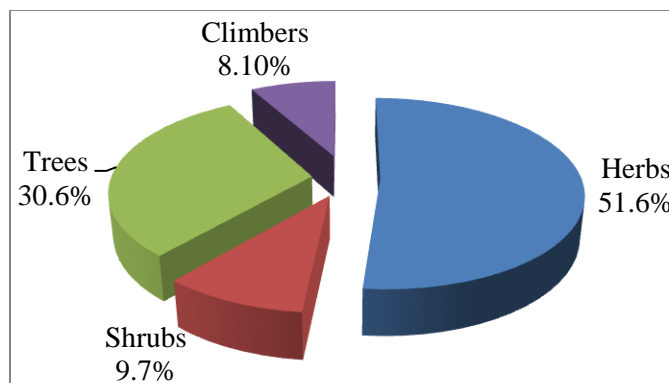


Fig. 4.19 Percentage contribution of different habits of Socio-magico-religious plants.

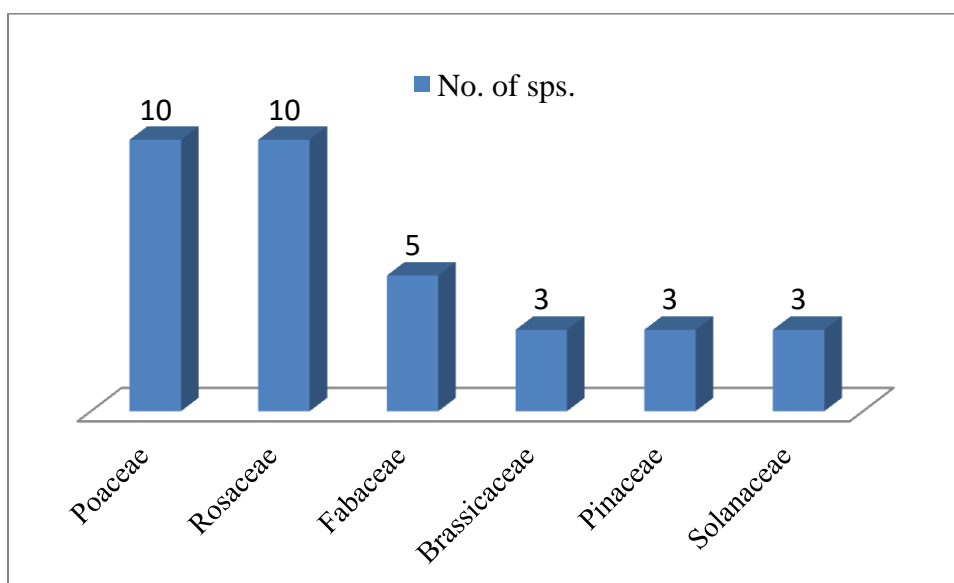


Fig. 4.20 The most represented families of socio-magico-religious plants.

Seeds (19.7%) were the most used plant-part followed by branches (14.1%), stem, bark (11.3% each), leaves and fruits (9.9% each), aerial parts (8.4%), roots (7.0%), flowers (5.6%), rhizome and fibre (1.4% each). These results are inconsistent to earlier findings those have reported leaves (Sharma and Pegu, 2011; Pangging et al., 2018; Chhetri et al., 2019; Luximon et al., 2019;) ortree trunk (Jigme and Yangchen, 2022) or whole-plant (Thakur et al., 2021a; Sharma et al., 2022) or flower (Thakur et al., 2023) as the most utilized plant parts.

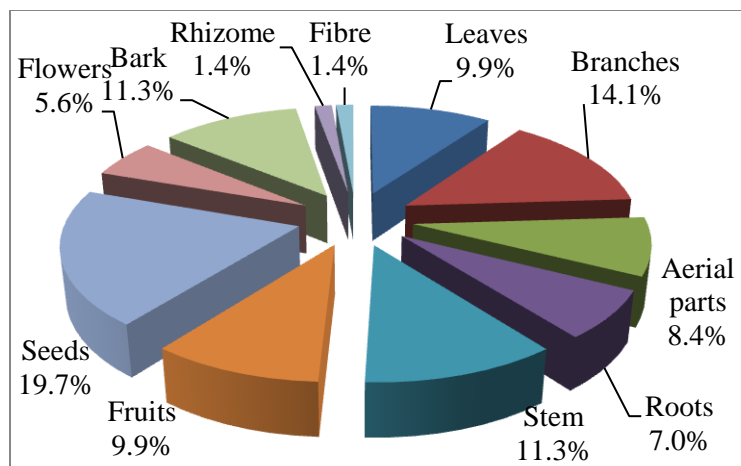


Fig. 4.21 Percentage contribution of different parts of socio-magico-religious plants.

4.5.2 Traditional uses of plants in socio-magico-religious practices.

For the convenience of study, SMRPs were categorized into four use categories viz. sacred and religious rites (SRR), socio-cultural rituals (SCR), magical belief and exorcism (MBE) and taboos (TAB). The SRR was the dominant use category with 37 plant species followed by MBE (26 sps.), SCR (11 sps.) and TAB (3 sps.).

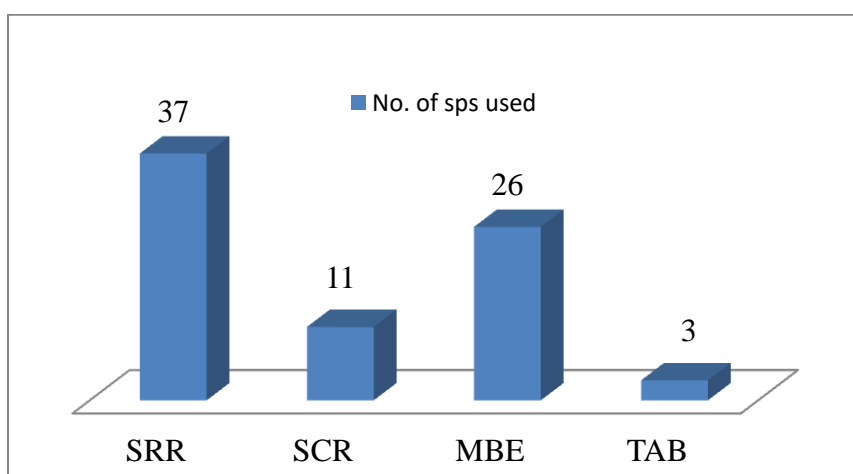


Fig. 4.22 Different categories of socio-magico-religious plants and number of plant species used in each category.

4.5.2.1 Sacred and religious rites (SRR)

Largest number (48%) of the documented species was reported to be used in sacred and religious rites (SRR). Similar findings are also reported for Kampti (Pangging et al., 2018) and Missing (Pangging et al., 2021) tribes of Assam, people of Doda district of JKUT (Thakur et al., 2021a), and ethnic people of Kullu district of Himachal Pradesh (Thakur et al., 2023). The highest usage of plants used in sacred and religious purposes indicates that the *Gaddi* and *Sippi* tribes are highly religious and have staunch faith in Gods and deities.

The informants of the present study use these species in different religious practices for example, *Cynodon dactylon*, *Dolomiaea macrocephala*, *Tagetes erecta*, *Desmostachya bipinnata*, *Brassica juncea*, *Datura stramonium*, *Hordeum vulgare*, *Ocimum tenuiflorum*, *Gossypium hirsutum*, and *Santalum album* were used while offering prayers to god and deities, and performing holy prayers (*yajanas*). *Cynodon dactylon* is considered pious and religious by *Gaddis* and *Sippis*, similar to Kampti and Missing tribes of Assam (Pangging et al., 2018; Pangging et al., 2021), Tharu and Bhoxa tribes of Uttarakhand (Sharma et al., 2022), and locals of Doda district (Thakur et al., 2021b), and in contrast to Halong community of Assam that uses this sacred grass against evil spirits (Sharma et al., 2012). The species has numerous medicinal properties. *Dolomiaea macrocephala* have strong aroma, and is burnt as incense for worshipping local deities. Similar findings are also reported by Thakur et al. (2021b) from Doda district. According to Hassan et al. (2021) the species is good for eyesight.

Flowers of *Tagetes erecta* are offered to the God or deity while worshipping and the garland of flowers is put around the neck of religious idols. These results are in concurrence with Thakur et al. (2021a,b), whereas in Kullu district of Himachal Pradesh, the species is used to decorate the palanquins of the local deities (Thakur et al., 2023). *Tagetes erecta* is aperient, and also used in otalgia (Bhatia et al., 2014). *Desmostachya bipinnata* is a holy grass, and finger ring made from its leaves is worn by the worshipper while performing pooja or *yajana* ceremony as a symbol of purity and sanctity. These findings are in agreement with Chhetri et al. (2019), Thakur et al. (2021a), and Sharma et

al. (2022). The use of *Datura stramonium* for the worship of Lord Shiva has also been reported in some other Himalayan regions of India (Kumar et al., 2020; Sharma et al., 2022) and Nepal (Gaire and Subedi, 2013). The species has immense medicinal value used to cure asthma, teeth pain, loss of hairs and dandruff, anti-septic, narcotic, joint pain (Bhat et al, 2014; Dutt et al., 2015; Singh et al., 2021; Trak and Giri, 2017; Dar et al., 2018; Wani et al, 2021; Mir et al., 2021; Khan et al, 2022; Farooq et al., 2022), poisonous insect bite, body part inflammation and arthralgia (Kumar et al., 2015).

Some others plants like *Fagopyrum esculentum*, *Amaranthus caudatus* and *Amaranthus viridis* are cooked in different forms and eaten by the devotees during religious fasting. These findings are in agreement with Chhetri et al. (2019), and Thakur et al. (2021a,b). These plants are consumed during fasting because all through pooja the consumption of cereals is prohibited, and these pseudocereals are the best supplementary food having high nutrient content. Seeds of *Fagopyrum esculentum* have high starch content, protein with a beneficial amino acid composition, a low concentration of gliadin, and a high content of dietary fibre (Dziedzic et al., 2012), the greatest sources of gluten-free food, rich in calcium, iron, phosphorus, potassium, rutin, vitamins B and E, and zinc (Dietrych-Szostak, 2006). Additionally, extracts from buckwheat flour have anti-mutagenic properties, offer defense against oxidative stressors, and may lessen the symptoms of diabetes (Inglett et al., 2010). *Amaranthus caudatus* is also a gluten-free pseudocereal, having high protein content (rich in lysine), dietary fiber, and bioactive compounds such as tocopherols, phenolic compounds, folate squalene, phytates, and vitamins (Zambrana et al., 2018).

Seeds of *Amaranthus viridis*, another pseudocereal, are also a nutrient-rich food that is a good source of protein, fiber, vitamins, minerals, and antioxidants. They contain 370 calories per 100 grams, 13 grams of protein, 6 grams of fat, 59 grams of carbohydrates, and 12 grams of fiber. They are also a good source of vitamins A, C, E, K, thiamin, riboflavin, niacin, folate, calcium, iron, magnesium, phosphorus, potassium, and zinc. In addition to these nutrients, *Amaranthus viridis* seeds also contain antioxidants and omega-3 fatty acids. The high fiber content of *Amaranthus viridis* seeds can help feel full

and satisfied after eating, and it can also help regulate blood sugar levels and improve digestion (<https://www.intechopen.com/chapters/67741>).

Cenchrus americanus, *Juglans regia*, *Cannabis sativa* and *Centella asiatica* (0.17) are used in making sacraments which are served to the devotees in temples and during religious ceremonies. Except *Cenchrus americanus*, the religious values of all the species are in concurrence with the other studies from India (Singh et al., 2021; Sharma et al., 2022; Thakur et al., 2023) and Nepal (Shakya et al., 2021). *Gaddi* and *Sippi* tribes are staunch devotees of Lord Shiva and when their wish is fulfilled they prepare a special liquid sacrament from *Cenchrus americanus* and *Triticum aestivum* flour in a thanks giving religious ceremony, known as *gusantan*. Seeds of *Juglans regia* are dipped in sacred water vessel while performing pooja on different occasions and served as sacrament (*prasad*), a ritual very similar to Kashmir Shaivism. The drink prepared from the seeds and leaves of *Cannabis sativa* is one of the most common drink throughout India, offered to God Shiva during *Shivratri*.

Some of the reported species were used in performing religious rites of dead persons e.g., *Cedrus deodara*, *Sesamum indicum* and *Oryza sativa*. Religious use of *Cedrus deodara* in *yagnas* is in accordance with Thakur et al. (2021a, b), however some other uses are peculiar to *Gaddi* and *Sippi* tribes viz. placing of a long wooden log of *Cedrus deodara* with flattened upper surface over a water stream as a foot bridge on the occasion of death anniversary of a person after performing religious rituals by the priest. It is a common belief that this practice helps the departed soul in crossing the rivers on his way to heaven. Similarly, a hollowed out long wooden trough (*charh*), made from *Cedrus deodara* wood is installed near a source of water for holding drinking water with a believe that by doing so the departed soul gets water for drinking during his journey to heaven.

Sesamum indicum is considered pious in other communities as well and used in *havan* during pooja (Chettri et al., 2019; Thakur et al., 2021b; Thakur et al., 2023) or Lohri festival (Thakur et al., 2021b), the usage of seeds of the species are considered to be holy and are mixed in water which is used for taking bath for purity of the body after

attending funeral ceremony, is reported for the first time. The use of *Oryza sativa* during funeral rites is a new report. Ropes made from paddy straw, considered pious, are used for tying small wooden posts for making bier (*arthi*), on which dead body is carried to the cremation ground.

4.5.2.2 Magical belief and exorcism (MBE)

Gaddi and *Sippi* tribes are highly superstitious people who believe in black magic and evil powers. They believe that certain plant species have magical healing powers and use 26 species (33.8%) in magical belief and exorcism (MBE) practices for protecting themselves, their cattle and houses against the harmful effects of black magic, ghosts, demons, and evil eyes. Sharma et al. (2022) has reported the plants used for magical usage as the most dominant use category in sub-Himalayan communities of Uttarakhand. The number of species used in MBE in the present study are more than those reported by Sharma et al. (2022) who have recorded 20 species and those used by Khampti (6) and missing (10) tribes of Assam (Pangging et al., 2018; Pangging et al., 2021).

Gaddi and *Sippi* tribes consult shamans and priests for exorcism. The species used for protecting the affected persons against black magic and bad evils primarily include *Brassica juncea*, *Rosa brunonii*, *Quercus floribunda*, *Alnus nitida*, *Cedrus deodara*, *Pyrus pashia*, *Glycine max* and *Parrotiopsis jacquemontiana*. *Brassica juncea* is also used as MBE in Assam by *Deori* and *Missing* tribes (Pangging et al., 2019; Pangging et al., 2021). *Quercus floribunda* is used by locals of Doda district but, as taboo tree (Thakur et al., 2021a), and *Cedrus deodara* as sacred and religious rites tree in Doda and other parts of Jammu region (Thakur et al., 2021a, b). *Rosa brunonii*, *Alnus nitida*, *Pyrus pashia*, *Glycine max*, and *Parrotiopsis jacquemontiana* are new reports for being used as MBE species.

The species used for the protection of houses against ghosts and demons were *Prinsepia utilis* (CI, 0.47), *Cedrus deodara*, *Hordeum vulgare* (0.26), *Dendrocalamus strictus* (0.14), and *Capsicum annuum* (0.10). Thakur et al. (2021a) have also reported the use of *Prinsepia utilis* in MBE from Doda district. A mixture of seven cereal grains

including *Hordeum vulgare*, *Oryza sativa*, *Phaseolus vulgaris*, *Vigna unguiculata*, *Triticum aestivum*, *Zea mays* and *Glycine max (satanna)* is spread inside the house for purification and around the house for protection against ghosts and bad evils by *Gaddis* and *Sippis*. In contrast to this, *Hordeum vulgare* is used as SRR species in Kullu district of Himachal Pradesh (Thakur et al., 2023) and in Doda district of JKUT (Thakur et al., 2021b).

Dendrocalamus strictus is used to rid a haunted house of the ghosts and evil powers, whereas in other parts of Jammu region it is used for making beer (Thakur et al., 2021b). *Capsicum annum* along with fruits of *Citrus limon* is tied together with a piece of charcoal and hanged over the entrance doors of houses to keep away the ghosts, demons and bad evil, in the present study as well as in other districts of Jammu region of JKUT (Thakur et al., 2021b). In Assam however, the dried fruits of *Capsicum annum* are burnt to protect against evil forces (Pangging et al., 2018; Pangging et al., 2021). As a novel use, *Gaddi* and *Sippis* believe that *Cannabis sativa* (CI, 0.30) is having magical power to cure the affected person against snake bite, and to facilitate conception of the cows.

4.5.2.3 Socio-cultural rituals (SCR)

Since *Gaddi* and *Sippi* tribes live in far flung, isolated places on sloppy terrains of NW Himalayas totally away from the influence of mainstream society, they have a rich and unique cultural heritage and plants form an integral part of their culture. Out of the total 62 plant species documented in the present study, 11 species (14.3%) were used in socio-cultural rituals. These species were used mostly in the marriage ceremonies. The most prominent of these species are *Prunus persica*, *Cynodon dactylon*, *Lagernaria* sp., *Themeda anathera* and *Cedrus deodara*. Socio-cultural usage of *Cynodon dactylon* in the marriage ceremonies is also reported from Jammu region of JKUT (Thakur et al., 2021b), Darjeeling and Sikkim Himalayas (Chhetri et al., 2019), Kullu district (Thakur et al., 2023), and sub-Himalayan region of Uttarakhand (Sharma et al., 2022). All the other species are new reports for the world. In a novel usage, during wedding ceremony 5

wooden parrots made from *Cedrus deodara* wood are affixed on top of the main entrance of the houses to guard the house against ghosts and evil eyes.

4.5.2.4 Taboos (TAB)

There are certain beliefs and taboos related to magico–religious plants among the tribes under survey. However, a comparatively small number of plants (3 species) belong to this category. Cutting of plants, mainly *Cedrus deodara* in the local sacred grooves (*banis*) is a taboo for *Gaddi* and *Sippi* tribes and it helps in the conservation of such plants through local sanctions. In Kullu district also, *Cedrus deodara*, is considered Tree of God and it is believed that *Devi Jogani* resides in the tree and is planted near temples (Thakur et al., 2023). *Gaddis* and *Sippis* don't burn the wood of *Ficus palmata* as it is considered inauspicious and bad omen. In contrast to this, the species is used for the funeral rites in Doda, Kishtwar, Poonch, and Rajouri of JKUT (Thakur et al., 2021b). In a novel usage, these communities consider *Tripidium rufipilum* grass as highly sacred and don't trample or sit on it. They believe that Bhagwan Ram used this plant as bedding for sleeping during exile.

From above discussion, it is clear that the *Gaddi* and *Sippi* tribes of the study area are highly religious and superstitious and thus use good number of plants in socio-magico-religious practices. *Gaddis* are Shaivites who worship Bhagwan Shiva and have staunch belief that the blessings of Bhagwan Shiva always provide protection to them and their flock of goats and sheep (Sharma, 2021). They believe in black magic and witchcraft, and consult shamans and priests, locally know as *chela*, for exorcism and finding solution to different problems of day to day life. Fumigation (*dhoni*) of the affected person with burning *Brassica juncea* seeds, after they were recited with incantation by the shaman or priest, for exorcism is a household practice among the whole community.

4.5.3 Quantitative analysis

4.5.3.1 Use Value (UV)

The most important SMRPs for *Gaddi* and *Sippi* tribes

The most important species (Table 4.1) for *Gaddi* and *Sippi* tribes were *Brassica juncea* (UV=2.2), *Cynodon dactylon* (2.1), and *Cedrus deodara* (1.6). The Deori (Pangging et al., 2019) and missing tribes (Pangging et al., 2021) of Assam have also reported *Brassica juncea* as the most important species used for sacred and religious rites and magical believes and exorcism. The species is employed to ward off unanticipated forces due to its unusual smell. *Cedrus deodara* and *Capsicum annum* were the most important SMR species of Doda district, and the various districts of Jammu region (Thakur et al., 2021a, b). In sub-Himalayan region of Uttarakhand, *Datura stramonium* L. was culturally the most important species (Sharma et al., 2022). Thakur et al. (2023) have reported *Ficus religiosa* as the most important species from Kullu district of Himachal Pradesh, India.

4.5.3.2 Informant Consensus Factor (F_{ic})

The values of F_{ic} ranged between 0.937 (Taboos) and 0.989 (Sacred and religious rites) (Table 3). These values are well within the range from 0.88 to 1.0 F_{ic} recorded for magico-religious studies carried out in different parts of India (Pangging et al., 2021; Thakur et al., 2021a, b; Sharma et al., 2022). Pangging et al. (2021) and Sharma et al. (2022) have also recorded the maximum values for the species used in sacred and religious rites. However, in Doda (Thakur et al., 2021a), and other districts of Jammu region (Thakur et al., 2021b), species used in divine drinks recorded the maximum consensus. The high values of F_{ic} indicate that the *Gaddi* and *Sippi* tribes have a great deal of agreement over the use of SMRPs, and they transfer this valuable information from one generation to another.

Table 4.10 Use categories and Informant Consensus Factor (Fic) for socio-magico-religious plants

S. No.	Use category	No. of use reports (nur)	No. of sps. used (nt)	Fic value
1	Sacred and religious rites (SRR)	3381	37	0.989
2	Magical belief and exorcism (MBE)	1347	26	0.981
3	Socio-cultural rituals (SCR)	749	11	0.986
4	Taboos (TAB)	33	3	0.937

4.5.4 Community based plant conservation practices.

There are some beliefs and taboos among the communities under investigation which are associated with the conservation of local phytodiversity. Many small sacred groves are found in the study area. People have imposed restrictions on cutting of plants and extraction of forest produce from the patches of forests in the close vicinity of forest deities in the study area and such sacred patches of forests with religious significance are locally known as '*bani*' (sacred groves). For example, some of the Banis found in Bhaderwah tehsil in the study area are *Nagni Mata Bani* –Manthla, *Buddu Nag Devta* – Bamlakhi, *Malni Mata Bani* –Kansar, and *Nag Bani* –Thuba. Most of the *banis* are associated with serpent God (*Nag Devta*) or serpent Goddess (*Nagni Mata*).

Gaddi and *Sippi* tribes are staunch worshippers of Lord *Shiva* and *Nag Devta* and thus worship snakes. It is a common belief among the *Gaddi* and *Sippi* tribes that cutting of trees or other plants within the *bani* of any of the local deities would displease the deity who may punish the offender individually or may bring the disaster for the whole community in the form of floods, drought, famine etc. It is believed that if someone breaks the taboo of cutting trees within the *bani* of *Nag Devta* or *Nagni Mata*, the snakes (*Nag*) would appear in the house of the offender and may cause heavy damage to him or his family in one way or the other. One *Gaddi* man of village Bamlakhi, tehsil Bhadarwah, suffered a snake bite in his finger which was damaged to such an extent that

he became permanently handicapped. It was narrated by the priest (*chela*) of *Nag Devta* while in trance that his finger was bitten by the snake (*Nag Devta*) as a punishment to him for cutting plants within the premises of *Buddu Nag Devta* in village Bamlakhi, Bhaderwah, in the study area.

Therefore, cutting plants within any of the *banis* is a strong taboo for the community members, which has led to the *in-situ* conservation of several plant species chiefly *Cedrus deodara* and *Pinus wallichiana* on religious grounds as all the *banis* in the study area are dominated by these species. Moreover, some of the reported plant species are cultivated by the tribes in question exclusively for their use in socio-magico-religious practices and are thus conserved by means of *ex-situ* conservation, for example, *Amaranthus caudatus*, *Amaranthus viridis*, *Cenchrus americanus*, *Lagenaria sps.*, *Ocimum tenuiflorum* and *Tagetes erecta*.

Further, *Gaddi* and *Sippi* tribes consider the grass broom made from *Themeda anathera* as pious and never trample it or touch it with feet. If it so happens accidentally to any person it is considered as inauspicious sign and the man bows down to the broom. This broom is used in the *Jogi* ceremony in boys' marriage when the groom's assistant covers the dried fruit of *Lagenaria sp.*, tied on groom's back, with this broom. The grass used for making broom is cut during *sharad navaratri* (autumn Navratri) during the month of October on religious grounds. *Desmostachya bipinnata* is another highly religious plant for *Gaddi* and *Sippi* tribes, which is harvested only on the day of *Amavasya* in the month of October. Interestingly, these plants set their seeds before their mentioned reaping periods which ensure uninterrupted propagation and thus conservation of these plants under natural conditions.

Thus the tribes under investigation are the ecosystem communities who live in complete harmony with nature and some of their socio-magico-religious practices are directly linked with the conservation of local plants. According to Convention on Biodiversity (CBD), the traditional knowledge possessed by the indigenous communities plays an important role in biodiversity conservation and environmental management (Glowka, 1998).

4.5.5 Current status of SMR practices of Gaddi and Sippi tribes

Despite a significant advancement in socio-economic conditions, education level and government employment as well as modernization among Gaddi and Sippi tribes during last 2 decades, these tribes are still carrying forward the legacy of plant based SMR practices without no change or a little change, which shows that they are highly superstitious, religious and have staunch faith in Gods and deities. On the contrary, a sharp decline has been observed in other aspects of plant based traditional knowledge possessed by these communities, e.g., ethnomedicinal practices, ethnoveterinary practices, wild edible plants and utilisation of PUPs.

4.5.6 Novelty

Cannabis sativa, *Glycine max*, and *Parrotiopsis jacquemontiana* are new reports for being used as MBE species. As a novel use, *Gaddi* and *Sippis* believe that *Cannabis sativa* (CI, 0.30) is having magical power to cure the affected person against snake bite, and to facilitate conception of the cows. *Prunus persica*, *Lagerania* sp., *Themeda anathera* and *Cedrus deodara* are new reports for their use in SCR practices. In a novel usage, during wedding ceremony 5 wooden parrots made from *Cedrus deodara* wood are affixed on top of the main entrance of the houses to guard the house against ghosts and evil eyes. As a new report, these communities consider *Tripidium rufipilum* grass as highly sacred and don't trample or sit on it. They believe that Bhagwan Ram used this plant as bedding for sleeping during exile.

4.6 Fodder and forage Plants

4.6.1 Diversity and characteristics of fodder/forage plants.

Fodder plants are those plant species which are harvested and taken to animals for feeding them whereas forage plants are those plant species which are browsed or grazed by the animals while still rooted in the soil in their natural habitat. A total of 210 informants were interviewed. The present study documented 70 species of fodder and forage plants belonging to 59 genera and 35 families. Herbs represented by 35 species

were the most used fodder/forage plants followed by trees (17 spp.), shrubs (13 spp.) and climbers (5 spp.).

The angiosperms and gymnosperms were represented by 68 and 2 species respectively. The number dicot and monocot species was 64 and 4 respectively. The largest genera were *Quercus* and *Trifolium* (3 spp.) followed by *Artemisia*, *Morus*, *Plantago*, *Prunus*, *Rubus*, *Rumex* and *Viburnum* (2 spp. each). Rosaceae was the largest family with 8 species closely followed by Fabaceae (7 spp.), Polygonaceae (5 spp.), Asteraceae (4 spp.), Fagaceae, Lamiaceae, Moraceae and Poaceae (3 spp. each). All other families were having one or two species each.

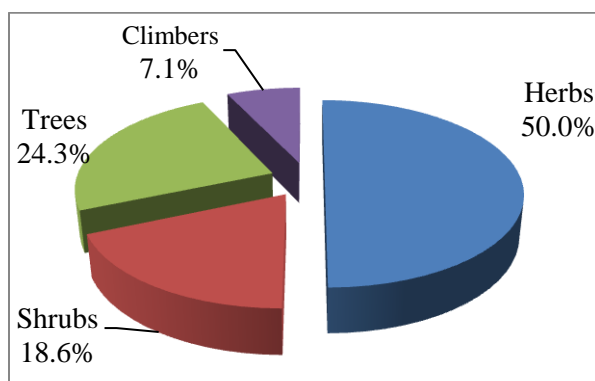


Fig. 4.23 Percentage contribution of different habits of fodder/forage plants.

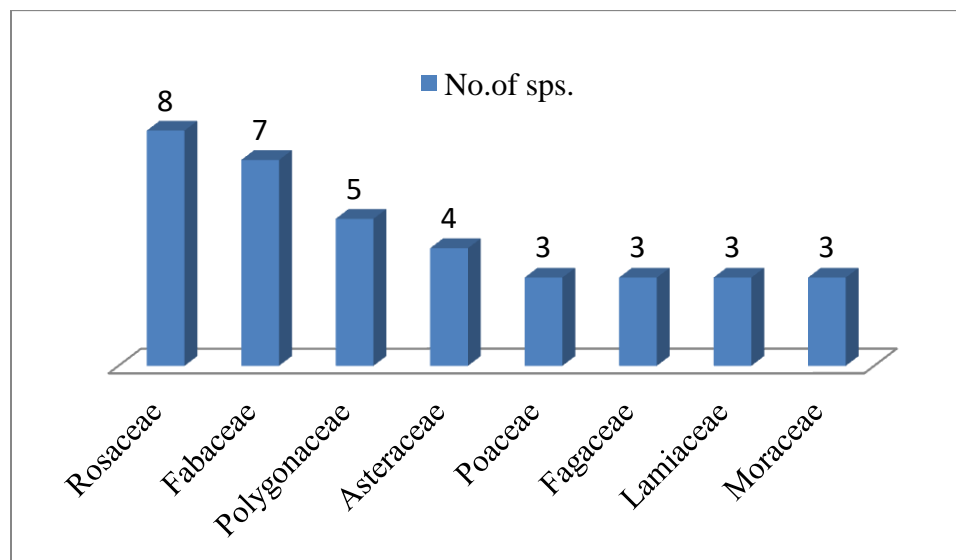


Fig. 4.24 The most represented families of fodder/forage plants.

Only three plant parts were used as fodder/forage for the livestock. Aerial parts (61.4%) were the most used plant parts followed by leaves (35.7%) and branches (2.9%).

All the reported 70 plant species were fed to the cattle in fresh form whereas 4 species viz. *Ficus palmata*, *Themeda anathera*, *Ulmus wallichiana* and *Zea mays* were used in fresh as well as dry form. During winter season when the fresh fodder/forage is not available, dried fodder of *Themeda anathera* and *Zea mays* is stored in large quantity in the form of grass bales outside the house for meeting the dietary requirement of cattle. Dried grass bales of *Themeda anathera* are stored off the ground in hay racks (*gaali*) in the close vicinity of the houses. Hay racks consist of a series of multiple vertical racks made up of very long wooden poles (about 15 feet long). The dried grass bales of *Zea mays* are stacked in the form of haycocks (locally known as *kundu*) which are large conical piles of *hay* in the agricultural fields and fed to the livestock during winter season.

Some of the important fodder plants fed to their cattle by the Gaddi and Sippi tribes include *Abies pindrow*, *Cedrus deodara*, *Quercus floribunda*, *Celtis australis*, *Desmodium elegans*, *Indigofera heterantha*, *Isodon rugosus*, *Melia azedarach*, *Morus alba*, *Olea ferruginea*, *Prunus armeniaca*, *P. cornuta*, *Robinia pseudoacacia*, *Sorbaria tomentosa*, *Spiraea canescens*, *Themeda anathera*, *Ulmus wallichiana* and *Zea mays*. Some of the important plants grazed/foraged by the cattle in the grasslands and forests include *Achillea millefolium*, *Artemisia scoparia*, *Berberis lyceum*, *Capsella bursa-pastoris*, *Chaerophyllum villosum*, *Cynodon dactylon*, *Cynoglossum lanceolatum*, *Dysphania ambrosioides*, *Erigeron bonariensis*, *Fagopyrum cymosum*, *Galium aparine*, *Impatiens glandulifera*, *Indigofera heterantha*, *Isodon rugosus*, *Jasminum officinale*, *Koenigia polystachya*, *Mentha longifolia*, *Oxalis corniculata*, *Plantago lanceolata*, *Prunella vulgaris*, *Rosa brunonii*, *Trifolium pratense* and *T. repens*.

Most of the settlements of Gaddi and Sippi tribes in the study area located on higher elevations of Himalayas ranging between 1900 m to 2400 masl and most of the fodder/forage plants reported in the present study were found growing in this altitudinal range. However, these tribes also have temporary houses, known as *Adhwari* located at

still higher elevation (2700 masl approx.) near alpine zone where they migrate along with their livestock during summer season to facilitate their grazing. These temporary houses are abandoned during winter season when the area remains covered with heavy snow. Some of the high altitude Himalayan fodder/forage plants growing in the higher elevations ranging between 2300 m to 2750 masl in the study area include *Abies pindrow*, *Achillea millifolium*, *Aesculus indica*, *Betula utilis*, *Hedera nepalensis*, *Koenigia polystachya*, *Parrotiopsis jacquemontiana*, *Prunella vulgaris*, *Prunus cornuta*, *Quercus leucotrichophora*, *Oxyria digyna*, *Viburnum cotinifolium*, *Viburnum grandiflorum* etc. The high altitude forage plants are also grazed by the goats and sheep of the semi nomadic tribes under investigation during their seasonal migrations from plains of district Kathua to hills of district Doda during summer and vice versa during winter, when they move across mountainous tracts passing through alpine pastures (3000 masl) and mountainous passes.

4.6.2 Fodder plants as nutraceuticals.

Some of the above mentioned fodder/forage plants also have ethnoveterinary medicinal values and are known as nutraceutical plants. Such plants are used not only for meeting dietary requirements of the cattle but also for treatment of their diseases and ailments. Hence, nutraceutical plants help in maintaining good health of the cattle. For example, tender branches of *Abies pindrow* and *Cedrus deodara*, aerial parts of *Indigofera heterantha* and leaves of *Robinia pseudoacacia* are fed to cattle as general tonic for maintaining good health, aerial parts of *Koenigia polystachya* and *Fagopyrum cymosum* are fed to the cattle as a treatment for Foot and Mouth disease and aerial parts of *Pilea umbrosa*, *Trifolium pratense* and *T. repens* are fed to cows as a galactagogue for increased lactation.

4.7. Marketing status of ethnobotanical plants and their processed products.

Out of the total 236 reported plant species, 11 wild plant species were collected by *Gaddis* and *Sippis* from the forest not only for their personal use but also for commercial purpose and are sold in the local market. Such plants play an important role in

sustenance and economic upliftment of these tribes. 6 plants are sold as vegetables and these include fruiting bodies of *Geopora arenicola*, *Geopora sumneriana*, *Sparassis crispa* and *Sparassis radicata* and young fronds of *Diplazium esculentum* and *Diplazium frondosum*. Fresh or dried leaves of *Allium stracheyi* are sold as condiment. *Morchella esculenta*, *M. conica* and *M. crassipes* are high value commercially important mushrooms and their fruiting bodies are collected by the tribes under investigation for commercial purpose. Dry fruiting bodies of these mushrooms have a very high market price of about 25,000 rupees per kg and are a good source of income for poor people of the study area. The dry roots of *Dolomiaea macrocephala* are sold in the market as incense. Mostly women and children between the age of 15 to 50 years and belonging to less income group collect these plants from the forests. However, roots of *Dolomiaea macrocephala* are collected from highly inaccessible alpine meadows by the migratory shepherds.

Moreover, many other reported plant species have significant ethnobotanical importance and have good marketing potential, but their uses are unknown to the modern society and restricted only to the tribals and rural communities. Hence, such species could be commercialized by the tribals so as to extend their use to the mainstream of the society and to boost the economy of tribals. For example, the products made from two plant species viz. *Berberis lyceum* and *Arisaema propinquum* could be commercialized by the tribes under survey for economic gains. A semi solid crude medicine, known as *rasaunt*, made by concentrating the root decoction of *Berberis lyceum* could be sold in the local market as it bears high medicinal value. Gaddi and Sippi tribes have developed an efficient indigenous method of extracting resin from the wood of *Cedrus deodara* by heating it inside the earthen pot. Resin has ethnomedicinal and ethnoveterinary properties and could be extracted in large quantities and marketed for economic gains.

A highly delicious pickle made by these tribes from the rhizomes of *Arisaema propinquum* could also be marketed as it has nutraceutical values. Value addition and processing of the pickle for long term storage is recommended for broadening its consumer base. Many wild vegetable having marketing potential could be collected and sold in the market e.g., *Chenopodium foliosum*, *Fagopyrum cymosum*,

Malva neglecta, *M. parviflora*, *M. sylvestris*, *Oxyria digyna*, *Phytolacca acinosa* and *Taraxacum officinale*. There are some other plant species which could be commercially exploited for their medicinal values, e.g., *Acorus calamus*, *Ajuga parviflora*, *Angelica glauca*, *Bergenia ciliata*, *Dolomiaea costus*, *Rheum australe*, *Swertia purpurascens*, *Viola canescens* and *V.odorata*.

4.8 Phytochemistry

4.8.1 Qualitative phytochemical screening for detection of secondary metabolites.

Qualitative phytochemical analysis was performed for detection of some important secondary metabolites viz. alkaloids, flavonoids, steroids, terpenoids, saponins, phenols, tannins and glycosides in 5 culturally important ethnomedicinal plants namely *Ajuga parviflora*, *Dysphania ambrosioides*, *Isodon rugosus*, *Indigofera heterantha* and *Pilea umbrosa* by using standard methods and the results are summarized in Table. 4.5. From the table it is clear that all the aforementioned secondary metabolites were present in all the selected five plant species except that no detectable steroids were found in *Indigofera heterantha*. All these secondary metabolites are medicinally important as they possess different therapeutic properties.

Table 4.11 Qualitative phytochemical screening of the plant extracts of selected plant species.

Sl.No	Phytochemicals and the type of test used	Methanolic Extract				
		<i>Isodon rugosus</i>	<i>Ajuga parviflora</i>	<i>Indigofera heterantha</i>	<i>Dysphania ambrosioides</i>	<i>Pilea umbrosa</i>
1	Alkaloid (Dragendroff's test)	+	+	+	+	+
2	Flavonoid (Shinoda's test)	+	+	+	+	+
3	Phenol (Ferric chloride test)	+	+	+	+	+
4	Terpenoids (Salkowski test)	+	+	+	+	+
5	Saponin (Froth test)	+	+	+	+	+
6	Steroids (Liebermann-Burchard's test)	+	+	-	+	+
7	Glycosides (Sodium hydroxide test)	+	+	+	+	+
8	Tannins (Ferric chloride test)	+	+	+	+	+

Results and Discussion

The TLC analysis of plant extract was performed on 20 cm x 10 cm silica gel aluminium plate using different mobile phases for detection of different secondary metabolites as shown in Table 4.12. After development, the plates were dried with and then visualized under UV 254 nm, and retention factor (RF) values were recorded. The different values of RF obtained for TLC detection of different secondary metabolites are shown in Table 4.12. It is clear from the Table 4.11 that all the aforementioned secondary metabolites were present in all the selected five plant species except that no detectable steroids were found in *Indigofera heterantha*.

Table 4.12 RF values of different secondary metabolites present in plant extracts of selected five plant species.

S.No	Phytochemicals	Mobile phase	RF values in Methanolic Extract				
			<i>Isodon rugosus</i>	<i>Ajuga parviflora</i>	<i>Indigofera heterantha</i>	<i>Dysphania ambrosioides</i>	<i>Pilea umbrosa</i>
1	Alkaloids	Chloroform: Glacial Acetic Acid: Methanol: Distilled Water- 16:8:3:2	0.92	0.97	0.97	0.619	0.614
2	Flavonoids	Ethylacetate: Distilled Water: Methanol: n-hexane 16:1:3:2	A:0.98 B:0.92	0.90	A:0.98 B:0.85 C:0.97	A=0.73 B=0.87	0.98
3	Phenols	Formaic acid: Ethylacetate: Glacial Acetic Acid: Distilled Water 14:5:3:3	0.84	0.78	0.97	0.67	A=0.53 B=0.68
4	Terpenoids	n-hexane: Diethyl ether: Glacial Acetic Acid: 80:20:1	A:0.06 B:0.09	A:0.06 B:0.13	A:0.085 B:0.17	A=0.96 B=0.32 C=0.33	A=0.14 B=0.28 C=0.35
5	Saponins	Dichloromethane: Methanol: Distilled Water 65:35:10	0.98	0.89	A:0.54 B:0.97	A=0.67 B=0.92	A=0.68 B=0.93
6	Steroids	Chloroform:	A:0.7	0.33	-	A=0.177	A=0.66

		Ethanol: Distilled Water: 9.3:0.5:0.05	B:0.74 C:0.87 D:0.95 E:0.97				B=0.84
7	Glycosides	Chloroform: Methanol: Ammonia solution: 7:2.5:1	0.74	0.78	0.89	A=0.77 B=0.91	A=0.86
8	Tannins	Chloroform: Methanol: Distilled Water 65:35:10	A: 0.77 B: 0.95	0.8	A: 0.5	0.78	0.76

4.8.2 Quantitative estimation of secondary metabolites.

Alkaloids.

For quantitative estimation of alkaloids, atropine was used as standard for comparing alkaloid content of plant samples. Calibration curve was drawn between absorbance of atropine taken on Y axis and concentration on X axis (4.25). Calibration curve of atropine was straight between 2 µg/ml to 10 µg/ml concentrations. The line equation of calibration curve generated was $Y=0.2057x - 0.1922$ and the results were expressed as atropine equivalent (AE).

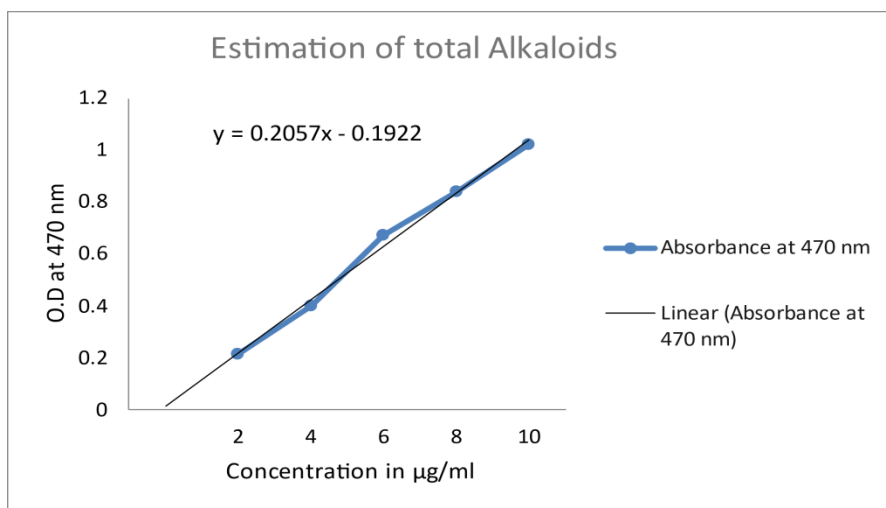


Fig. 4.25 Calibration curve of atropine for quantitative estimation of alkaloids.

Table 4.13 Absorbance and quantitative estimation of alkaloids in methanolic extracts of selected plant species.

Sample	OD	Conc $\mu\text{g/ml}$
<i>Isodon rugosus</i>	1.221	68.70
<i>Ajuga parviflora</i>	0.032	10.89
<i>Indigofera heterantha</i>	0.099	14.16
<i>Dysphania ambrosioides</i>	0.321	24.94
<i>Pilea umbrosa</i>	0.021	10.36

The spectrometric determination analysis of alkaloid contents in the selected five plants using the chloroform method revealed significant differences in their concentrations. *Isodon rugosus* was found to possess the highest alkaloid concentration (68.70 $\mu\text{g/ml}$) among the five plants, followed by *Dysphania ambrosioides* (24.94 $\mu\text{g/ml}$), *Indigofera heterantha* (14.16 $\mu\text{g/ml}$), and *Ajuga parviflora* (10.89 $\mu\text{g/ml}$) whereas, *Pilea umbrosa* with 10.36 $\mu\text{g/ml}$ alkaloid concentration has the lowest alkaloid content.

Flavonoids.

For quantitative estimation of flavonoids, quercetin was used as standard for comparing flavonoid content of plant samples. Calibration curve was drawn between absorbance of quercetin taken on Y axis and concentration on X axis (Fig.4.26). Calibration curve of quercetin was straight between 25 mg/ml to 125 mg/ml concentrations. The line equation of calibration curve generated was $Y=0.0656x - 0.0844$ and results were expressed as quercetin equivalents (mg quercetin/ g dried extract).

Results and Discussion

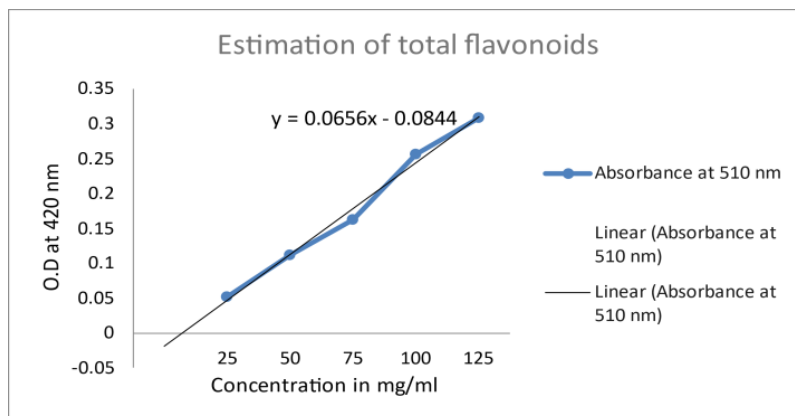


Fig. 4.26 Calibration curve of quercetin for quantitative estimation of flavonoids.

Table 4.14 Absorbance and quantitative estimation of flavonoids in methanolic extracts of selected plant species.

Sample	OD	Conc mg/ml
<i>Isodon rugosus</i>	0.066	2.29
<i>Ajuga parviflora</i>	0.046	1.99
<i>Indigofera heterantha</i>	0.033	1.79
<i>Dysphania ambrosioides</i>	1.025	16.91
<i>Pilea umbrosa</i>	0.021	1.61

The spectrometric determination analysis of flavonoid contents in plant extracts of selected five plants using the aluminum chloride method showed the presence of flavonoids in all the selected plants. The highest concentration of flavonoids was found in *Dysphania ambrosioides* (16.91 mg/ml), whereas *Pilea umbrosa* has lowest flavonoid content of 1.61 mg/ml. The plant extracts of *Isodon rugosus*, *Ajuga parviflora* and *Indigofera heterantha* contain 2.29 mg/ml, 1.99 mg/ml and 1.79 mg/ml flavonoid content respectively. Flavonoids are important phytochemicals known for their potential health benefits and antioxidant properties. *Indigofera heterantha* exhibited notable flavonoid content with a concentration of 1.79 mg/ml, indicating that it could be a potential source of these beneficial compounds.

Phenolics.

For quantitative estimation of total phenolics, gallic acid was used as standard for comparing phenolic content of plant samples. Calibration curve was drawn between absorbance of gallic acid taken on Y axis and concentration on X axis (Fig.4.27). Calibration curve of gallic acid was straight between 20 mg/ml to 100 mg/ml concentrations. The line equation of calibration curve generated was $Y=0.1244x - 0.2104$, and results were expressed as gallic acid equivalents (GAE) in mg/g of dry material (GAE/g)

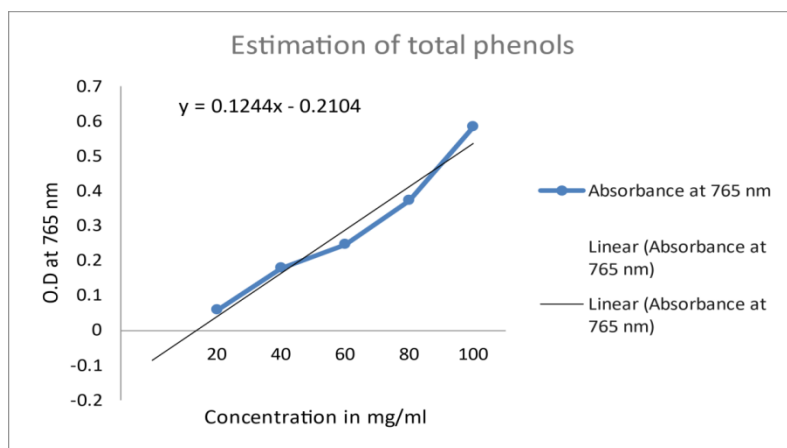


Fig. 4.27 Calibration curve of gallic acid for quantitative estimation of total phenolics.

Table 4.15 Absorbance and quantitative estimation of total phenolics in methanolic extracts of selected plant species.

Sample	OD	Conc mg/ml
<i>Isodon rugosus</i>	1.837	164.58
<i>Ajuga parviflora</i>	0.992	96.65
<i>Indigofera heterantha</i>	1.254	117.71
<i>Dysphania ambrosioides</i>	0.963	94.32
<i>Pilea umbrosa</i>	0.015	18.12

The estimation of total phenols using the Folin-Ciocalteu reagent method revealed varying concentrations of phenolic compounds in the plant extracts of the selected five

plants. The results indicated that *Isodon* possessed the highest concentration of total phenols, measuring 164.58 mg/ml. Following closely was *Indigofera heterantha* with a total phenol concentration of 117.71 mg/ml, while *Ajuga parviflora* and *Dysphania ambrosioides* exhibited total phenolics concentration at 96.65 mg/ml and 94.32 mg/ml respectively. These findings provide valuable insights into the phenolic content of these plant species, which are known for their potential health benefits and contributions to traditional medicine. Further research and analysis of these phenolic compounds could unlock their therapeutic properties and potential applications in various industries. *Pilea umbrosa* was having the lowest phenolic concentration at 18.12 mg/ml.

Terpenoids

The quantitative determination of terpenoid contents in the methanolic extracts of the selected five plant species revealed intriguing results. *Ajuga parviflora* with 77% terpenoid yield was found to contain highest concentration of terpenoids closely followed by *Indigofera heterantha* with 60% yield. The percentage yield of terpenoids in other plants species was 44% for *Isodon rugosus*, 24% for *Pilea umbrosa* and 13% for *Dysphania ambrosioides*. These values indicate significant variations in terpenoid content among the five selected plant species. Terpenoids are bioactive compounds known for their diverse pharmacological properties and potential health benefits. The substantial terpenoid yield in the *Ajuga parviflora* extract suggests its potential as a rich source of these valuable compounds.

Table 4.16 Percentage yield of terpenoid contents in plant extracts of the selected plant species.

Sample	Initial weight	Final weight	%yield
<i>Isodon</i>	100	56	44
<i>Ajuga</i>	100	23	77
<i>Indigofera</i>	100	40	60
<i>Dysphania ambrosioides</i>	100	87	13
<i>Pilea Umbrosa</i>	100	76	24

Saponins.

For quantitative estimation of saponins, pure saponin was used as standard for comparing saponin content of plant samples. Calibration curve was drawn between absorbance of standard saponin solution, taken on Y axis and concentrations ranging

between 1 – 7 $\mu\text{g/ml}$ taken on X axis (Fig.4.28). The line equation of calibration curve generated was $Y=0.153x - 0.418$, R^2 value was equal to 0.806 and the results were expressed as saponin equivalents in $\mu\text{g/ml}$.

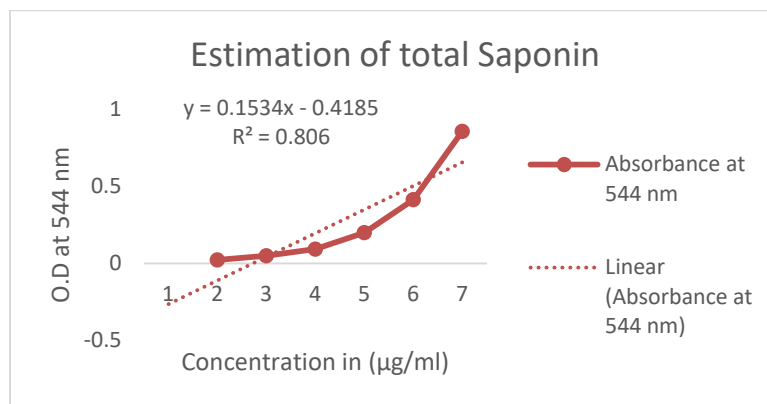


Fig. 4.28 Calibration curve of pure saponin for quantitative estimation of saponins in plant extracts.

Table 4.17 Absorbance and quantitative estimation of total saponins in methanolic extracts of selected plant species.

Sample	OD	Conc $\mu\text{g/ml}$
<i>Isodon rugosus</i>	0.537	62.28
<i>Ajuga parviflora</i>	1.342	114.76
<i>Indigofera heterantha</i>	1.834	146.83
<i>Dysphania ambrosioides</i>	1.259	109.35
<i>Pilea umbrosa</i>	1.524	126.63

The estimation of saponin content using the vanillin reagent method revealed varying concentrations for the five selected plant species. The results indicated that *Indigofera heterantha* exhibited the highest concentration of saponin among the five species, with a remarkable value of 146.83 units. It was followed by *Pilea umbrosa* and *Ajuga parviflora* with concentration values of 126.63 units and 114.76 units respectively. The *Isodon rugosus* exhibited lowest saponin concentration values of 62.28 units. Hence,

there is a significant variation in saponin content across the selected five plant species which provides valuable insights into their potential medicinal or commercial applications.

Steroids.

For quantitative estimation of total steroids, corticosteroids solution was used as standard for comparing phenolic content of plant samples. Calibration curve was drawn between absorbance of corticosteroids taken on Y axis and concentration on X axis (Fig. 4.29). Calibration curve of gallic acid was straight between 25 $\mu\text{g/ml}$ to 125 $\mu\text{g/ml}$ concentrations. The line equation of calibration curve generated was $Y=0.240x + 0.038$, R^2 value was equal to 0.996 and the results were expressed as corticosteroids equivalents in $\mu\text{g/ml}$.

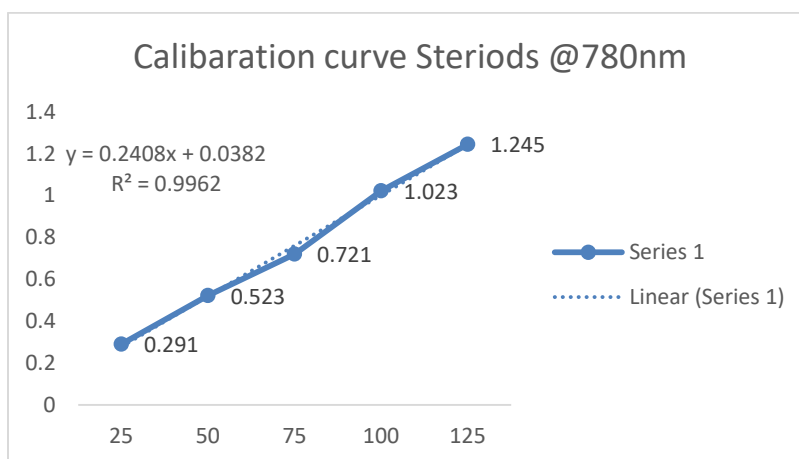


Fig. 4.29 Calibration curve of corticosteroids for quantitative estimation of steroids in plant extracts.

Table 4.18 Absorbance and quantitative estimation of steroids in methanolic extracts of selected plant species.

Sample	OD @ 780nm	Conc $\mu\text{g/ml}$
<i>Isodon rugosus</i>	1.223	4.9
<i>Ajuga parviflora</i>	1.599	6.5
<i>Indigofera heterantha</i>	-0.834	-
<i>Dysphania ambrosioides</i>	1.814	7.4
<i>Pilea umbrosa</i>	0.562	2.2

The spectrophotometric estimation of steroids in the plant extracts of selected five plant species yielded distinct concentration values, showcasing variations in the steroid content among plant extracts of these plants. *Dysphania ambrosioides* demonstrated the highest concentration of steroids, with a value of $7.4\mu\text{g/ml}$, indicating its potential for medicinal or pharmaceutical applications due to its rich steroid content. *Ajuga parviflora* and *Isodon rugosus* followed closely behind with concentration values of $6.5\mu\text{g/ml}$ and $4.9\mu\text{g/ml}$ respectively, suggesting its possible significance in certain therapeutic areas. However, *Pilea umbrosa*, with steroid concentration of $2.2\mu\text{g/ml}$, displayed lowest steroid content among the five selected plants and *Indigofera heterantha* exhibited no detectable presence of steroids in the tested sample.

Tannins

For quantitative estimation of tannins, tannic acid was used as standard for comparing tannin content of plant samples. Calibration curve was drawn between absorbance of tannic acid solution, taken on Y axis and concentrations ranging between 12.5 – 100 mg/ml taken on X axis (Fig. 4.30). The line equation of calibration curve generated was $Y=0.117x - 0.109$, and the results were expressed as tannic acid equivalents in mg/ml.

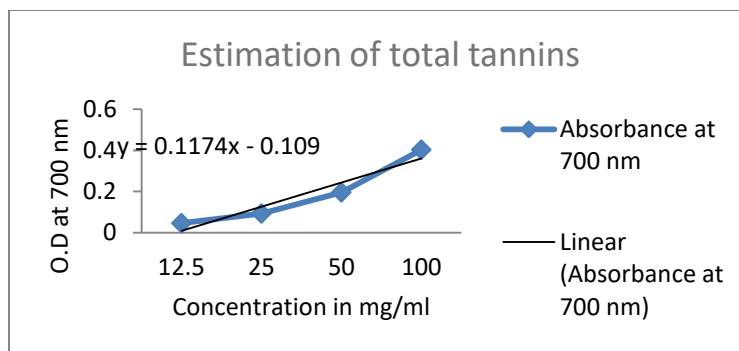


Fig. 4.30 Calibration curve of tannic acid for quantitative estimation of tannins in plant extracts.

Table. 4.19 Absorbance and quantitative estimation of tannins in methanolic extracts of selected plant species.

Sample	OD @ 700nm	Conc mg/ml
<i>Isodon rugosus</i>	0.192	256
<i>Ajuga parviflora</i>	0.725	710
<i>Indigofera heterantha</i>	0.263	317
<i>Dysphania ambrosioides</i>	0.013	104
<i>Pilea umbrosa</i>	0.054	139

The results of spectrophotometric estimation of tannins in the plant extracts of selected five plant species by Folin-Ciocalteu method shows a great variation in tannin content, ranging from 104 mg/ml in *Dysphania ambrosioides* to 710 mg/ml in *Ajuga parviflora*. Tannin content in extracts of *Indigofera heterantha*, *Isodon rugosus* and *Pilea umbrosa* was found to be 317 mg/ml, 256 mg/ml and 139 mg/ml respectively.

Glycosides

For quantitative estimation of glycosides, standard cardiac steroidal glycosides was used as standard for comparing glycoside content of plant samples. Calibration curve was drawn between absorbance of cardiac steroidal glycosides, taken on Y axis and concentrations ranging between 20 – 100 µg/ml taken on X axis (Fig. 4.31). The line equation of calibration curve generated was $Y=0.019x + 0.006$, R^2 value was equal to 0.994 and the results were expressed as cardiac steroidal glycosides equivalents in µg/ml.

Results and Discussion

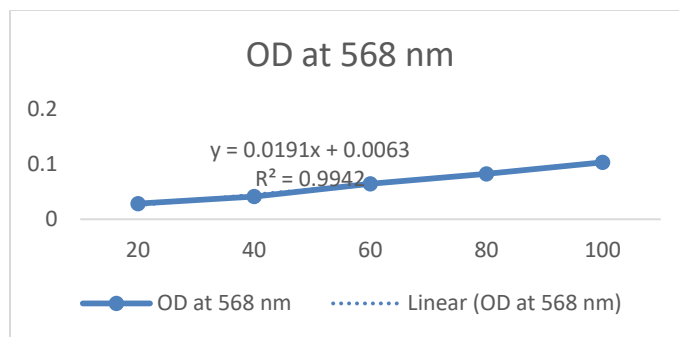


Fig. 4.31 Calibration curve of standard cardiac steroidal glycosides for quantitative estimation of glycosides in plant extracts.

Table 4.20 Absorbance and quantitative estimation of glycosides in methanolic extracts of selected plant species.

Sample	OD @ 568nm	Conc µg/ml
<i>Isodon rugosus</i>	1.523	794
<i>Ajuga parviflora</i>	1.092	568
<i>Indigofera heterantha</i>	1.839	959
<i>Dysphania ambrosioides</i>	0.982	511
<i>Pilea umbrosa</i>	1.102	574

From the above Table, it is clear that the methanolic extracts of all the five selected plant species contain glycosides. The plant extract of *Indigofera heterantha* contains highest concentration (959 µg/ml) of glycosides whereas *Dysphania ambrosioides* contains lowest concentration (511 µg/ml). The glycoside content in the extracts of other three plant species was found to be 794µg/ml in *Isodon rugosus*, 574 µg/ml in *Pilea umbrosa* and 568 µg/ml in *Ajuga parviflora*.

4.8.3. Determination of antioxidant activity by ABTS free radical scavenging assay.

Based on the results of of ABTS assay *Dysphania ambrosioides* showed highest antioxidant potential (98.41%), followed by *Indigofera heterantha* (76.17) and *Ajuga parviflora* (76.01%) which showed comparable antioxidant potential followed by *Pilea ambrosia* (59.92%). Lowest antioxidant ability was shown by *Isodon rugosus*(50.94%). The ethnomedicinal plants like *Dysphania ambrosioides* having high antioxidant

potential can ameliorate diseases which have oxidative stress as genesis. The results of ABTS assay are shown in the following tables (Tables 4.21 to Table 4.26).

Table 4.21 ABTS free radical scavenging assay of quercetin standard.

Concentration (ug/ml)	Absorbance at 734 nm	% Inhibition	% Inhibition Standard deviation
100	0.045	98.57	1.28
50	0.044	69.73	0.35
25	0.047	54.40	0.94
12.5	0.046	32.52	0.00
6.25	0.044	14.11	3.83
Control	0.045	0.00	0.00
		1.78	0.18

Table 4.22 ABTS free radical scavenging assay of plant extract of *Isodon rugosus*.

Concentration	Blank	% Inhibition	% Inhibition Standard deviation
100	0.051	50.94	0.28
50	0.049	47.12	0.90
25	0.05	40.28	0.26
12.5	0.046	36.37	12.87
6.25	0.047	4.72	0.61
control	0.049	0.00	0.00
	IC 50	56.06	0.64

Table 4.23 ABTS free radical scavenging assay of plant extract of *Ajuga parviflora*.

Concentration	Blank	% Inhibition Average	% Inhibition Standard deviation
1000	0.085	76.01	0.55
500	0.071	74.59	0.64
250	0.057	55.47	1.53
125	0.052	51.80	0.87
62.5	0.051	45.92	1.88
control	0.05	0.00	0.00
	IC 50	106.00	1.96

Table 4.24 ABTS free radical scavenging assay of plant extract of *Indigofera heterantha*.

Concentration	Absorbance	% Inhibition Average	% Inhibition Standard deviation
1000	0.271	76.17	1.04
500	0.195	74.31	0.23
250	0.131	67.54	0.94
125	0.063	61.23	0.77
62.5	0.06	40.12	2.66
control	0.536	0.00	0.00
	IC 50	531.23	55.84

Table 4.25 ABTS free radical scavenging assay of plant extract of *Dysphania ambrosioides*.

Concentration	Blank	% Inhibition Average	% Inhibition Standard deviation
100	0.033	98.41	0.61
50	0.042	59.13	1.23
25	0.041	44.84	0.61
12.5	0.04	39.68	1.63
6.25	0.039	25.00	1.06
control	0.035	0.00	0.00
	IC 50	34.01	0.64

Table 4.26 ABTS free radical scavenging assay of plant extract of *Pilea umbrosa*.

Concentration	Blank	% Inhibition	% Inhibition Standard deviation
100	0.044	59.92	9.735912
50	0.044	37.56	6.323939
25	0.043	22.39	6.862528
12.5	0.043	16.57	5.248481
6.25	0.045	9.92	9.739516
control	0.038	0.00	0
	IC 50	79.89	20.505

Chapter 5

Summary and Conclusions

The present research work entitled “Ethnobotanical studies of plants used by Gaddi and Sippi tribes of District Doda, J&K” was carried out from 2019 to 2023 to document the ethnobotanical wisdom of the aforementioned tribes. The study was also undertaken to find out the culturally important plants, homogeneity of knowledge and most preferred plant species used to cure a particular disease by using quantitative indices viz. informant consensus factor (Fic), use value (UV) and Fidelity level (FL) respectively. Phytochemical analysis of five culturally important medicinal plant species viz. *Ajuga parviflora*, *Isodon rugosus*, *Indigofera heterantha*, *Dysphania ambrosioides* and *Pilea umbrosa* was also performed for qualitative detection and quantitative estimation of some important secondary metabolites viz. alkaloids, flavonoids, steroids, saponins, phenols, tannins and glycosides. Antioxidant activity of the aforementioned plant species was also studied by using ABTS Free Radical Scavenging Method which is based on spectrophotometric measurement of changes in ABTS concentration as a result of reaction of ABTS with an antioxidant.

The findings of the study reveal that Gaddi and Sippi tribes are highly knowledgeable about traditional uses of plants for varied purposes and that they exhibit high degree of sharing of traditional knowledge with one another. Factors attributed to the high dependence of Gaddi and Sippi tribes on local plants of ethnobotanical importance are location of their settlements in remote and secluded places in close vicinity of forests away from the influence of mainstream of the society, lack of access to modern healthcare and veterinary facilities, lack of road connectivity and market access, poverty and pastoral occupation.

1. The present research study recorded total 236 plant species of ethnobotanical importance belonging to 183 genera and 77 families and is the pioneering work on rigorous and systematic ethnobotanical studies on Gaddi and Sippi tribes of the UT of J&K.

2. Rosaceae, Asteraceae and Fabaceae represented by 20, 18 and 16 species respectively were the most dominant families.
3. Herbs (142 sps.) were the most utilized habit and leaves (26.5%) were the most utilized plant part.
4. A total of six different aspects of ethnobotanical uses of plants viz. ethnomedicinal, ethnoveterinary, food plants, fodder/forage plants, plants used in making PUPs and socio-magico-religious plants were studied in the present research work.
5. Out of the total 236 reported plant species, 155 were ethnomedicinal plants, 72 were ethnoveterinary plants, 88 were food plants, 62 were socio-magico-religious plants, 70 were fodder/forage plants and 60 were used in making plant derived utility products. Hence Gaddi and Sippi tribes of the study area sustainably use different ecosystem services locally available to them for their sustenance.
6. Three plant species viz. *Berberis lyceum*, *Prinsepia utilis* and *Quercus floribunda* find their use in all the aforementioned six aspects of ethnobotany whereas eight species viz. *Cedrus deodara*, *Indigofera heterantha*, *Pinus wallichiana*, *P. roxburghii*, *Pyrus pashia*, *Cannabis sativa*, *Ficus palmata* and *Viburnum grandiflorum* were used in one or another of the five out of six aspects of ethnobotany studied in the present research work. However, 19 and 39 species were used in one or another of the 4 and 3 different aspects of ethnobotany respectively.
7. The outcome of the present study shows that 17 species of ethnomedicinal plants, 24 species of ethnoveterinary plants, 9 species of edible plants and 51 species of plants used in making utility products are the new records from UT of J&K.
8. The study also documented 113 new use reports of 84 ethnomedicinal plants from the UT of J&K.
9. Large number of new records and novel use reports of ethnomedicinal plants provides a deep insight into the unique methods of drug preparation and therapeutic uses of plants developed by the Gaddi and Sippi tribes themselves

based on their long experience with nature which are not known to the rest of the world.

10. New records and novel use reports of ethnomedicinal plants offer scope for future ethnopharmacological research and provide potential drug leads for discovery of novel drugs.
11. Out of 88 food plants 38 plants have been reported to be nutraceuticals, having both nutritional and medicinal values and thus help in maintaining good health.
12. 11 wild plant species were seasonally sold in the local market as vegetables, condiments, and incense which provide sustainable livelihood opportunities to the tribes under investigation.
13. Nearly 74 human diseases/ailments and 29 livestock diseases/ailments were treated which were categorized into 12 and 9 disease/ailment categories respectively.
14. The highest number of plant species was used for treatment of digestive disorders (65 spp.) followed by general and unspecified problems (53 spp.) and skin problems (36 spp.) of human beings which shows that digestive disorders are most prevalent in the study area.
15. For ethnoveterinary purpose, the highest number of plant species was used for treatment of general problems (34 spp.) followed by digestive problems (19 spp.).
16. Leaves (33.7%) and roots (23.7%) were the most used plant parts in ethnomedicinal and ethnoveterinary practices respectively.
17. Paste with 25.9% contribution and crushed form with 27.1% contribution were the most used dosage form for treatment of human and cattle diseases respectively.
18. Gaddis and Sippis have devised some unique traditional methods of extraction and preparation of plant based drugs. For example, extraction of resin by heating *Cedrus deodara* wood in an earthen pitcher which is used as medicine for curing digestive and skin problems of humans as well as cattle is an innovative method.

This is a most effective method for resin extraction and could be exploited for large scale commercial extraction of resin.

19. These tribes are also skilled in determining the dose of some poisonous medicinal plants e.g., *Aconitum ferox* which, if taken in large quantity may prove fatal.
20. The informant consensus (Fic) values, ranging between 0.87 to 1.0, were found to be very high for all the human disease categories which indicate high degree of knowledge sharing and homogeneity of knowledge among the respondents. High Fic value plants are recommended for future ethnopharmacological studies which may lead to drug discovery.
21. High altitude mountains are very rich in medicinal plant diversity and are considered to be the hot spots of medicinal plants. But such areas have been less explored by the researchers because of their inaccessibility due to difficult terrains and harsh climatic conditions. Thus there are greater chances of discovering novel bioactive compounds by exploring the rich traditional knowledge of Gaddi and Sippi tribes who inhabit higher elevations of the Himalayas.
22. The phytochemical analysis of five selected ethnomedicinal plants of relatively high importance shows that eight different types of secondary metabolites viz. alkaloids, flavonoids, saponins, steroids, tannins, phenols, terpenoids and glycoside were present in all the selected plant species except that steroids were found absent in *Indigofera heterantha*.
23. *Isodon rugosus* was found to contain relatively high content of alkaloids and phenols. *Indigofera heterantha* was relatively rich in saponin and glycosides. *Dysphania ambrosioides* contained relatively larger content of flavonoids and steroids whereas *Ajuga parviflora* was rich in terpenoids and tannins.
24. The results of ABTS assay revealed relatively high antioxidant activity in extract of *Indigofera heterantha*.
25. The therapeutic properties of the aforementioned ethnomedicinal and ethnoveterinary plant species may be attributed to the presence of different

secondary metabolites, as mentioned above, in adequate quantity and strong anti oxidant activity.

26. Use of a specific ethnomedicinal or ethnoveterinary plant for treatment of particular disease is based merely on trial and error method as such plants lack scientific investigations and hence they should be subjected to ethnopharmacological and clinical studies to test their safety, efficacy and toxicity. It may also lead to discovery of modern drugs.
27. Consumption of wild edible plants is an integral part of cultural gastronomic heritage of Gaddi and Sippi tribes. Since wild edible plants are generally drought resistant and disease resistant, these are consumed by the tribes under survey during famine or crop failure as emergency foods.
28. The highest number of edible plants were consumed raw (38 spp.) followed by cooked vegetables (31 spp.).
29. Wild edible plants have an edge over their cultivated counterparts as they are by and large disease free, purely organic, highly nutrient rich, drought resistant and do not include GMOs. Hence, rural and tribal people who regularly consume forest foods have been found to be heart and hale and hardly suffer from any disease.
30. Forest food fests, sensitization lectures and value addition of wild edible products should be prioritized to popularize forest foods among mainstream of the society in general and younger generation in particular who are more inclined towards packed and fast foods.
31. Gaddi and Sippi tribes are highly skilled in identifying and excluding poisonous plants from the list of wild edible plants consumed by them. They have also developed their own indigenous methods for detoxifying harmful toxic compounds, removing bitterness and foul smell from certain wild edibles e.g., *Arisaema propinquum*, *Phytolaca acinosa* and *Urtica dioecia* so as to improve the flavor and make their consumption safe.

32. Agricultural diversification through introduction of wild medicinal and edible plant species into cultivation and their commercialisation is recommended for mainstreaming such species. It would help not only in conservation of such species but also in ensuring livelihood promotion for the tribals.
33. Plantation of wild fruit plants should be introduced in social forestry and agro-forestry programmes.
34. A total of 96 PUPs made from 60 plant species were used by the Gaddi and Sippi tribes which were categorized into 5 usage categories. Tools with 52.1% contribution were the major usage category of PUPs.
35. Contrary to the market products of utility which are generally made up of plastic and metals, PUPs are eco-friendly as well as cost effective and hence value addition of these products and encouraging of their use is recommended.
36. Wild plant species having marketing potential should be exploited for mainstreaming their use by setting up agro based cottage industries like food processing industry, basketry and carpet industry, wooden containers and broom making industries in Gaddi and Sippi inhabited areas in collaboration with SC, ST, OBC Development Corporation and District Industries Centre, Doda. It will help in socio-economic upliftment of the Gaddi and Sippi tribes and other rural communities.
37. The traditional knowledge possessed by the Gaddi and Sippi tribes increased significantly with age and decreased with education of the informants.
38. The forest dwelling tribes are not only well versed with the traditional uses of plant wealth but also familiar with the ecological interactions between different components of forest ecosystem much better than the environmental scientists. The various myths, taboos, beliefs and avoidances like establishment of sacred grooves by the tribal societies have proved instrumental in conservation of forests. Ethnobotanical studies, thus, help the conservation biologists in understanding the relationship between local communities and their environment and to devise

strategy for biodiversity conservation in local context (Kumar et al., 2011; O'Neill et al., 2017).

39. Agenda 21 of Rio Declaration on Environment and Development (1992) also advocates the participation of tribals and other rural communities in sustainable management of natural resources and environmental conservation because of their long association and experience with nature (UN Conf. on Env. & Dev., Rio de Janeiro, 1992; Simon, 2011).
40. Gaddi and Sippi tribes have very high ethics of community based conservation of local plant species. Many plant species including *Cedrus deodara*, *Pinus wallichiana* etc. are conserved in small sacred grooves, locally known as *banis* on religious grounds.
41. Moreover, harvesting of a few plant species during certain specific period of time on cultural and religious grounds which coincides with the seed set timing of these plants is a unique socio-cultural environmental practice of Gaddi and Sippi tribe which helps in conservation of such plants.
42. In most of the high altitudinal medicinal plants like *Rheum australe*, *Dolomiaea costus*, *Dolomiaea macrocephala*, *Aconitum heterophyllum*, *A. ferox*, *Picrorhiza kurroa* etc. roots are used for preparation of crude drugs and hence the whole plant is uprooted. Community members should be sensitized not to uproot such plants before they set seeds so as to ensure their uninterrupted propagation and therefore conservation. Such plants should also be brought under cultivation for their conservation.
43. As an outcome of the present study, it has been observed that the plant based traditional knowledge of Gaddi and Sippi tribes is diminishing at a faster pace and keeping in view the perceptible future threat to traditional knowledge, its documentation and preservation is strongly recommended.

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ANNEXURE-I ETHNOBOTANICAL PLANTS, THEIR USES, METHODS OF USE, USE VALUE AND REFERENCES FROM PREVIOUS STUDY FROM UT OF J&K.

S. No	Name of the plant species /family/ herbarium accession no.	Local name	Habit	Part/ exudate used	Major Use category	Use category	Ethnobotanical uses/Product made (No. of use reports-UR)	ΣUR	Use value (UV)	Ethnobotanical uses reported in previous studies from UT of J&K
ANGIOSPERMS										
1	<i>Achillea millefolium</i> L. Family: Asteraceae Accession No.:HBJU-16764	Dand- jadi	Herb	Aerial parts	MED	Skin problems	Aerial parts are ground with cow urine to form a thin paste which is applied externally for treatment of skin rashes generally in arm pits, groin and on the back caused due to sweating (8)*.	14	0.1	Toothache, inflamed gums, snake bite, diuretic, brain tonic, fever, cold, cough, headache, ,reduce perspiration, retention of urine, wounds, urinary tract infection, diarrhea, dysentery, gastritis, abdominal pain, antihelminthic, carminative, jaundice, throat infection, stimulant [24,32,36,41,42,47,53,55,56,61,79,80, 82, 86,93,98,99].
						Digestive problems	Aerial parts are chewed raw and rubbed against teeth and gums for alleviating teeth ache (6).			
					VET	General	Aerial parts are ground to paste which is applied locally on udder of cow for treatment of mastitis, locally known as <i>rang</i> and the symptoms of the disease include udder inflammation, udder pain, reduced milk yield and presence of pus or blood in milk (142).	142	0.7	Snakebite, Abdominal worms [51,84,10,66,22,103,104,105].
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	69	0.3	
2	<i>Aconitum ferox</i> Wall. ex Ser. Family:Ranunculaceae Accession No.:HBJU- 16846	Bish	Herb	Roots	MED	General and unspecified.	Fresh roots are rubbed on a flat stone to form a thin paste which is applied topically as an antidote against snake bite and scorpion sting (6)*.	22	0.1	Piles [42].
						Skin problems	Root paste is used externally on the skin for curing infectious swelling			

							with redness (16)*.			
					VET	Digestive problems	Roots are crushed, mixed with salt and administered orally to goats and sheep for intestinal deworming and as appetiser (134). The plant is highly poisonous and hence a very small quantity of root, about one small piece per 100 livestock, is given as a dose. It is not given to pregnant goats and sheep as it may cause termination of pregnancy.	158	0.8	New Record
						Respiratory/pulmonary problems.	The above formulation is administered orally to goats and sheep in case of lung infection (14).			
						General problems	The above formulation is administered orally to goats and sheep for body heat (10).			
3	<i>Aconitum heterophyllum</i> Wall. ex Royle. Family:Ranunculaceae Accession No.:HBJU- 16847	Patreesh	Herb	Roots	MED	Digestive problems	Roots are dried and ground to powder which is taken internally with butter as a dose for curing stomach ailments, dyspepsia, abdominal pain, for intestinal deworming and improving appetite (82).	98	0.5	Cough, anti inflammatory, urinary problem, joint problem, skin disease, wounds, diarrhea, dysentery, abdominal pain, food poisoning, vomiting, antihelminthic, gastritis, fever, tooth ache, respiratory problems, gynaecological problems, leprosy, tuberculosis, typhoid, snake bite [28,35,39,42,43,46,53,56,61,79,80,82,83,86,89,93,96,98,99].
						Respiratory problems	The above formulation is given orally in case of cough (16).			
					VET	Digestive	Roots are crushed, mixed with maize dough and given orally to cattle in case of loose motions (145).	145	0.7	Swellings [10,22,44,103].
4	<i>Aconitum hookeri</i> Stapf. Family:Ranunculaceae Accession No.:HBJU-16848	Bishdi	Herb	Roots	MED	General and unspecified	Roots are rubbed on a flat stone to form a thin paste which is applied externally as an antidote against snake bite and scorpion sting*. It is less effective than <i>A. ferox</i> (7).	7	0	Fungal infection and hair loss [42].

5	<i>Acorus calamus</i> L. Family: Acoraceae Accession No.: HBJU- 16747	Baryan	Herb	Rhizome	MED	Digestive problems	Rhizome is roasted on the griddle, rubbed on a flat stone and thin paste formed is given orally to small children in case of loose motions (30).	42	0.2	Diarrhea, gastritis, loss of appetite, flatulence, abdominal pain, antihelminthic, acidity, carminative, nausea, stimulant and tonic, headache, cough, liver pain, heart infection,
						Musculoskeletal problems	Fresh rhizome is ground to paste which is applied topically on joints to subside arthritis pain. Dried rhizome powder mixed with mustard oil is also massaged on the affected parts for the same purpose (12)*.			cardiovascular problems, chest infection, respiratory problems, gastrointestinal disorder, common cold, allergy, kidney disorder, toothache, strengthen gum and teeth, memory enhancer, speech disorder, skin disease, snake bite [34,35,36,42,53,55,76,79,80,83,86,91,96,99]
					VET	Musculoskeletal problems	Rhizome are crushed, mixed with maize dough and salt and given as a dose to cows and bulls as a treatment of arthritis, locally known as <i>granu</i> , a disease with joint pain symptoms (114)*.	155	0.7	Diarrhea, dyspepsia, anthelmintic infestation, internal parasites, wounds, snakebite, allergy, stomach pain [15,22,27,44,48,54,84].
						Digestive problems	The above formulation is also given to the cattle in case of diarrhoea and dysentery (31).			
						General problems	Rhizome of <i>Acorus calamus</i> , roots of <i>Angelica glauca</i> and seeds of <i>Trigonella foenum-graecum</i> are crushed, salt is added and then given orally to cows as galactagogue for increasing milk yield (10)*.			
6	<i>Aesculus indica</i> (Wall. ex Cambess.) Hook. Family: Sapindaceae Accession No.: HBJU- 16869	Goon	Tree	Stem, branches, leaves, seeds	MED	Digestive problems	Seed kernel is crushed and taken internally in case of abdominal pain, abdominal cramps and bloating (26).	40	0.2	Frostbite, fever, whooping cough, headache, anti-inflammatory, rheumatism, joint pain, astringent,
						General and unspecified	Seed kernel is crushed and taken orally as a remedy for fever and shivering (14).			gastrointestinal problem, loose motions, dermatological problem, cracked heels, dandruff, hair fall,

										boils, skin rashes, eruption, burns, wounds, cold, haemorrhoids and ulcers [32,34,35,42,49,56,61,62,79,80,83,91,93,98]
					VET	Digestive problems	Crushed seed kernel is given orally to the horse as a treatment for colic pain and abdominal swelling accompanied with fever, a condition locally known as <i>shool</i> (134).	157	0.8	Colic, indigestion, helminthic infestation, stomachache & indigestion, cold, loose motion, pneumonia, chest disease, general weakness [2,9,27,29,44,48,58,103,105].
						General and unspecified	Crushed kernel is given to goats and sheep as a general tonic (23).			
					PUP	Containers/storage products	Kunala, Kutroshu, ganarh (100).	305	1.1	
						Miscellaneous Products	Kaathi, goon (25).			
						Tools	Jungla, charkha, kaanghi, naal, rachh, konkdi, kuranu (180)			
					FOD	Fresh	Leaves used as fodder/forage for cattle.	110	0.5	
7	<i>Ainsliaea latifolia</i> (D.Don) Sch.-Bip. Family:Asteraceae Accession No.:HBJU- 16765	Maljoori	Herb	Leaves, roots	MED	Digestive problems	Fresh leaf paste or dried root powder is taken orally as antihelminthic and for alleviating gastric troubles, vomiting, diarrhoea and indigestion (17). The juice of fresh leaves is taken orally as a remedy for jaundice (7)*.	24	0.1	Antihelminthic [42].
8	<i>Ajuga parviflora</i> Benth. Family:Lamiaceae Accession No.:HBJU- 16806	Fuljadi	Herb	Leaves	MED	Digestive problems	Dried leaf powder is taken orally as a remedy for mouth sores and bitterness of mouth (34)*. Leaf powder mixed with seeds of <i>Anethum graveolens</i> and sugar crystals (<i>mishri</i>) is taken with water empty stomach in the morning in case of loss of appetite, pitta dosh, xanthosis and liver complaints (12)*.	110	0.5	Stomachache, diarrhea, wounds, chest congestion, cold, diuretic [42,79,80].

							Fresh leaves are crushed and eaten in case of jaundice (24)*. Leaf powder along with seeds is taken together for digestion and liver disorders (04).			
						Endocrine, metabolic and nutritional problems	Fresh leaves are crushed and given orally as a treatment for diabetes (22)*.			
						General and unspecified	Dried leaf powder is taken orally as a remedy for cold and fever (4)*. Leaf juice extracted by crushing the fresh leaves is mixed with mustard oil and applied in the hair as a remedy for itch, dandruff, hair fall and killing head louse (10)*.			
					VET	General	Leaf decoction is applied externally to get rid of ectoparasites (40).	40	0.2	Weaknesses, indigestion, fever, sores, wounds, swelling [8,29,104,105].
9	<i>Allium sativum</i> L. Family:Amaryllidaceae Accession No.:HBJU- 17542	Thoom	Herb	Leaves	MED	Skin problems	The bulb (fleshy leaves) of garlic is ground to paste, a thin layer of paste is applied topically for removal of blackmoles (40)*.	40	0.2	Headache, heart ailments, gastritis, hypertension, respiratory disorders, asthma, eyesight, skin diseases, otalgia [24,33,39,67].
10	<i>Allium stracheyi</i> Baker. Family:Amaryllidaceae Accession No.:HBJU- 16755	Farni	Herb	Leaves	MED	Digestive problems	Dried and crushed leaves are used as condiments in fried rice which is eaten for curing gastric upset and indigestion (10).	24	0.1	New Record
						Urological problems	Dried leaves are burnt and the affected person is fumigated to get relief from burning micturition (14).			
					EDB	Chutney	Fresh leaves are used for making chutney (22).	109	0.4	[68] .
						Flavouring agents	Dried leaves are slightly warmed on griddle (<i>tawa</i>), crushed to powder, salt is added and then sprinkled on kedgree (<i>khichdi</i>) as condiment			

11	<i>Alnus nitida</i> (Spach) Endl. Family:Betulaceae Accession No.:HBJU- 17549	Champ	Tree	Bark	SMR		followed by addition of <i>ghee</i> and eaten, nutraceutical (37).			
						Miscellaneous	Fresh or dried leaves are crushed and used as substitute for onion for cooking pulses and vegetables (50).			
						MBE	A sacred divine water prepared by dipping the bark of 7 trees generally <i>Quercus floribunda</i> , <i>Fraxinus excelsior</i> , <i>Cedrus deodara</i> , <i>Pyrus pashia</i> , <i>Alnus nitida</i> , <i>Pyrus communis</i> and <i>Pyrus pyrifolia</i> in water collected from seven different water springs is used to ward off demons, ghosts, influence of black magic and bad evils from the affected person. The affected person is made to sit in cross legged position, his body is completely covered with a fresh white cotton cloth and the water is sprinkled over his body through a sieve by the shaman (witch doctor) and this process is locally known as <i>nahaun</i> (54).	54	0.3	
12	<i>Amaranthus caudatus</i> L. Family:Amaranthaceae Accession No.: HBJU- 17580	Chawla	Herb	Seeds	EDB	Miscellaneous	A sweet milky dessert (<i>kheer</i>) is prepared from the seeds of <i>Amaranthus caudatus</i> .	67	0.5	
						SMR	SRR	A sweet milky dessert (<i>kheer</i>) is prepared from the seeds of <i>Amaranthus caudatus</i> which is eaten by the devotees during religious fasting (104).	104	0.6
13	<i>Amaranthus spinosus</i> L. Family:Amaranthaceae Accession No.:HBJU- 16751	Chawli	Herb	Leaves	EDB	Vegetable	Cooked as vegetable.	104	0.4	[1,6,12,17,38,68]

14	<i>Amaranthus viridis</i> L. Family:Amaranthaceae Accession No.:HBJU- 16752	Chawla	Herb	Leaves, seeds	VET	Pregnancy and calving	Seeds are boiled in water and decoction given orally for removal of placenta of cows after calving (51)*.	51	0.2	Dizziness, weakness [9,51]. [1,12,16,38,75,78,85,87,88,95].
					EDB	Vegetable	Leaves are cooked as vegetable.	104	0.4	
					SMR	SRR	Seeds are roasted, soaked in warm water, added in milk or curd and eaten by the devotees during religious fasting (102).	102	0.6	
15	<i>Anaphalis margaritacea</i> (L.) Benth & Hook. F. Family:Asteraceae Accession No.:HBJU- 16899	Bhujli	Herb	Leaves	MED	General and unspecified	The leaf peel is burnt and crushed which is applied topically in case of injury to stop bleeding and reduce healing time (32)*.	32	0.2	Fractured bones [41].
					PUP	Miscellaneous Products	Bhujli (12).	12	0	
16	<i>Anaphalis triplinervis</i> (Sims) C.B. Clarke. Family:Asteraceae Accession No.:HBJU 17030	Bhujli	Herb	Leaves	PUP	Miscellaneous Products	Bhujli (12).	12	0	
17	<i>Anethum graveolens</i> L. Family:Apiaceae Accession No.:HBJU- 16756	Soye	Herb	Seeds	MED	Digestive problems	Seeds are taken internally as a remedy for flatulence and constipation (10). Seeds are taken with honey or boiled in water which is taken internally to get rid of liver heat, locally known as <i>jiggar-ari- garmi</i> (26)*. Seeds are also taken together with leaf powder of <i>Ajuga parviflora</i> for the same purpose (3).	44	0.2	Carminative [42]. [68,78].
					EDB	Raw	Seeds mixed with black pepper and crystal sugar (<i>mishri</i>) are taken orally in case of vertigo (5)*.	102	0.4	
18	<i>Angelica glauca</i> Edgew. Family:Apiaceae Accession	Chora	Herb	Roots	MED	Digestive problems	Small pieces of roots are used as spice in some hard-to-digest dishes like kidney beans (<i>rajmash</i>), black gram lentil (<i>maash</i>) and potatoes to	98	0.5	Gastric ailments, stomach ache, bloating, acidity, deworming, obesity, jaundice, fever, gastritis, joint pain [28,43,47,53,79,82].

	No.:HBJU- 16757						make these dishes easily digestible (98).			
					VET	Digestive problems	Roots are crushed, mixed with maize dough and salt and given orally as a dose, locally known as <i>kijji</i> , to cows, bulls, buffaloes, goats and sheep for treatment of indigestion, colic pain and flatulence (112).	160	0.8	Cold, diarrhea, alopecia, tympany, bloat, cough, flatulence, acidity, abdominal colic, FMD, anthelmintic, galactagogue [8,29,44,54,66,72,74,103, 104,105].
						Respiratory/pulmonary problems	The above formulation is given to cattle in case of pneumonia, locally known as <i>taaku</i> (33)*.			
						General and unspecified	The above formulation is given to the cattle for body heat. Roots of <i>Acorus calamus</i> and <i>Angelica glauca</i> and seeds of <i>Trigonella foenum-graecum</i> are ground together to form a paste in which salt is added and given orally to cows as galactagogue for increasing milk yield (15).			
					EDB	Flavouring agents	Small pieces of roots are added as a spice while cooking kidney beans (<i>rajmash</i>), beans, and black gram lentil (<i>maash</i>) to enhance flavor, nutraceutical.	120	0.5	[1,18,50,68,78].
19	<i>Arisaema jacquemonti</i> i Blume. Family:Araceae Accession No.:17785	Keedae-ri-kukdi	Herb	Rhizome	VET	Respiratory/pulmonary problems.	Rhizome is crushed, mixed with maize dough and salt and then given orally to cows, bulls, buffaloes, goats and sheep as a dose for treatment of pneumonia, locally known as <i>taaku</i> * (83).	83	0.4	Pyrexia, snakebite [22,54,84,103].
20	<i>Arisaema propinquum</i> Schott. Family:Araceae	Shundga l	Herb	Rhizome	MED	Endocrine, metabolic and nutritional problems	Pickle of the rhizome is recommended in case of diabetes and thyroid problem (17)*.	35	0.2	Skin eruptions and rashes [52].

	Accession No.:HBJU- 16762					General and unspecified	The rhizome is rubbed on surface of a flat stone and the juice thus obtained is applied externally on the scalp for better hair growth and for curing alopecia areata, locally known as <i>bal-chara</i> (18)*.			
					EDB	Preserved foods	Small pieces of cleaned rhizomes are boiled in water with tamarind (<i>imli</i>) for 7-8 hours to neutralize its toxic affect. The outer membranous covering of the rhizomes is removed after boiling and the rhizomes are then dried. Ingredients like oil and spices are added to boiled and dried rhizomes and pickle is prepared following traditional recipe, nutraceutical.	77	0.3	[78].
						Miscellaneous	Boiled rhizomes are crushed with hands to form paste which is added to wheat dough in the ratio 1:2 (approx.) which is then fermented, fried in oil as chapatti (<i>babru</i>) and eaten.			
21	<i>Artemisia maritima</i> L. Family:Asteraceae Accession No.:HBJU- 16766	Saski	Shrub	Leaves	MED	Digestive problems	Leaves are crushed and eaten for treatment of indigestion, flatulence, abdominal pain (82)*. It is also used as antihelmintic (22).	104	0.5	Intermittent fever, abscess, expectorant, stomachache, antihelmintic, boils due to burning, joint pain [28,42,45].
22	<i>Artemisia scoparia</i> Waldst. And Kit. Family: Asteraceae Accession No.:HBJU- 16767	Jhao	Herb	Aerial parts, leaves, roots	MED	Digestive problems	The fresh root is crushed and placed between the teeth for alleviating tooth ache (8)*. It also gives protection against germs and thus helps in maintaining oral hygiene (50). A mixture of the crushed dried leaves of <i>Artemisia scoparia</i> , <i>A. maritima</i> and <i>Skimmia antiquilla</i> is prescribed orally as a treatment for gastric ailment, indigestion, loose	88	0.4	Jaundice, hepatitis, gall bladder inflammation, antihelmintic, dyspepsia, ear and toothache [28,42,76].

							motions, vomiting, loss of appetite and as anthelmintic (18).			
						Endocrine, metabolic and nutritional problems	Crushed leaves are taken internally in case of diabetes (12).			
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	108	0.5	
23	<i>Artemisia vestita</i> Wall. ex Besser. Family:Asteraceae Accession No.:HBJU- 16768	Jhao	Herb	Aerial parts, leaves	MED	Digestive problems	Fresh leaves are crushed and prescribed in case of indigestion, vomiting and loose motions (34).	44	0.2	New Record
						Endocrine, metabolic and nutritional problems	Fresh leaves of <i>Artemisia vestita</i> and <i>Isodon rugosus</i> are crushed and taken together as a remedy for diabetes (10).			
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	108	0.5	
24	<i>Asparagus filicinus</i> Buch.-Ham. ex D.Don. Family:Asparagaceae Asparagaceae Accession No.:HBJU- 17545	Sainsbuti	Herb	Roots	SMR	MBE	Crushed roots are placed in sacred water collected from seven different water springs, which is sprinkled by the shaman or priest on the affected person to get rid of evil powers (20).	20	0.1	
25	<i>Astragalus rhizanthus</i> Benth. Family:Fabaceae Accession No.:17585	Mushkanda	Herb	Aerial parts	PUP	Miscellaneous products	Aerial parts are kept around the openings of rat burrows around the house to get rid of rats, as the plant bears prickly thorns due to which rats could not pass through them (9).	9	0	
26	<i>Atropa acuminata</i> Royle ex Lindl. Family:Solanaceae Accession No.: HBJU- 17589	Belladonna	Herb	Roots	MED	General and unspecified	Root powder is mixed with water to form paste which is applied topically as an antidote against snake bite (24)*.	24	0.1	Joint pain, gout, rheumatism, whooping cough, asthma, chest infection, dyspepsia [53,62].
27	<i>Berberis lycium</i>	Kishmaly	Shrub	Roots,	MED	Digestive	Roots are boiled in water and	98	0.5	Splenic problems, respiratory

	Royle. Family:Berberidaceae Accession No.:HBJU- 16776			stems, branches, fruits, leaves		problems; decoction is filtered. The filtrate is concentrated by boiling until a semi solid paste locally known as <i>rasaunt</i> is formed. This paste, which is bitter in taste, is prescribed orally with water and sugar in case of liver complaints, loss of appetite and mouth sores (46). The crushed tips of peeled tender twigs are taken internally together with fresh leaves of <i>Isodon rugosus</i> , <i>Artemisia maritima</i> and <i>A. scoparia</i> in case of gastric upset, indigestion, bloating etc. (20).			disorder, throat and chest troubles, eye diseases, eye sores, eye lotion, acute conjunctivitis, chronic ophthalmia, fever, wounds and cuts , styptic, antiseptic, astringent, urinary problems, body weakness, indigestion, laxative, constipation, cholera, stomach ache, dyspepsia, gastric tonic, piles, liver ailments, joint pains, bone fracture, cooling agent, blemishes, diabetes, intermittent fever, diuretic, kidney stones, hypertension [28,32,35,36,42,45,46,47,65,79,86,89, 91,93,96,98].
						Endocrine, metabolic and nutritional problems. Rasaunt is prescribed orally as a remedy for diabetes. Tips of peeled tender twigs are also taken internally for the same purpose (10).			
						Neurological problems The juice obtained by crushing roots is taken internally in case of head ache (12)*.			
						General and unspecified problems. <i>Rasaunt</i> is prescribed orally in case of cold, shivering and fever (10).			
					VET	Digestive Root decoction is given orally to cattle as a treatment for jaundice (56).	56	0.3	Jaundice, wound, maggots in wounds, fractures [9,44,84,103,105].
					EDB	Raw Fresh leaves, ripe fruits and peeled off tender twigs are eaten raw.	100	0.4	[1,11,12,14,16,37,38,50,60,64,69,75,78, 81,85,92,97].
					PUP	Tools Tarnethi, konkdi (52).	190	0.7	
					Construction Products Baad (18).				
					Atrefacts Jaabu, keed (120).				
					SMR	SCR A large sized basket, locally known as <i>chabri</i> , made from the shreds of	28	0.2	

							fresh twigs is used in one of the wedding rituals known as <i>shandi</i> (<i>telai</i>). The basket is filled with corn seeds, covered with a small blanket and the bride and groom are made to sit in this basket at their own places throughout the <i>shandi</i> ritual (28).			
					FOD	Fresh	Leaves used as fodder/forage for goats and sheep.	156	0.7	
28	<i>Bergenia ciliata</i> (Haw.) Sternb. Family:Saxifragaceae Accession No.:HBJU-16870	Shapdotri	Herb	Roots	MED	Digestive problems	The dried roots are pounded into powder which is applied on gums to alleviate gum bleeding and tooth ache (40)*.	100	0.5	Wounds, injuries, antiseptic, joint pain, liver disease, asthma, cough, fever, chest infection, gastrointestinal infection, abdominal diseases, acidity, gastritis, stomach ulcer, intestine disorders, diarrhoea, dysentery, kidney and gall bladder stone, menstrual health, wrinkles, tonic, cutaneous disorder, eyes, ear and nose problem [24,25,30,34,42,43,46,52,59,62,79,80,82,83,89,91,93,96,98].
						General and unspecified problems	Dried root powder is sprinkled over the affected area for effective wound healing. Paste of dried root powder in milk is applied topically for healing internal injury (34).			
						Musculoskeletal problems	Decoction of fresh root is prescribed orally for alleviating orthopaedic, rheumatic and arthritis pain (26).			
					VET	Urological problems	Roots are crushed, mixed with maize dough and salt and given orally as a dose, locally known as <i>kijji</i> , to cows, bulls, buffaloes, goats and sheep for treatment hematuria (130).	130	0.6	Diarrhea, weakness, galactagogue, foot & mouth disease (FMD) [2,9,29,44,66,103].
29	<i>Bergenia stracheyi</i> (Hook.f. & Thomson)	Shapdotri	Herb	Roots	MED	Digestive problems	The dried root is pounded into powder which is applied on gums to alleviate gum bleeding and Tooth ache (40)*.	100	0.5	Ulcer, blister in mouth [28].
	Engl. Family:Saxifragaceae Accession No.:HBJU-16871					General and unspecified problems	Dried root powder is sprinkled over the affected area for effective wound healing*. Paste of dried root powder in milk is applied topically for healing internal injury (34)*.			
						Musculoskeletal problems;	Decoction of fresh root is prescribed orally for alleviating orthopaedic,			

							rheumatic and arthritis pain (26)*.			
					VET	Urological problems	Roots are crushed, mixed with maize dough and salt and given orally as a dose, locally known as kijji, to cows, bulls, buffaloes, goats and sheep for treatment hematuria (130).	130	0.6	New Record
30	<i>Betula utilis</i> D.Don. Family:Betulaceae Accession No.:HBJU-16778	Bhuj	Tree	Branches, leaves, bark	PUP	Tools	Hal, maandh (55).	55	0.2	
					SMR	MBE	The paper like bark of <i>Betula utilis</i> is used for writing sacred incantations (<i>mantras</i>) having healing power which is then placed in an amulet and worn in the arm or neck to ward off evil spirits and bring good luck. (10).	10	0.1	
					FOD	Fresh	Leaves used as fodder/forage for goats and sheep.	50	0.2	Hay fever, tongue whitening, stomach problem, coldness, asthma, rheumatism, joint inflammation, menstrual disorders, menorrhagia [32,42,79,80,90].
31	<i>Bistorta amplexicaulis</i> (D.Don) Greene. Family:Polygonaceae, Accession No.:HBJU-16834	Troodh	Herb	Roots	MED	Respiratory problems	Roots are brewed to tea which is taken internally as a remedy for pulmonary congestion, respiratory troubles and throat irritation (30).	42	0.2	
						General and unspecified	Root tea is taken in case of fever, as blood purifier and for refreshing the body (12)*.			
					EDB	Beverages	Roots used for making tea, nutraceutical.	40	0.2	[14,50,64,68,75,78,81,92]
32	<i>Brassica oleracea var. gongylodes</i> L. Family:Brassicaceae Accession No.:HBJU-16901	Kadam	Herb	Leaves	MED	Skin problems	Leaves are crushed and then rubbed against the skin as a remedy for skin allergy caused due to contact with <i>Toxicodendron succedaneum</i> , an allergic tree (48)*.	48	0.2	Constipation, corns, to ooze out puss [39,49,67].
33	<i>Brassica juncea</i> (L.) Czern. Family:Brassicaceae Accession No.:HBJU-17551	Sharoon	Herb	Seeds	MED	Endocrine, metabolic and nutritional problems	The warm mustard seed oil is applied on the whole leaf of <i>Calotropis procera</i> which is then tied on the foot sole for the whole night to control diabetes (40).	50	0.2	Rheumatism, head and body massage, moisturiser [33].
						Musculoskeletal	Seed oil is massaged locally to get relief from orthopaedic pain			

						problems.	including back pain (10).			
					VET	Respiratory/pulmonary problems.	The seeds are kept outside the house for the whole night during winter season so that they absorb moisture due to dew formation and given next morning with butter milk (<i>lassi</i>) to cows as a remedy for cough (12)*.	125	0.6	Constipation, indigestion, yoke gall, ticks and lice, mastitis [44,57,103].
						Foot & Mouth disease	Mustard seed oil is given orally to cattle in case of foot and mouth disease (23)*.			
						General problems	Oil cakes are given to cows as a galactagogue (90)*.			
					SMR	SRR	Seed oil is used for lighting sacred lamp (<i>diya</i>) while worshipping (143).	402	2.2	
						MBE	Dry seeds are recited with incantations by the shaman or priest, burnt in red hot cinders and the affected person is fumigated (<i>dhoni</i>) to get rid of demons, bad evils and black magic. Seeds are placed on the head or kept in the pocket for protection against ghosts and evil spirits (259).			
34	<i>Bupleurum falcatum</i> L. Family:Apiaceae Accession No.:HBJU-16758	Trin-ari-dawa	Herb	Aerial parts	MED	General and unspecified	Aerial parts are ground to paste which is applied topically as an antidote in case of snake bite (26)*.	80	0.4	Liver troubles, stomach complaints [28,42].
						Skin	The above paste is also used for treatment of poisonous swelling with redness, locally known as <i>trin</i> , caused due to pricking of bones of dead snakes in the body of affected person while working in agricultural fields and grasslands (54)*.			
					VET	General	Aerial parts are pounded to paste which is applied topically for treatment of snake bite (36).	36	0.2	Snakebite [22].

35	<i>Calendula officinalis</i> L. Family:Asteraceae Accession No.:HBJU-16769	Hamesh -bahar	Herb	Leaves	MED	Eye problems	Leaves are ground with cow urine to form a thin paste which is applied on the skin around the eyes in case of eyelid abscess, pain, redness and burning sensation in eyes (96)*.	96	0.5	Wound healing, eczema, skin rashes, boils, eyelid abscess, antiseptic, ear ache, jaundice, burns, muscle spasm; anemia, blood tonic, blood purifier, constipation, pneumonia. [39,41,49,53,56,62,86,99].	
36	<i>Calotropis procera</i> (Aiton) Dryand. Family:Apocynaceae Accession No.:HBJU-16761	Akk	Shrub	Leaves, latex	MED	Digestive problems	Latex from leaf petiole is applied on painful decaying wisdom tooth which relieves the tooth ache and subsequently the decaying tooth also falls out. Hence no tooth extraction by the dentist is required (10)*.	14	0.1	Joint pain, arthralgia, scorpion sting, skin diseases, cough, asthma, wounds, toothache, ringworm, abscess, cholera, appetizer, diarrhoea, dysentery, deworming [34,52,59,76,91,93].	
						Endocrine, metabolic and nutritional problems	The warm mustard oil is applied on the whole leaf which is then tied on the foot sole for the whole night to control diabetes (4)*.				
37	<i>Cannabis sativa</i> L. Family:Cannabaceae Accession No.:HBJU-16783	Bhaang	Herb	Aerial parts, leaves, fibre	MED	Musculoskeletal problems	Fresh leaves are pounded into paste which is applied externally on the affected parts as a remedy for arthritis pain* (74).	84	0.4	Excessive urination, convulsions, tumors, ulcers, diarrhoea, aperient, cholera, wormicide, gastroenteritis, loss of appetite, piles, nausea, sickness & vomiting, skin	
						General and unspecified	Crushed leaves are rubbed on affected body part immediately after the bite of honey bees and wasps for alleviating pain and swelling (10).			diseases, scabies, dandruff, narcotic, sedative, intoxicant, tonic, analgesic, antiseptic, depression, blood purifier, cuts, wound healing, antioxidant, alopecia, scorpion sting, snake bite, backache, rheumatism, fractured bone, poisonous insect bite, antiaphlogistic, earache, poisonous insect bite & pain relief, analgesic, bee and wasp sting, swelling and inflammation releif [35,36,39,42,43,45,46,52,62,65,67,76,77,82,86,91,93,96,99].	
						EDB	Beverages	Fresh leaves are used for making a sedative milk drink (<i>shardhai</i>) generally on the occasion of	105	0.4	[14,75,78,87,92,95].

							Shivratri, a Hindu festival devoted to Lord Shiva (46).			
						Miscellaneous	Fresh leaves are used for making snacks (<i>pakora</i>) generally on the occasion of Shivratri (59).			
					PUP	Atreifacts	Jodi (30).	30	0.1	
					SMR	SRR	Fresh leaves are used for making <i>pakora</i> and a sedative milk drink (<i>shradhai</i>) which are offered as sacrament to the devotees on the occasion of <i>Shivratri</i> , a Hindu festival devoted to Bhagwan Shiv Ji (100).	100	0.6	
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	84	0.4	
38	<i>Capsella bursa-pastoris</i> (L.) Medik. Family:Brassicaceae Accession No.:HBJU- 17550	Ban-sharoon	Herb	Aerial parts	EDB	Vegetable	Aerial parts are cooked as vegetable.	67	0.3	
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	80	0.4	
39	<i>Capsicum annuum</i> L. Family:Solanaceae Accession No.:HBJU-17018	Pipli	Herb	Fruits	SMR	MBE	The fruits of <i>Citrus limon</i> and <i>Capsicum annum</i> and a piece of charcoal are tied together with a thread and hanged over the entrance doors of houses to keep the demons and bad evil away (18).	18	0.1	
40	<i>Cassia fistula</i> L. Family:Fabaceae	Karanga l	Tree	Seeds	VET	Digestive	Seeds are given orally to goats and sheep as a remedy for constipation (100).	100	0.5	Constipation, indigestion, conjunctivitis [27,48].
41	<i>Cassiope fastigiata</i> (Wall.) D.Don. Family:Ericaceae Accession No.:HBJU-16794	Heun-shale	Shrub	Leaves	MED	General and unspecified	Dried leaves are crushed to powder which is sprinkled on the affected body parts to heal fire burns (17).	17	0.1	Fire burns, skin infection [42].
42	<i>Celtis australis</i> L. Family:Cannabaceae Accession No.:HBJU-	Khedak	Tree	Bark, leaves, fruits, stem	MED	Skin problems	The paste of fresh bark mixed with curd is applied topically for treatment of shingles, locally known	35	0.2	Tonic, allergy, anti-inflammatory, astringent, laxative, diarrhoea, colic disorder, stomach ache, burning

	16788						as <i>janaeu</i> (35).			sensation of soles, herpes, cardiovascular disorder, amenorrhea, heavy menstruation [35,42,45,52,83,91,93,98,99].
					EDB	Raw	Fruits eaten raw	75	0.3	[11,14,16,78,81].
					PUP	Tools	<i>Kuranu</i> made from stem (22).	22	0.1	
					FOD	Fresh	Leaves used as fodder/forage for cattle.	9	0	
43	<i>Cenchrus americanus</i> (L.) Morrone. Family:Poaceae Accession No.:HBJU-17581	Kodra	Herb	Seeds	SMR	SRR	Gaddi and Sippi tribes solemnise a thanks giving religious ceremony, known as <i>gusantan</i> , which is devoted to Bhagwan Shiv Ji, when their wish is fulfilled. A special fermented liquid sacrament, known as <i>bagni</i> , is prepared from <i>Cenchrus americanus</i> and <i>Triticum aestivum</i> seed flour which is served to all the devotees at the culmination of ceremony (116).	116	0.6	
44	<i>Centella asiatica</i> (L.) Urb. Family:Apiaceae Accession No.:HBJU-17582	Brahami	Herb	Leaves	SMR	SRR	Fresh leaves are crushed and mixed with water to form a sacrament, known as <i>charanamata</i> , in the temple (30).	30	0.2	
45	<i>Chaerophyllum villosum</i> Wall. ex. DC. Family:Apiaceae Accession No.:HBJU-16759	Handori	Herb	Aerial parts, leaves	MED	Skin problems	Leaves are crushed and rubbed against the skin as a remedy for skin allergy caused due to contact with <i>Toxicodendron succedaneum</i> , an allergic tree (38).	38	0.2	Carminative [4].
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	78	0.4	
46	<i>Chenopodium album</i> L. Family:Amaranthaceae Accession No.:HBJU-16753	Kunha/Bathu	Herb	Leaves	MED	Digestive problems	Leaf vegetable is consumed in case of constipation (48).	48	0.2	Stomach pain [52].
					EDB	Vegetable	Cooked as vegetable, nutraceutical.	100	0.4	[1,6,11,12,16,38,40,50,64,69,75,78,81,85,87,92,95,102].

47	<i>Chenopodium foliosum</i> Asch. Family:Amaranthaceae Accession No.:17788	Jherad	Herb	Leaves	EDB	Vegetable	Cooked as vegetable.	96	0.4	New Record
48	<i>Chrysojasmium humile</i> (L.) Banfi. Family:Oleaceae Accession No.:HBJU-17565		Herb	Flowers	MED	Skin problems	Juice obtained by crushing flowers is applied externally in case of skin rashes and itching (27).	27	0.1	Mouth freshner [63].
49	<i>Cichorium intybus</i> L. Family:Asteraceae Accession No.:HBJU-16770		Herb	Leaves	EDB	Vegetable	Cooked as vegetable.	112	0.5	[1,38,40,50,69,78,81,100]
50	<i>Citrus limon</i> (L.) Osbeck. Family:Rutaceae Accession No.:HBJU-17776	Nimbu	Tree	Fruits	SMR	MBE	The fruits of <i>Citrus limon</i> and <i>Capsicum annum</i> and a piece of charcoal are tied together with a thread and hanged over the entrance doors of houses to keep the demons and bad evil away (12).	12	0.1	
51	<i>Clematis montana</i> Buch.-Ham. ex DC. Family:Ranunculaceae Accession No.:HBJU-17571		Climber	Leaves	MED	Digestive problems	Leaf powder is prescribed in case of digestive problems (6).	8	0	Fever, poisonous sting, diabetes, urinary diseases [30,52].
						Endocrine, metabolic and nutritional problem	Leaf powder is taken internally in case of diabetes (2).			
52	<i>Crataegus songarica</i> K.Koch. Family:Rosaceae Accession No.:HBJU-16851	Pendakh	Tree	Fruits	MED	Digestive problems	Fruits are eaten as laxative (8).*	8	0	Hypertension [99].
					EDB	Raw	Fruits eaten raw, nutraceutical.			
53	<i>Curcuma longa</i> L. Family:Zingiberaceae Accession No.:HBJU-17777	Haldar	Herb	Rhizome	MED	General and unspecified	Rhizome powder (turmeric) is mixed with luke warm milk and given orally to the affected person immediately after he suffers internal injury (14). Turmeric powder pasted in mustard oil is applied locally in	54	0.3	Snake bite [55].

							case of injury (40).			
					VET	General	Turmeric powder pasted in mustard oil is applied locally in case of injury (127).	127	0.6	Internal injury, wound, blood in excreta, fever, FMD, fracture, broken horn, joint problem [27,44,48,51,72,74,104].
					SMR	SCR	Powdered rhizomes of <i>Curcuma longa</i> are mixed with wheat flour and a semi solid batter with pouring consistency, locally known as <i>lopri</i> , is prepared which is applied on the hands, arms, feet and legs of bride and bridegroom on day of Mehandi (32).	32	0.2	
54	<i>Cydonia oblonga</i> Mill. Family:Rosaceae Accession No.:HBJU-16905	Baei	Tree	Fruits, seeds	MED	Digestive problems	Seeds are recommended orally as a remedy for chronic dysentery (44).	44	0.2	Boils, throat infection, diarrhea, dysentery, constipation, bowel pain, jaundice, respiratory disorder, asthma, expectorant, cough, cold, weakness of heart, cardiac stimulant, dandruff, hair health, chapped skin, itching, astringent, tonic, birth problems, fever, blood purifier, chest problems, body weakness, muscular pain [49,53,56,61,62,83,93,99]
					EDB	Raw	Fruits eaten raw.	82	0.3	
					SMR	SRR	Fruits are fixed on the tridents which are offered to local deities (74).	74	0.4	
55	<i>Cynodon dactylon</i> (L.) Pers. Family:Poaceae Accession No.:HBJU-17569	Darub	Herb	Aerial parts	SMR	SRR	It is considered as highly sacred plant and is used in different social and religious ceremonies. On the occasion of 12th day ceremony, (locally known as <i>barola</i>) of new born baby, the father of baby keeps this sacred grass in his turban as a good omen (37). Aerial parts are placed in cooked food items during solar eclipse to protect the food from harmful effect of the eclipse (25).	380	2.1	

							Ganga jal is sprinkled inside the house with aerial parts of this plant to purify the house (28).			
					SCR		Aerial parts are tied together with kautuka (<i>mouli</i>) thread, dipped in mustard oil and touched three times on the head of bride as well as groom by their all relatives one by one while solemnising an important wedding ceremony locally known as <i>shandi (telai)</i> (225). On mehendi day a small quantity of mehendi alongwith this grass and some other articles are gifted by groom's family to bride's family (65).			
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	132	0.6	
56	<i>Cynoglossum lanceolatum</i> Forssk. Family: Boraginaceae Accession No.: HBJU- 16779	Nikki kithdi	Herb	Aerial parts, leaves	MED	Skin problems	The leaf paste is applied externally around the centre of hard skin boils or furuncles which reduces swelling and cures boils by extracting pus (78).	84	0.4	Anti allergic, swelling, vomiting [5].
						General and unspecified	Fresh leaves are ground to paste which is applied externally on affected parts for wound healing (6).			
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	12	0.1	
57	<i>Cynoglossum wallichii</i> G. Don. Family: Boraginaceae Accession No. HBJU- 16780		Herb	Aerial parts	MED	General and unspecified	Aerial parts are pounded into paste which is applied externally for wound healing (30).	30	0.1	Cough, swelling, vomiting [3].
58	<i>Dactylorhiza hatagirea</i> (D. Don) Soo. Family: Orchidaceae	Salam panja	Herb	Roots	MED	Musculoskeletal problems	The roots of <i>Xanthium strumarium</i> and <i>Dactylorhiza hatagirea</i> are rubbed on a flat stone (locally known as <i>shill</i>) to form a thin paste in which	44	0.2	Sexual problems [21].

	Accession No.:17590						1-2 drops of seed oil of <i>Prunus armeniaca</i> are added. The affected parts are gently massaged with this thin paste to alleviate orthopaedic and rheumatic pain (44).			
59	<i>Daphne oleoides</i> Schreb. Family:Thymelaeaceae Accession No.:HBJU- 16876	Kashadi	Shrub	Leaves, Roots	MED	Pregnancy, child bearing and family planning (women).	The whole fresh root is used as vaginal suppository for abortion within 2-3 months of conception (2)*.	9	0	Aperient, cuts and wounds, antiphlogistic, abscess, boils [42,45,76].
						Skin problems	The leaf paste is applied externally around the centre of skin boils or furuncles which reduces swelling and cures boils by extracting pus (7).			
					FOD	Fresh	Leaves are used as fodder/forage for cattle.	10	0.1	
60	<i>Datura stramonium</i> L. Family:Solanaceae Accession No.:HBJU-16873	Dheintu ra	Herb	Leaves, Seeds, flowers	MED	Musculoskeletal problems	Dried seed powder pasted with cow urine is applied topically on joints to alleviate arthritis pain (10). The entire fresh leaf is warmed and wrapped around joints for the same purpose. 2-3 seeds are ground and used as one of the ingredients in tea which is taken as a treatment for arthritis (4).	14	0.1	Narcotic, body pain, toothache, asthma, loss of hair, dandruff, antiseptic, boils, frost bite, sciatica, mastitis, piles, rheumatism, arthralgia, dental caries, neuralgia, blood impurity, treat swelling, prevent miscarriage, otalgia, urinary infection, poisonous insect bite, body part inflammation, dandruff, cough, cold & sneezing, wounds [86,53,91,65,32,36,93,89,56,36,99,67, 45,98,96,82,42]
					SMR	SRR	Flowers are offered to Bhagwan Shiv Ji during solemnisation of <i>nuala</i> (Shiv pooja) ceremony (100).	100	0.6	
61	<i>Delphinium roylei</i> Munz. Family:Ranunculaceae Accession No.:17789	Mori	Herb	Seeds	MED	Skin problems	Seeds are pounded into paste which is applied topically in case of skin eruptions (13).	13	0.1	Tooth ache [53,61].
62	<i>Dendrocalamus</i> mus	Baans	Tree	Stem	SMR	MBE	A sacred bamboo stick bearing 7	26	0.1	

	<i>strictus</i> (Roxb.) Nees. Family:Poaceae Accession No.:NL						joint, locally known as <i>khori</i> , is used to rid a haunted house of the ghosts and evil powers. One person tightly holds the stick with his one hand and the shaman recites sacred incantations in front of stick. The stick starts moving under the influence of incantations and guides the person holding it to the place where evil spirit, locally known as <i>jadu</i> , is located which is dug out from the floor by the shaman and burnt in open (26).			
63	<i>Desmodium elegans</i> DC. Family:Fabaceae Accession No.:HBJU-16796	Pree	Shrub	Branches, leaves	MED	Digestive problems	Tender twigs are chewed as datun for preventing gum bleeding (22).	22	0.1	Cuts, teeth cleaning, wounds [13].
					PUP	Miscellaneous Products	Beedi (18).	18	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for cattle.	106	0.5	
64	<i>Desmostachya bipinnata</i> (L.) Stapf. Family:Poaceae Accession No.:17790	Darba	Herb	Leaves	SMR	SRR	This is a sacred plant which is considered as manifestation of Brahama, Vishnu and Mahesh. The finger ring made from its leaves is worn by the worshipper while performing pooja or yajana ceremony as a symbol of purity and sanctity. A few leaves are placed on the floor under the mat before starting pooja which symbolises seat (<i>aasan</i>) for pooja (118).	130	0.7	
						TAB	Gaddis and Sippis don't trample or sit on this grass as they believe that Bhagwan Ram used this plant as bedding for sleeping during exile (12).			
65	<i>Dicliptera</i> <i>sps.</i> Family:Acanthaceae	Fukhina eri-dawa	Herb	Aerial parts	MED	General and unspecified	Aerial parts are ground to paste which is applied externally to treat	7	0	

	Accession No.:HBJU- 16746						fire burns (7).			
66	<i>Digitalis purpurea L.</i> Family:Plantaginaceae Accession No.:16827	Ghanti	Herb	Flowers	PUP	Miscellaneous Products	Flowers are crushed, mixed with water which is sprayed as pesticide in the kitchen gardens (9).	9	0	
67	<i>Dioscorea deltoidea Wall. ex Griseb.</i> Family:Dioscoreaceae Accession No.:HBJU-16791	Kins	Climber	Aerial parts, rhizome	PUP	Miscellaneous Products	Rhizome, locally known as kins, used as soap for washing clothes (23).	23	0.1	
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	15	0.1	
68	<i>Diospyros lotus L.</i> Family:Ebenaceae Accession No.:HBJU-16792	Amlook	Tree	Fruits	EDB	Raw	Fruits eaten raw.	82	0.3	[1,11,64,78,85].
69	<i>Dipsacus inermis Wall.</i> Family:Caprifoliaceae Accession No.:HBJU-16784	Thanthana	Herb	Aerial parts, leaves	MED	Eye problems	Fresh leaves in early stage are eaten as vegetable for improving eye sight (42)*.	42	0.2	Tightening of blood vessels, cough, sore throat, weakness, swelling, skeletal muscular disorder, pain [33,67,80,83,91].
					EDB	Vegetable	Fresh leaves are cooked as vegetable, nutraceutical.	66	0.3	[6,12,14,18,38,68,78,81,97,100].
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	16	0.1	
70	<i>Dodonaea viscosa Jacq.</i> Family:Sapindaceae Accession No.:HBJU- 17778	Santha	Shrub	Leaves	VET	Musculoskeletal	The whole leaves are warmed on the griddle and tied around the joints of cattle in case of arthritis (100).	100	0.5	Intestinal worms [2,9].
71	<i>Dolomiaea costus (Falc.) Kasana & A.K. Pandey.</i> Family:Asteraceae Accession No.:HBJU-17021	Kuth	Herb	Roots	MED	Musculoskeletal problems	The affected body parts are massaged with dry root powder mixed with mustard oil for getting relief from orthopaedic and rheumatic pain (98).	98	0.5	Rheumatism, arthritis, joint swelling, scabies, acne, boils, blister, cold, cough, asthma, toothache, urinary problem, analgesic, antipyretic, paralysis, gastrointestinal disorder, applied on wounds as insecticidal, sole ulcers, leprosy, ear ache [28,42,53,65,79,80,82,83,

										86,89,93,96,98].
					VET	Musculoskeletal problems	The above formulation is given as a dose to cows and bulls as a treatment of arthritis, locally known as <i>granu</i> , a disease with joint pain symptoms (74)*.	146	0.7	Cold [29].
						Respiratory/pulmonary problems.	The above formulation is given orally to cattle in case of cough (36)*.			
						Digestive problems	The above formulation is given internally to the cattle as a remedy for diarrhoea and dysentery (36)*.			
72	<i>Dolomiaea macrocephala</i> DC. ex Royle. Family:Asteraceae Accession No.:HBJU-16771	Deshi dhoop	Herb	Roots	MED	Skin problems	Root is pounded into paste which is mixed with jaggery and salt and applied on the skin for extraction of pricked plant spines and thorns from the body (28) Root paste is applied topically for treatment of hard skin boils which makes the pus ooze out from centre of the boils (16).	44	0.2	Eyesight [86].
					PUP	Miscellaneous Products	Roots used as <i>Deshi dhoop</i> (55).	55	0.2	
					SMR	SRR	The dried roots are burnt as incense in the red hot cinder placed in a small bowl like earthen pot with handle, locally known as <i>daeru</i> , for worshipping family diety and local dieties and purifying air (160).	160	0.9	
73	<i>Drepanosta chyum falcatum</i> (Nees) Keng f. Family:Poaceae Accession No.:HBJU-17567	Kalam	Shrub	Stem	PUP	Miscellaneous Products	<i>Kalam</i> (pen) is made from the stem (9).	9	0	
74	<i>Duchesnea indica</i> (Andrew) Focke. Family:Rosaceae	Gilad	Herb	Fruits	EDB	Raw	Fruits eaten raw.	49	0.2	[12,14,16,37,38,64,75,85]

	Accession No.:HBJU-16852									
75	<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants. Family:Amaranthaceae Accession No.:HBJU- 16900	Bawase erari-dawa	Herb	Aerial parts, leaves	MED	General and unspecified	Leaves are crushed and kept in water overnight and the water is taken internally next morning empty stomach as a treatment for piles (104)*.	104	0.5	Malaria, cholera, dandruff [45,90].
					VET	Digestive	Leaves are crushed, mixed with maize dough and given orally to cattle for intestinal deworming (80).	80	0.4	Intestinal worms [15].
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	8	0	
76	<i>Elaeagnus umbellata</i> Thunb. Family:Elaeagnaceae Accession No.:HBJU-16793	Ban kanak	Shrub	Fruits	EDB	Raw	Fruits eaten raw.	57	0.2	[12,14,38,78,85,92].
77	<i>Elwendia persica</i> (Boiss.) Family:Apiaceae Accession No.:HBJU-17022	Kala Zeera	Herb	Seeds	EDB	Flavouring agents	Used as spice.	74	0.3	[78,97,100].
78	<i>Erigeron bonariensis</i> L. Family:Asteraceae Accession No.:HBJU-16772	Jhao	Herb	Aerial parts, leaves	MED	Digestive problems	The leaf paste is made into small balls which are consumed with sugar crystals (<i>mishri</i>) or jaggery (<i>gud</i>) to cure bloody dysentery (42)*.	42	0.2	Urinary tract infection, heart burn sensation [32,90].
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	100	0.5	
79	<i>Euphorbia helioscopia</i> L. Family:Euphorbiaceae Accession No.:HBJU- 17556	Dudhli	Herb	Latex	MED	Skin problems	Latex applied externally for removal of skin warts (11).	11	0.1	Skin fungal infection, ringworm, skin eruptions, warts, indigestion, constipation, deworming, expectorant, diaphoretic [45,49,62,65].
80	<i>Euphorbia heterophylla</i> L. Family:Euphorbiaceae Accession No.:HBJU-	Dudhli	Herb	Latex	MED	Skin problems	Latex applied externally for treatment of skin warts (10).	10	0.1	New Record

	17557									
81	<i>Euphorbia pilosa</i> L. Family:Euphorbiaceae Accession No.:HBJU-17558		Herb	Latex	MED	Skin problems	Latex applied externally for treatment of skin warts (10).	10	0.1	Fistula sore [42].
82	<i>Fagopyrum cymosum</i> (Trevir.) Meisn. Family:Polygonaceae Accession No.:HBJU-16835	Fafra	Herb	Aerial parts, leaves	MED	Digestive problems	Vegetable of fresh leaves is prescribed as a liver tonic and as remedy for mouth sores, bitterness of mouth and loss of appetite (90)*.	90	0.4	Rheumatic pain, lung diseases, urinary diseases, treat hypertension [42].
					VET	Foot & Mouth disease	Aerial parts are ground to paste which is given orally to cows, bulls, goats and sheep for treatment of Foot and Mouth Disease, locally known as <i>kharedu</i> (148).	148	0.7	New Record
					EDB	Vegetable	Leaves are cooked as vegetable, nutraceutical.	121	0.5	[64,75,92].
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	78	0.4	
83	<i>Fagopyrum esculentum</i> Moench. Family:Polygonaceae Accession No.:HBJU-17779	Fulan	Herb	Aerial parts, seeds	VET	General and unspecified	Aerial parts boiled in water, locally known as <i>darakal</i> , are served to the cows and buffaloes as galactagogue for increasing lactation (49)*.	49	0.2	Liver problem [44].
					SMR	SRR	A semi solid batter of <i>Fagopyrum esculentum</i> flour with pouring consistency is spread evenly on the griddle to form a thin circular crepe, locally known as <i>thaplu</i> , which is eaten by the devotees during religious fasting (106).	106	0.6	
84	<i>Ficus palmata</i> Forssk. Family:Moraceae Accession No.:HBJU-16819	Fagra	Shrub	Latex, aerial parts, branches, fruits	MED	Digestive problems	Fresh tender twigs are chewed in case of tooth ache (10)*.	34	0.2	Digestive, astringent, diuretic, tonic, constipatin, laxative, lung infection, bladder diseases, wound healing, styptic, absceses, ooze out thorn, bone inflammation, bladder infection, piles [34,36,42,46,62,76,77,91]
						Skin problems	A small cut is made in the wart on Friday to let 1-2 drops of blood come out. Stem latex is then applied topically to get rid of warts*. Stem latex is also applied externally on skin for extraction of pricked plant			

							thorn or spine from the human body (24).			
					VET	Digestive	Branches are burnt as fuelwood, the ash is mixed with maize dough and given orally to cattle in case of bloating (40).	40	0.2	Wounds [9].
					EDB	Raw	Fruits eaten raw.	30	0.1	[1,11,12,14,16,37,38,64,75,78,85,87,92,95,102].
					SMR	SRR	Three small pieces of twigs are tied around a small earthen pot with the help of a piece of thread. The earthen pot is filled with water and used for performing <i>karma</i> ritual of a dead person for first 10 days of death (25).	38	0.2	
						TAB	Although branches are burnt to ash which is used as ethnoveterinary medicine, many Gaddis and Sippis don't burn the wood of <i>Ficus palmata</i> as it is considered inauspicious and bad omen (13).			
					FOD	Fresh, dry	Aerial parts are used as fodder/forage for cattle.	146	0.7	
85	<i>Fragaria vesca</i> L. Family:Rosaceae Accession No.:HBJU-16853	Bhunun u	Herb	Roots, fruits	MED	General and unspecified	Roots are brewed to tea which is taken in case of common cold*. Fruits are eaten as cooling agent (44).	44	0.2	Diuretic, sunburns, blemishes, antipyretic, asthenia, demulcent, prevent abortion, digestive disorder, aperient, laxative, indigestion, irregular bowel movements, dyspepsia, weakness and rheumatism, arthralgia, cooling agent [25,35,42,45,46,47,59,91].
					EDB	Beverages	Roots brewed to tea.	86	0.4	[1,40,50,60,68].
						Raw	Fruits eaten raw, nutraceutical.			
86	<i>Fraxinus excelsior</i> L. Family:Oleaceae Accession No.:HBJU-	Shunu	Tree	Stem, branches, bark	PUP	Tools	Stems and branches are used for making dikhra, hatha, khadavan, naal, rachh, unsan, dabotan1, jandra,	200	0.7	

	16820						maanjan, padetri, randa (130).			
						Atreifacts	Branches are used for making manja (12).			
						Miscellaneous Products	Stem and branches are used for making kaathi and palak (58).			
					SMR	MBE	Bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (54).	54	0.3	
87	<i>Fumaria parviflora</i> Lamk. Family: Papaveraceae Accession No.: HBJU-16825	Pitpapa	Herb	Leaves	MED	Digestive problems;	Leaf powder mixed with water is given orally to new born babies to prevent vomiting, flatulence and to improve digestion (6). Dried leaf powder of <i>Fumaria parviflora</i> either singly or mixed with dried leaf powder of <i>Swertia purpurascens</i> and <i>Ajuga parviflora</i> and dried root powder of <i>Picrorhiza kurroa</i> and <i>Aconitum heterophyllum</i> is prescribed internally as a remedy for loss of appetite, indigestion, liver complaints (32). It is also given in case of bitterness in mouth, mouth sores and ulcers (4)*.	54	0.3	Liver disorder, indigestion [42].
						Neurological problems	The above mentioned powder is also prescribed internally as a remedy for headache (4)*.			
						General and unspecified	The above mentioned powder is also prescribed internally as a remedy for cold and fever (8)*.			
88	<i>Galium aparine</i> L. Family: Rubiaceae Accession No.: HBJU-16865	Chippu	Herb	Aerial parts	MED	Skin problems	Aerial parts are pounded along with cow urine and the resulting thin paste is applied topically for treatment of skin allergy caused due to contact with <i>Toxicodendron</i>	34	0.2	Wounds, stop bleeding, healing, antiseptic, gastrointestinal problems, laxative, diuretic, cooling agent, tetanus, skin diseases, skin allergy and redness, detoxification, anti-

							<i>succedaneum</i> , an allergic tree. This paste is also applied locally as a remedy for cold sore disease of lips and mouth in children locally known as <i>loot</i> (16).			inflammation [28,30,32,42,59,76,80,83,91,98].
						Pregnancy, child bearing and family planning (women).	The above paste is applied locally on the women's bosom for treatment of mastitis (locally known as <i>rang</i>) which is characterised by painful swelling of breast with production of blood-tinged-breast milk by lactating mothers (18).*			
					VET	General and unspecified	Aerial parts are ground to paste which is applied locally on udder of cow for treatment of mastitis, locally known as <i>rang</i> and the symptoms of the disease include udder inflammation, udder pain, reduced milk yield and presence of pus or blood in milk (142)*.	142	0.7	Wound [29,105].
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	78	0.4	
89	<i>Geranium wallichianum</i> D.Don ex Sweet. Family: Geraniaceae Accession No.:HBJU-17562		Herb	Roots	MED	Digestive problems	Roots are chewed in case of gum bleeding and swelling and for maintaining oral hygiene (11).	11	0.1	Tooth ache, gum bleeding, sore throat, diarrhoea, dark circles around eyes, dandruff, skin dryness [42,43,45].

90	<i>Girardinia diversifolia</i> (Link) Friis. Family:Urticaceae Accession No.:HBJU-16878	Motti Aen	Herb	Roots, fibre	MED	Skin problems	Roots of <i>Girardinia diversifolia</i> and <i>Urtica dioica</i> are ground together into paste which is applied externally to treat hard skin boils or furuncles. It reduces swellings and also extracts pus from the boils (84)*.	84	0.4	Swelling, gonorrhoea, applied on skin to boost blood circulation [30,42].
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					VET	Musculoskeletal problems	Roots of <i>Girardinia diversifolia</i> and root bark of young <i>Cedrus deodara</i> tree are pounded together to form a paste which is mixed with black salt and applied externally in case of joint pains and fractures of cattle (120)*.	120	0.6	Red water diseases, Retention of placenta, cuts and wounds [2,9,84].
					PUP	Atreifacts	Jodi (56).	56	0.2	
91	<i>Glycine max</i> (L.) Merr. Family:Fabaceae Accession No.:17009	Moth	Herb	Seeds	SMR	MBE	A mixture of seven seeds and grains generally including <i>Hordeum vulgare</i> , <i>Oryza sativa</i> , <i>Phaseolus vulgaris</i> , <i>Vigna unguiculata</i> , <i>Triticum aestivum</i> , <i>Zea mays</i> and <i>Glycine max</i> , locally known as <i>satanna</i> , is spread inside the house for purification and around the house for protection against ghosts and bad evils (46).	46	0.3	
92	<i>Gossypium hirsutum</i> L. Family:Malvaceae Accession No.:NL	Roon	Shrub	Fibre	SMR	SRR	Cotton fiber obtained from the seeds of the plant is used for making wick of religious lamp (<i>diya</i>) which is burnt during worshipping (90).	90	0.5	
93	<i>Hedera nepalensis</i> K.Koch. Family:Araliaceae Accession No.:HBJU-17544	Kurray	Climber	Aerial parts, fruits	MED	Digestive problems	Fruits are eaten as a treatment in case of constipation (5).	9	0	Stimulant, diaphoretic, rheumatism, cathartic, aperient, abscess, ulcers [32,42,45].
						General and unspecified	Fruits are given in case of fever (4).			
					FOD	Fresh	Aerial parts are used as fodder/forage for cattle.	16	0.1	
94	<i>Hordeum vulgare</i> L. Family:Poaceae Accession No.:HBJU-17031	Jao	Herb	Aerial parts, seeds	VET	Urological problems	Seeds are boiled in water, drained and given orally to cattle as a remedy for hematuria, locally known as <i>luntra</i> (127)*.	127	0.6	General weakness, Galactagogue, blood in excreta, FMD [27].

					PUP	Container s/storage products	Aerial parts are used in making koolhi (45).	45	0.2	
					SMR	SRR	Seeds covered with hull are used as one of the ingredients in <i>havan samagri</i> which is burnt in <i>havan kund</i> (sacred fire) during <i>yajnas</i> (42). Seeds are sown and seedlings, locally known as <i>haryali</i> , are used in pooja and also placed on the turban of priests during <i>Naag Jagra</i> , a local religious festival (28).	116	0.6	
						MBE	A mixture of seven seeds and grains known as <i>satanna</i> , as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46).			
95	<i>Hymenolaena candollei</i> DC. Family:Apiaceae Accession No.HBJU-17543		Herb	Roots	MED	Digestive problems	Roots are pounded into paste which is recommended orally in case of gastric trouble (7).	7	0	Headache, fever [47].
96	<i>Impatiens glandulifera</i> Royle. Family:Balsaminaceae Accession No.:HBJU-16775	Hallu	Herb	Aerial parts, branches, seeds, leaves	EDB	Raw	Seeds eaten raw.	36	0.2	[1,50,78,81].
					PUP	Miscellaneous Products	Tender leaves and branches are used as hand dye, locally known as <i>hallu</i> (70).	70	0.3	
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	74	0.4	

97	<i>Indigofera heterantha</i> Brandis. Family:Fabacea Accession No.:HBJU-16797	Kathu	Shrub	Leaves, stems, aerial parts	MED	General and unspecified	Fresh leaves are chewed to paste and the paste is applied on the cuts and wounds for stopping bleeding and for wound healing (106).*	106	0.5	Antimicrobial, abdominal pain, toothache, tooth caries, halitosis, wounds, styptic, antimicrobial, improve digestion & eyesight, myalgia [35,42,45,47,52,91,93,98,99].
					VET	General and unspecified	Aerial parts are given to cattle for maintaining general health (20).	20	0.1	New Record
					PUP	Tools	Lath is made from stem (20).	38	0.1	
						Miscellaneous Products	Beedi and chubdi are made from stem (18).			
					SMR	SRR	Tender stems are used for tying together the small pieces of finely split, resinous softwood of <i>Cedrus deodara</i> , locally known as <i>jangni</i> , which are set on fire to form a wooden fire torch used in <i>Jagra</i> , a religious ceremony devoted to <i>Nag devta</i> (22).	22	0.1	
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	160	0.8	
98	<i>Inula racemosa</i> Hook. F. Family:Asteraceae Accession No.:HBJU-17546		Herb	Roots	MED	Musculoskeletal problems	Root paste is applied topically to subside orthopaedic pain (20).	20	0.1	Rheumatism, joint pain, wounds, insecticidal, stomach ache [42,53].
99	<i>Ipomoea batatas</i> (L.) Lam. Family:Convolvulaceae Accession No.:HBJU-17553	Shakar kandi	Herb	Roots	VET	Pregnancy and calving	The underground root tuber is crushed and administered orally to cows for expulsion of retained placenta after calving (23).	23	0.1	New Record

100	<i>Ipomoea purpurea</i> (L.) Roth. Family:Convolvulaceae Accession No.:HBJU-17554		Climber	Aerial parts, flowers	VET	General and unspecified	Flowers are crushed and given orally to cows to increase the lactation (32).	32	0.2	New Record
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	60	0.3	
101	<i>Isodon rugosus</i> (Wall. ex Benth.) Codd. Family:Lamiaceae Accession No.:HBJU-16807	Kothal	Shrub	Aerial parts, leaves, stems	MED	Digestive problems	Fresh leaves of <i>Isodon rugosus</i> and <i>Oxalis corniculata</i> are crushed together and administered orally in case of gastric ailments, indigestion, abdominal pain, flatulence, loss of appetite and for intestinal deworming (40).	108	0.5	Foot fever, stomachache, diarrhea, snake bite [79,80].
						Endocrine, metabolic and nutritional problem	Fresh leaves of <i>Artemisia vestita</i> and <i>Isodon rugosus</i> are crushed and taken together as a remedy for diabetes (38)*.			
						General and unspecified	Leaves are boiled in water which is then filtered and the filtrate is applied in the hair just like hair oil after washing hair with cow urine for preventing hair loss and greying of hair (30)*.			
					PUP	Tools	Stems are used for making <i>loath</i> (53).	53	0.2	
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	25	0.1	
					102	<i>Jasminum officinale</i> L. Family:Oleaceae Accession No.:HBJU-16821	Suin	Climber	Stems, aerial parts	PUP
Miscellaneous Products	<i>Chubdi</i> is made from stem (25).									

					SMR	SRR	Tender stems are used for tying together the small pieces of finely split, resinous softwood of <i>Cedrus deodara</i> , locally known as <i>jangni</i> , which are set on fire to form a wooden fire torch used in <i>Jagra</i> , a religious ceremony devoted to <i>Nag devta</i> (22).	22	0.1		
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	55	0.3		
103	<i>Juglans regia</i> L. Family:Juglandaceae Accession No.:HBJU-16902	Akhod	Tree	Stem, branches, bark, leaves, seeds	MED	Digestive problems	Teeth are brushed with dried stem bark and fresh leaves. It helps in gum protection and maintaining oral health (44).	62	0.3	Tooth infection, plaque, oral hygiene, strengthen gums, hypertension, asthma, dry cough, cure frost bite, hair fall, alopecia, grey hair, hair dye, chillblain, rheumatism, joint pains, internal fever, headache, giddiness, feeble & falling pulse, extreme coldness, diarrhea, constipation, antihelmintic, severe biliousness, tuberculosis, leucorrhoea, memory enhancer, wound healing, treat fungal infections [35,36,39,42,43,45,47,49, 56,61,91,93,96,99].	
						General and unspecified	Fresh bark is pounded into paste which is applied topically in case of alopecia areata, locally known as <i>bal-chara</i> . Seed kernel eaten raw as a brain tonic (18).				
					EDB	Raw	Seed kernel eaten raw, nutraceutical.	123	0.5		[11,12,14,38,50,64,71,75, 78,85,92,100].
					PUP	Tools	Charkha, hatha, rachh, kuranu, randa are made from stem and branches (402).	450	1.6		
					Miscellaneous Products		Palak is made from stem and branches (48).				

					SMR	SRR	3-4 seeds of walnut are dipped in sacred water vessel (<i>kalash</i>) while performing pooja on different occasions and served as sacrament (<i>prasad</i>). Seeds are also used in <i>Yajna</i> (sacred fire) (116).	116	0.6	
104	<i>Jurinea heteromalla</i> (D.Don) N.Garcia, Herrando & Susanna. Family:Asteraceae Accession No.:HBJU-17547	Shamtu	Herb	Roots	EDB	Raw	Roots eaten raw	53	0.2	New Record
105	<i>Koenigia polystachya</i> (Wall. ex Meisn.) T.M.Schust. & Reveal. Family:Polygonaceae Accession No.:HBJU-16837	Amthilla	Herb	Branches, aerial parts, roots	MED	Digestive problems	Fresh tender twigs are sour in taste and are eaten in case of liver heat (16). The external covering of roots is removed and then cooked as vegetable which is prescribed as an appetizer and liver tonic (12).	28	0.1	New Record
					VET	Foot & Mouth disease	Aerial parts are administered orally to cattle in case of foot and mouth disease (107).	107	0.5	New Record
					EDB	Vegetable	The external covering of roots is removed and then cooked as vegetable, nutraceutical.	63	0.3	New Record
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	52	0.3	

106	<i>Lagenaria</i> sps. Family:Cucurbitaceae	Bibdi	Climber	Fruits	SMR	SCR	While solemnising the <i>Jogi</i> or <i>yagnopavit (janaeu)</i> ceremony in boys' marriage, the dried fruit of <i>Lagenaria</i> sps. (locally known as <i>bibdi</i>) is tied with a rope on back of groom and covered with a local grass broom (<i>boukari</i>) which is held firmly in hand by the grooms assistant (<i>patmara</i>) (66).	66	0.4	
107	<i>Macrotylom a uniflorum</i> (Lam.) Verdc. Family:Fabaceae Accession No.:HBJU-17780	Kulth	Herb	Seeds	MED	Urological problems	Seeds boiled in water and decoction taken internally in case of kidney stone (15).	15	0.1	New Record
108	<i>Malus domestica</i> (Suckow) Borkh. Family:Rosaceae Accession No.:HBJU-17574	Cho	Tree	Fruits	SMR	SRR	Fruits are fixed on the trident and also offered to God during worship (108).	108	0.6	
109	<i>Malva neglecta</i> Wallr. Family:Malvaceae Accession No.:HBJU- 16815	Sonchal	Herb	Leaves	MED	Digestive problems	Leaf vegetable is prescribed as a remedy for constipation (28).	28	0.1	Appetiser, cough, nerve tonic, stomach cramps, ulcers, wounds [20].
					EDB	Vegetable	Cooked as vegetable, nutraceutical.	125	0.5	[14,18,40,69,78,81]
110	<i>Malva parviflora</i> L. Family:Malvaceae Accession No.:HBJU-16816	Sonchal	Herb	Leaves, branches	MED	Digestive problems	Soft tender twig is used as rectal suppository in case of constipation in children (12)*. Leaf vegetable is also prescribed as a remedy for constipation (4)*.	16	0.1	Cold, cough, pyrexia [35].

					EDB	Vegetable	Leaves are cooked as vegetable, nutraceutical.	124	0.5	[1,38,64,75,85,87,92].
111	<i>Malva sylvestris</i> L. Family:Malvaceae Accession No.:HBJU-16817	Sonchal	Herb	Leaves	MED	Digestive problems	Leaf vegetable is prescribed as a remedy for constipation (18).	18	0.1	Stomach cramps, nervic tonic [35]
					EDB	Vegetable	Cooked as vegetable, nutraceutical (8).	124	0.5	[1,6,11,81].
112	<i>Meconopsis aculeata</i> Royle. Family:Papaveraceae Accession No.:HBJU-17566		Herb	Flowers	MED	General and unspecified	Decoction of the flowers is used as antiseptic for washing wounds (10).	10	0.1	Wound washing, antiseptic [26].
113	<i>Melia azedarach</i> L. Family:Meliaceae Accession No.:HBJU-16818	Darenk	Tree	Aerial parts, leaves, branches	MED	Urological problems	Crushed leaves are eaten as cooling agent and for easy passing out of urine in case of difficulty in urinating (50)*.	50	0.2	Antiseptic, snake bite, maintain blood sugar level, antipyretic, stomachache, anthelmintic, dysentery, headache, antidandruff, scabies, skin eruption [25,36,42,45,52,91,93].
					PUP	Tools	<i>Unsan</i> is made from branches (16).	16	0.1	
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	10	0.1	
114	<i>Mentha arvensis</i> C.Presl. Family:Lamiaceae Accession No.:HBJU-16808	Potna	Herb	Leaves	MED	Digestive problems	Fresh or dried leaves are crushed and mixed with curd which is taken orally for treatment of flatulence and loose motions (40). Dried leaves are used as condiment in fried rice which are eaten with curd for the same purpose (4).	44	0.2	Asthma, cough, cold, indigestion, diarrhea, gastroenteritis, flatulence, aperients, abdominal spasm, appetizer, acidity, joint pain, rheumatism, headache [43,76,79,80,96,99].
					EDB	Chutney	Chutney is made from leaves (114).	137	0.6	[12,14,38,50,85].
Flavouring agents	Leaves used as condiment, nutraceutical (23)									

115	<i>Mentha longifolia</i> (L.) L. Family:Lamiaceae Accession No.:HBJU-16809	Maldhei	Herb	Roots, leaves, aerial parts	MED	Digestive problems	Roots are used as a spice in cooked watery rice (<i>kachoti</i>) which are eaten as a cure for gastric troubles, loose motions, flatulence and for deworming. Chutney is made from leaves which is eaten in case of loose motions and gastric upset (40).	40	0.2	Abdominal pain, flatulence, aperients, abdominal spasm, indigestion, dysentery, diarrhoea, vomiting, carminative, liver problem, rheumatism, cooling effect, body pain, bad breath, respiratory tract disorder, asthma, cough, fever, headache, tonsils, diabetes, heart problem, stimulant [25,33,35,42,46,62,65,76,79,80,89,91,93,96].
					EDB	Chutney	Chutney is made from leaves.	129	0.5	[1,11,12,16,40,60,64,69,75,78,87,92,100,102]
						Flavouring agents	Leaves used as condiment, nutraceutical.			
FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	18	0.1						
116	<i>Mentha spicata</i> L. Family:Lamiaceae Accession No.:HBJU-16810	Potna	Herb	Leaves	MED	Digestive problems	Fresh or dried leaves are crushed and mixed with curd which is taken orally for treatment of flatulence and loose motions (6). Dried leaves are used as condiment in fried rice which are eaten with curd for the same purpose (18).	24	0.1	Diarrhoea, flatulence, nausea, vomiting [3].
					EDB	Chutney	Chutney is made from leaves.	123	0.5	[73,78,95].
						Flavouring agents	Leaves used as condiment, nutraceutical.			
117	<i>Morus alba</i> L. Family:Moraceae Accession No.:HBJU-16820	Toot	Tree	Fruits, leaves, branches	EDB	Raw	Fruits eaten raw.	80	0.3	[1,11,12,38,40,50,60,64,70,73,75,78,81,85,87,102].
					PUP	Tools	Branches are used for making bongadi and soti (83).	83	0.3	

					SMR	SRR	An oblation of the plant is made to the God by offering 108 small pieces of twigs one by one in the yajna (60).	60	0.3	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	76	0.4	
118	<i>Morus nigra</i> L. Family:Moraceae Accession No.:HBJU-17564	Kala Toot	Tree	Fruits, leaves, branches	EDB	Raw	Fruits eaten raw.	61	0.3	[11,12,38,64,78,81,85,95]
					PUP	Tools	Branches are used for making bongadi and soti (21).	21	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	20	0.1	
119	<i>Nardostachys jatamansi</i> (D.Don) DC. Family:Caprifoliaceae Accession No.:HBJU 16785	Pernahni/mur mah	Herb	Roots	MED	Digestive problems	Root powder mixed with leaf powder of <i>Ajuga parviflora</i> is taken orally for treatment of gastric troubles, indigestion and loss of appetite (58)*.	58	0.3	Nerve unrest, eye diseases, blood and liver problems, tranquilizer, abdominal pain, heart disease, Skeletal muscular, dermatological disorder, vermicide [35,83,89,91,96,98].
					PUP	Miscellaneous Products	Roots are used as <i>Pernahni</i> (54).	54	0.2	
					SMR	SRR	Dried roots are crushed and used as an ingredient in havan samagri (52).	52	0.3	
120	<i>Nasturtium officinale</i> W.T Aiton. Family:Brassicaceae Accession No.:HBJU-16781	Loot-ari-dawa	Herb	Aerial parts, leaves	MED	Skin problems	Leaves are ground alongwith with cow urine to form a thin paste which is applied locally as a remedy for cold sore disease of lips and mouth in children, locally known as <i>loot</i> (20).*	20	0.1	Mumps, stomach cramps, appetizer [42,79,80,91].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	57	0.3	

121	<i>Nicotiana tabacum</i> L. Family:Solanaceae Accession No.:HBJU-17781	Tamaku	Herb	Aerial parts	VET	Skin problems	Aerial parts are crushed, boiled in water and decoction applied topically in case of mange of goat and sheep, locally known as <i>chaid</i> * (151).	151	0.7	Myiasis, wounds, external parasites, maggots [9,27,57].
122	<i>Ocimum basilicum</i> L. Family:Lamiaceae Accession No.:HBJU-16811	Kudmali	Herb	Seeds, aerial parts	MED	Digestive problems	Seeds are soaked in water overnight and consumed in the morning as a treatment for digestive problems (40).	56	0.3	Cooling effect, digestive [36].
						Urological problems	Water soaked seeds are consumed in case of burning micturition (16)*.			
					SMR	SRR	It is considered as a pious plant and aerial parts are offered to the God while worshipping (90).	90	0.5	
123	<i>Ocimum tenuiflorum</i> L. Family:Lamiaceae Accession No.:HBJU-17782	Tulsi	Herb	Aerial parts, leaves	MED	Respiratory problems	Leaves are used in making tea which is taken internally as a remedy for cough, cold, throat irritation (26).	26	0.1	Respiratory troubles, bronchitis, Pharyngitis, flatulence, antipyretic [35,46].
					SMR	SRR	It is a sacred plant and considered as manifestation of goddess Lakshmi. It is grown in the lawns of houses and worshipped to remove negativity from the houses. Aerial parts are offered to the God while worshipping (17). Fresh leaves are crushed and mixed with water to form a sacrament, known as <i>charanamata</i> , in the temple (75).	92	0.5	
124	<i>Olea ferruginea</i> Royle. Family:Oleaceae Accession	Kahu	Tree	Branches, leaves	MED	Digestive problems	Tender twigs are chewed as tooth brush, locally known as <i>beedi</i> , for cleaning teeth. It helps in gum protection and maintaining oral hygiene (22).	22	0.1	Toothache, stomachache, antipyretic, whooping cough, throat sore, antidote for scorpion sting, rubefacient [34,42,46,91,93].

	No.:HBJU- 16823				PUP	Tools	Branches are used in making baela, bongadi, chindri, darati, khangu, kuradu, soti and tarnethi (115).	157	0.6	
						Artefacts	Tareda is made from branches (17).			
						Miscellaneous Products	Branches are used as beedi (25).			
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	142	0.7	
125	<i>Orobanche sps.</i> Family:Orobanchaceae Accession No.:HBJU-16824	Baram-ari-dawa	Herb	Roots	MED	General and unspecified	Roots are rubbed on a flat stone along with cow urine to form a paste which is applied topically in order to help healing of infected wounds (locally known as <i>barm</i>) which have developed swelling and redness (10).	10	0.1	
126	<i>Oryza sativa</i> L. Family:Poaceae Accession No.:HBJU-16904	Dhaan	Herb	Aerial parts, fruits	VET	General and unspecified	The outer covering of pods of <i>Vigna mungo</i> and <i>Phaseolus vulgaris</i> and the straw of <i>Triticum aestivum</i> are boiled together in water alongwith a very small quantity of seeds of <i>Phaseolus vulgaris</i> and grains (fruits) of <i>Oryza sativa</i> and <i>Zea mays</i> and the product thus formed, locally known as <i>darakal</i> , is served to the cows as galactagogue for increasing milk yield (18).	18	0.1	Retention of placenta, constipation, hematuria, mange, galactagogue, good health [27,29,44,48,103].
					PUP	Tools	Aerial parts are used in making masheen (32).	188	0.7	
						Artefacts	Chakotu, pand, jodi, poola are made from aerial parts (156).			

				SMR	SRR	Ropes made from paddy straw are used for tying small wooden posts for making bier (<i>arthi</i>), locally known as <i>shidh</i> , on which dead body is carried to the cremation ground (8). Paddy grains are used as one of the ingredients in <i>havan samagri</i> (8). Rice grains and flowers are mixed in water and the goats and sheep are worshipped by sprinkling it in small quantity on their body before sacrificing them. This practice is locally known as <i>patri</i> (21). Straw sleepers (<i>poola</i>) made from paddy straw are used as footwear while performing pooja at specified pooja place (<i>thala</i>) in the house (21).	114	0.6	
					SCR	Paddy grains covered with hull are roasted and showered by the brother of bride on bride and groom while they circumambulate the sacred fire 7 times exchanging their marital vows when the wedding is solemnised (10).			
					MBE	A mixture of seven seeds/grains known as <i>satanna</i> , as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46).			

127	<i>Oxalis corniculata</i> L. Family:Oxalidaceae Accession No.:HBJU-16825	Amloodi	Herb	Leaves, aerial parts	MED	Cardiovascular	Fresh leaves are eaten in case of syncope or fainting (19)*.	99	0.5	Tonic, diarrhea, dysentery, abdominal pain, flatulence, appetizer, gum bleeding, jaundice, blood purifier, fever, toothache, halitosis, convulsions, warts, cataract, diuretic, eye sight, eye inflammation, headache, skin allergy, counteract intoxication, antidote, scurvy, convulsion [33,36,42,45,59,61,76,79,93,98].	
						Digestive problems	Fresh leaves are eaten raw together with leaves of <i>Isodon rugosus</i> as a treatment for gastric ailments, indigestion, abdominal pain, flatulence, loss of appetite. Chutney made from leaves is consumed in case of indigestion and gastric upset (80).				
						VET	Foot & Mouth disease	Aerial parts are ground to paste which is given orally to cows, bulls, goats and sheep for treatment of Foot and Mouth Disease, locally known as <i>kharedu</i> (120)*.	120	0.6	Scabies, warts, skin disorders [2,9].
						EDB	Chutney	Chutney is made from leaves, nutraceutical (40).	67	0.3	[1,11,12,14,16,37,38,64,68,75,78,85,87,92].
							Raw	Leaves eaten raw (27).			
FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	77	0.4							
128	<i>Oxyria digyna</i> (L.) Hill. Family:Polygonaceae Accession No.:HBJU-	Chukru	Herb	Leaves, aerial parts	MED	Digestive problems	Leaves cooked as vegetable and eaten in case of scurvy and as liver tonic and appetiser (82)*.	82	0.4	Cooling agent [42].	

	16838				VET	Foot & Mouth disease	Aerial parts are pounded into paste which is given orally to cows, bulls, goats and sheep for treatment of Foot and Mouth Disease, locally known as <i>kharedu</i> (56).	56	0.3	New Record
					EDB	Vegetable	Leaves cooked as vegetable, nutraceutical.	50	0.2	[1,6,12,18,38,50,60,68,78,92].
					FOD	Fresh	Aerial parts are used as fodder/forage for goats and sheep.	75	0.4	
129	<i>Parnassia nubicola</i> Wall. ex Royle. Family:Celastraceae Accession No.:HBJU-17552		Herb	Roots	MED	General and unspecified	Root paste is used externally as an antidote against snake bite and for wound healing (10).	10	0.1	New Record
130	<i>Parrotiopsis jacquemontiana</i> (Decne.) Rehder. Family:Hamamelidaceae Accession No.:HBJU-16805	Killar	Tree	Branches, leaves.	MED	Skin problems	Tender twigs are burnt at one end and the burnt end is rubbed on a hard substance so that juice comes out, which is applied externally on the affected parts as a remedy for scabies and skin eruptions (24).	24	0.1	Skin infection and eruptions, dermatitis, general body pain, wound healing [36,39,45,98].
					PUP	Tools	Branches are used in making baela, bongadi, chindri, darati, khangu, kuradu, soti, tarnethi, dingar, latha, shangi and toka (107).			
						Construction Products	Branches are used in making <i>gaien</i> (16).			
					Artefacts	Keed and tareda are made from branches (57).				

					SMR	MBE	The small pox disease, locally known as <i>mata</i> , is regarded as manifestation of goddess <i>Sitla</i> and treated by worshipping the goddess. The patient sleeps over the bedding on the floor and a long sharp edged sickle (<i>darati</i>) with wooden handle made from <i>Parrotiopsis jacquemontiana</i> or <i>Quercus floribunda</i> is kept under his pillow for protection against evil eyes and repelling neagative energy (46).	46	0.3	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	143	0.7	
131	<i>Persicaria hydropiper</i> (L.) Delarbre. Family:Polygonaceae Accession No.:HBJU-	Pipla	Herb	Leaves	MED	Skin problems	Leaves are crushed and rubbed against the skin as a remedy for skin allergy caused due to contact with <i>Toxicodendron succedaneum</i> , an allergic tree (88)*.	88	0.4	Hypertension, jaundice, gastric problem, styptic, antiphlogistic, gastrointestinal problem diarrhoea, bleeding piles, painful menstruation, appetizer [45,83,93].
	16839				VET	Foot & Mouth disease	Leaves are ground to paste which is applied on the lips and inside the mouth of cows and bulls as a treatment of Foot and Mouth disease (119)*.	119	0.6	Tongue infection [15,105].
132	<i>Persicaria nepalensis</i> (Meisn.) Miyabe. Family:Polygonaceae Accession No.:HBJU-16840	Zaharari-Dawa	Herb	Aerial parts, leaves	MED	General and unspecified	Aerial parts are ground along with cow urine to form a paste which is applied topically in order to help healing of infected wounds which have developed swelling and redness (16).	16	0.1	Aantifungal [91].
					VET	Eye problems	Leaf juice is poured into the eyes of cows, bulls, goats and sheep as a treatment for cataract to improve eyesight (96).	96	0.5	New Record

133	<i>Phaseolus vulgaris</i> L. Family:Fabaceae Accession No.:HBJU-16798	Roung	Climber	Fruits, seeds	VET	General	<i>Darakal</i> formed as mentioned above in case of <i>Oryza sativa</i> is served to the cows as galactagogue for increasing milk yield (12).	12	0.1	New Record
					SMR	MBE	A mixture of seven seeds and grains known as <i>satanna</i> , as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46).	46	0.3	
134	<i>Phytolacca acinosa</i> Roxb. Family:Phytolaccaceae Accession No.:HBJU- 16826	Ransag	Herb	Leaves	MED	Digestive problems	Vegetable of tender leaves is recommended for treatment of constipation (20)*.	24	0.1	Rheumatism, eye disease and cough, anti-inflammatory, used as sedative for wound treatment [39,42,80,83,96,98].
						Endocrine, metabolic and nutritional problems	Vegetable of tender leaves is recommended for diabetic patients (4)*.			
						EDB	Vegetable	Tender leaves are boiled in water, drained and cooked as vegetable, nutraceutical.	50	0.2
135	<i>Picrorhiza kurroa</i> Royle ex Benth. Family:Plantaginaceae Accession No.:HBJU-16828	Koud	Herb	Roots	MED	Digestive problems	Dry roots are crushed to powder which is mixed with the dried leaf powder of <i>Swertia purpurascens</i> , <i>Fumaria parviflora</i> and <i>Ajuga parviflora</i> and dried root powder of <i>Aconitum heterophyllum</i> and is prescribed internally as a remedy for loss of appetite, liver complaints (34). It is also used as aremedy for mouth sores and bitterness in mouth (6)*.	52	0.3	Gastrointestinal disorders, abdominal pain, appetizer, antihelminthic, laxative, jaundice, liver disorder, respiratory tract problem, fever, urine infection, coolant, skeletal muscle disorder, tonic [24,35,53,83,96,98].
						General and unspecified	The above formulation is prescribed internally as a remedy for cold and			

							fever (4).			
						Neurological problems	The above formulation is prescribed internally as a remedy for headache (6)*.			
						Endocrine, metabolic and nutritional problems	Root powder is taken orally for treatment of diabetes (2)*.			
					VET	Respiratory	Powder of dry roots is mixed with maize dough and the dose is given orally as a treatment for pneumoniae (117).	117	0.6	Pneumonia, tapeworms, general debility [9,29,103].
136	<i>Pilea umbrosa</i> Wedd. ex Blume. Family:Urticaceae Accession No.:HBJU-16879	Shaunda	Herb	Aerial parts	MED	Skin problems	Aerial parts are ground along with cow urine to form a thin paste which is applied externally as a treatment for shingles, locally known as <i>janaeu</i> (104).	104	0.5	New Record
					VET	General	Aerial parts are fed to the cows as galactagogue (50).	50	0.2	New Record
137	<i>Plantago lanceolata</i> L. Family:Plantaginaceae Accession No.:HBJU-16829	Chapdotri	Herb	Leaves, aerial parts	MED	Eye problems	Leaf juice is extracted by crushing fresh leaves and poured into eyes for improving eyesight, treatment of cataract, redness and irritation in the eyes (44).	82	0.4	Cough ,asthma, bronchitis, urine infection, antiinflammatory, typhoid fever, stomach disorder, stomach acidity, dysentery, laxative, aperient, improve eyesight, hearing problem, skin

						Skin problems	Leaves of <i>Plantago lanceolata</i> and <i>Galium aparine</i> are pounded together into paste which is applied topically in case of painful and itching rashes caused due to contact with the tiny hairs of caterpillars (locally known as <i>padshila</i>) (20)*.			diseases, menorrhagia, joint pains, cardiovascular disorder, styptic, abscess, antiseptic, wounds healing, boils, heart disease, body pain, fever, yoke gall [80,36,39,42,45,53,59,62,65,67,80,82,91,93,96,98,99].
						General and unspecified	Leaves are ground into paste which is applied locally on the injury for stopping bleeding and quick healing (18).			
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	60	0.3	
138	<i>Plantago major</i> L. Family:Plantaginaceae Accession No.:HBJU-16830	Chapdot ra	Herb	Leaves, aerial parts	MED	Skin problems	Fresh leaves are crushed and the juice extracted is applied topically in case of skin allergies caused due to physical contact with certain allergic insects and caterpillars (44)*.	44	0.2	Bloating, irritable bowel syndrome, diarrhoea, dysentery, constipation, acidity, gastric and peptic ulcers, rheumatism, styptic, antiseptic, cuts and wounds, inflammation, bronchitis, asthma, hay fever, urinary problems, kidney infection, sore throat, toothache, boils, reduce swelling and pain [28,35,42,45,53,56,61,79,80,93].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	60	0.3	
139	<i>Poa calliopsis</i> Litv. ex Ovcz. Family:Poaceae Accession No.:HBJU- 17568	Mitha ghaa	Herb	Leaves	EDB	Raw	Leaves are sweet in taste and are eaten raw for their organoleptic properties.	25	0.1	New Record

140	<i>Polygonatum verticillatum</i> (L.) All. Family:Asparagaceae Accession No.:HBJU-16763	Salam Mishri	Herb	Roots	MED	Male genital problems	Roots are crushed and taken internally as an aphrodite and increasing sperm count and libido in men (6)*.	14	0.1	Asthma, tuberculosis [4].
						General and unspecified	Roots are crushed and given orally in case of piles (8)*.			
					VET	Pregnancy and calving	Roots are crushed and given to cows for expelling retained placenta after calving (62).	62	0.3	Galactogague [66].
141	<i>Populus alba</i> L. Family:Salicaceae Accession No.:HBJU-17578	Safeda	Tree	Bark	MED	Musculoskeletal problems	The decoction of the bark is taken internally to alleviate orthopaedic and rheumatic pain (10).	10	0.1	Bone fracture [35].
142	<i>Portulaca oleracea</i> L. Family:Portulacaceae Accession No.:HBJU-16845	Kulfa	Herb	Leaves	MED	General and unspecified	Fresh leaves are ground to paste which is applied topically as a treatment for fire burn (10)*.	10	0.1	Anthelmintic, constipation, burning sensation of stomach, epigastric pain, ulcer, jaundice, febrifuge, bronchitis, improve eyesight, blurred vision, urine infection, kidney stones, cardiovascular disorder, skeletal muscle disorder, hair tonic, headache, acne, chronic pain, liver and heart diseases [35,45,53,62,83,86,96].
					EDB	Vegetable	Cooked as vegetable.	90	0.4	[1,6,38,69,81,85,92,95,97].
143	<i>Potentilla nepalensis</i> Hook. Family:Rosaceae Accession No.:HBJU-17577		Herb	Roots	MED	General and unspecified	Root paste is applied locally for healing fire burns (8).	8	0	Skin burn [42].
144	<i>Prinsepia utilis</i> Royle. Family:Rosaceae Accession No.:HBJU-16854	Jeentay	Shrub	Seeds, branches, leaves, flowers	MED	Musculoskeletal problems	Seed oil is massaged on affected parts for alleviating orthopaedic pain (25).	25	0.1	Rheumatism, tonsillitis, stone, allergies, abdominal pain, muscular fatigue, blood purification & diabetes [30,42,47,55,91,93].

					VET	General	Flowers are crushed, mixed with maize dough and given orally to cattle as a remedy for cough (84).	84	0.4	Digestive disorders, stomatitis, cough [10,44].
					EDB	Miscellaneous	Seed oil is used for cooking purpose.	28	0.1	[37,75].
					PUP	Miscellaneous Products	Branches are used for making chhonka and pichkari (28).	28	0.1	
					SMR	SRR	On the occasion of <i>Kanchoth</i> (Gauri tritya), a local religious festival, the married women use leaves and flowers of <i>Prinsepia utilis</i> for worshipping (102).	146	0.8	
						MBE	Gaddis and Sippis believe that the evil powers become most effective and harmful during 7 days period after <i>Shivratri</i> - a famous Hindu festival. Fresh twigs are hanged over the doors, windows, ventilators and chimneys of houses on the occasion of <i>Shivratri</i> with the belief that it guards the house, keeps the ghosts and demons away and neutralises the evil powers (44).			
					FOD	Fresh	Leaves are used as fodder/forage for the goats.	98	0.5	

145	<i>Prunella vulgaris</i> L. Family:Lamiaceae Accession No.:HBJU-16812	Ushat	Herb	Aerial parts	MED	Skin problems	Aerial parts are pounded with cow urine to form a thin paste which is applied topically for treatment of itchy bumps on skin caused by mosquito bites and skin allergy caused due to contact with <i>Toxicodendron succedaneum</i> , an allergic tree (20). It is also used for treatment of skin boils and furuncles (16)*.	36	0.2	Expectorant, cough, cold, headache, antineuralgic, fever, bleeding hemorrhoids, constipation, loss of appetite, burning sensation of stomach, gastric problems, sore throat, wounds, body pain, heart problems, breathing disorder, hair fall, antipyretic, analgesic, abscess, hair growth, blood purifier, rheumatism, muscular pain, dizziness, frost bite [24,30,35,42,53,56,61,65,67,79,80,86,93,98,99].
					VET	Eye problems	Juice obtained by crushing aerial parts is poured into the eyes of cows and bulls for treatment of cataract and improving eyesight (117)*.	117	0.6	Fever, cold, indigestion, stomach, liver disorders [66,72].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	75	0.4	
146	<i>Prunus armeniaca</i> L. Family:Rosaceae Accession No.:HBJU-16855	Cheir	Tree	Seeds, Fruits, leaves, stem, branches	MED	Skin problems	The seed kernels are ground to paste which is applied topically around the centre of skin boils or furuncle. It reduces swelling and cures boils by extracting pus through their centres (16)*. Seeds are chewed and the paste thus formed is applied topically for healing cracked skin of hands and feet (20)*.	54	0.3	Constipation, ringworm, joint pains, protein deficiency, arthralgia, joint pain, toothache, external parasite removal [24,36,45,93].
						Pregnancy, child bearing and family planning women).	Seed oil together with jaggery is eaten with <i>chapatti</i> as postpartum tonic for women (8)*.			

						Respiratory problems	Seed kernels are roasted on griddle and given orally as a remedy for cough (10)*.			
					EDB	Raw	Fruits eaten raw.	102	0.4	[11,14,60,64,68,78,85].
						Miscellaneous	Seed oil is used for cooking purpose.			
					PUP	Tools	Dikhra, molh, kaanghi, naal, unsan, jandra and padetri are made from stem and branches (160).	160	0.6	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	98	0.5	
147	<i>Prunus cornuta</i> (Wall. ex Royle) Steud. Family:Rosaceae Accession No.:HBJU-16856	Jamo	Tree	Fruits, leaves, branches	EDB	Raw	Fruits eaten raw	24	0.1	[14,50,60,78,81].
					PUP	Tools	Jungla, maandh are made from branches (98).	98	0.4	
					FOD	Fresh	Leaves are used as fodder/forage for goats and sheep.	88	0.4	
148	<i>Prunus persica</i> (L.) Batsch. Family:Rosaceae Accession No.:HBJU-16857	Aaroon	Tree	Fruits, branches	EDB	Raw	Fruits eaten raw	99	0.4	[64].
					PUP	Tools	Lath made from branches (14).	32	0.1	
						Miscellaneous Products	Beedi made from branches (18).			
					SMR	SCR	A bow and a walking stick made from fresh twigs of <i>Prunus persica</i> are used during <i>Jogi</i> ceremony in boys' wedding. As part of a ritual the groom is guided by the priest to moves from inside of the house to outside and vice versa 7 times carrying the bow slinging over his shoulder and stick in his hand(114).	114	0.6	

149	<i>Punica granatum</i> L. Family:Lythraceae Accession No.:HBJU-16814	Dadoo ni	Tree	Seeds	MED	Digestive problems	Seeds are eaten in case of liver complaints and jaundice. Seeds are taken together with leaves of <i>Artemisia maritima</i> for treatment of indigestion, flatulence and abdominal pain (48).	48	0.2	Jaundice, dysentery, diarrhoea, appetizer, antihelminthic, antispasmodic, tonic for anemia, styptic, astringent, insomnia, gum bleeding, halitosis, pimples, burn, intermittent fever, weakness, backache, heart diseases, blood flow, headache due to hypertension, liver ailments [32,36,42,45,47,52,56,76,91,93].
					EDB	Chutney	Chutney is made from seeds.	79	0.3	[1,11,12,14,37,38,64,68,75,78,85,87,92,100].
						Raw	Seeds eaten raw.			
150	<i>Pyrus communis</i> L. Family:Rosaceae Accession No.:HBJU-17576	Bhagosh	Tree	Bark	EDB	Raw	Fruits eaten raw.	63	0.3	
					SMR	MBE	Bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (54).	54	0.3	
151	<i>Pyrus pashia</i> Buch.-Ham. ex D.Don. Family:Rosaceae Accession No.:HBJU-16858	Kaith	Tree	Fruits, bark, stem, branches	MED	General and unspecified	Fruits are crushed and the juice is applied externally for blackening of hair and preventing hair fall (24).	24	0.1	Conjunctivitis, eye infection, hair fall, diarrhoea [52,76,91,93].
					VET	Eye problems	Fruits are chewed finely by a person and then sprinkled forcefully alongwith saliva from his mouth into the eyes of goats, sheep, cows and bulls for treatment of a local disease namely <i>andhlu</i> in which the whole eye including pupil becomes white accopained with partial or complete blindness (138).	138	0.7	Eye diseases, conjunctivitis [10,27,48].
					EDB	Raw	Fruits eaten raw.	66	0.3	

					PUP	Tools	Shangi and jandra are made from stem and branches.	35	0.1	
					SMR	MBE	Stem bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (54).	54	0.3	
152	<i>Pyrus pyrifolia</i> (Burm.f.) Nakai. Family:Rosaceae Accession No.:HBJU-17575	Nakh	Tree	Fruits, Bark	EDB	Raw	Fruits eaten raw.	81	0.3	[11,12,14,16,37,38,64,75,78,85,97].
					SMR	MBE	Bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (54).	54	0.3	
153	<i>Quercus floribunda</i> Lindl. ex A.Camus. Family:Fagaceae Accession	Maru	Tree	Stem, branches, seeds, leaves, leaf galls, bark	MED	Musculoskeletal problems	Seeds of <i>Quercus floribunda</i> , locally known as <i>maroli</i> , are boiled in water, external coat is removed and the kernel is crushed into paste which is taken internally as a remedy for arthritis (24).	24	0.1	New Record
	No.:HBJU- 16801				VET	General and unspecified	Seeds are given orally to goats and sheep as a tonic to promote general health (27).	27	0.1	New Record
					EDB	Raw	Leaf galls eaten raw.	45	0.2	New Record
					PUP	Tools	Khadavan, rachh, unsan, dabotan1, konkdi, baela, bongadi, chindri, darati, dhaleran, dikhra, dingar, hal, halotra, keeli, khangu, kuradu, mach, molh and toka are made from stem and branches (463).	500	1.8	

					Construction Products	Branches are used as <i>Baad</i> (16).			
					Miscellaneous Products	Tender twigs are used as <i>beedi</i> (21).			
				SMR	SRR	The fuel wood of <i>Quercus floribunda</i> is used for sacred fire (<i>Jagra</i>) lit in open during the Amavasya night of Bhadu month on the occasion of a religious festival known as <i>Jagra</i> devoted to Nag Devta. In the morning before sunrise, the red hot cinders of <i>Quercus floribunda</i> fuelwood are trampled bare feet by the priests while they are in trance (14). A small rod made from branch of <i>Q. floribunda</i> is used for stirring a liquid sacrament prepared from flour of <i>Cenchrus americanus</i> and <i>Triticum aestivum</i> grains in a religious ceremony viz. <i>gusantan</i> devoted to Bhagwan Shiv Ji (8).	86	0.5	
					MBE	Bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (54). A long sharp edged sickle (<i>darati</i>) with wooden handle is used for treatment of small pox disease as described above in case of <i>Parrotiopsis jacquemontiana</i> (10).			
				FOD	Fresh	Leaves are used as fodder/forage for the cattle.	172	0.8	

154	<i>Quercus leucotrichopora</i> A.Camus. Family:Fagaceae Accession No.:HBJU-16802	Banj	Tree	Bark, branches, leaves	MED	Digestive problems	Bark is chewed as datun for preventing gum bleeding and maintaining oral hygiene (34).	34	0.2	Stomachache, piles, toothache [32,36].
					VET	General	The inner part of the bark is boiled in water and the decoction is given orally to goats and sheep for alleviating pain due to internal injury (44).	44	0.2	New Record
					PUP	Tools	Branches are used for making hal and soti (32)	32	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	126	0.6	
155	<i>Quercus semecarpifolia</i> Sm. Family:Fagaceae Accession No.:HBJU- 16803	Kharshu	Tree	Branches, leaves	PUP	Tools	Bongadi, hal, haladi, halotra and kuradu are made from branches (37).	37	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	120	0.6	
156	<i>Ranunculus sceleratus</i> L. Family:Ranunculaceae Accession No.:HBJU- 17572	Zaldaru	Herb	Aerial parts	MED	Musculoskeletal problems	Aerial parts are ground to paste and a very thin layer is applied externally on affected parts for alleviating joint pains. It may cause painful skin burn if used in large quantity (10).	10	0.1	Dermatitis [56].
157	<i>Raphanus sativus</i> L. Family:Brassicaceae Accession No.:HBJU-16782	Mooli	Herb	Roots, leaves	MED	Digestive problems	Tuberous roots and leaves are eaten as vegetable in case of jaundice. Tuberous roots are also eaten as salad for the same purpose, nutraceutical (14).	14	0.1	Jaundice, indigestion, diarrhea, chronic constipation, appetizer, urinary infection, hair fall, impotency, bleeding piles [33,56,93,96].

					SMR	SRR	Roots are used while performing pooja during pindadan ritual from 1st to 10th day of death of a person and also during <i>sraddha</i> ritulas (annual homage to dead ancestors) (98).	98	0.5	
158	<i>Rheum australe</i> D. Don. Family:Polygonaceae Accession No.:HBJU-16841	Chukri	Herb	Roots	MED	Neurological problems	Dry roots are pasted by rubbing them with a little milk on a hard substance and a thin layer of the paste applied topically on forehead in case of head ache (44)*.	100	0.5	Ulcer, abdominal pain, appendicitis, urine infection, cough, boils, cuts, wounds, joint pains, fracture [47,53,86,90,93].
						General and unspecified	The above mentioned paste is applied topically in case of internal injury to subside the pain and to prevent blood clotting and swelling (56)*.			
					VET	General	The above formulation is used locally in case of internally injury (137).	137	0.7	Fracture [47].
159	<i>Rhododendron arboreum</i> Sm. Family: Ericaceae Accession No.:HBJU-16795	Cheu	Tree	Flowers	MED	Digestive problems	Flower juice is administered orally in case of diarrhoea and as anti emetic drug (39).	39	0.2	Giddness, lung refreshment, digestive and respiratory problems, blood enhancer [30,32].
					VET	Urological problems	Flowers are crushed and given to cows and bulls as a treatment of a disease viz. hematuria, locally known as <i>luntra</i> and the disease symptoms include presence of blood in urine (76).			
					EDB	Chutney	Flowers used for making chutney	25	0.1	[11,12,37,38,68,75,78,85]
						Raw	Flowers eaten raw.			
160	<i>Rhododendron anthopogon</i> D.Don.	<i>Ganpati</i>	Shrub	Leaves	PUP	Miscellaneous Products	Leaves are crushed and rubbed around on the outer surface of traditional honey barrel around its opening for	26	0.1	

	Family:Ericaceae Accession No.:HBJU-17555						attracting honey bees. Leaves are dried, burnt and honey barrel is fumigated for the same purpose (26).			
161	<i>Rhododendron campanulatum</i> D.Don. Family:Ericaceae Accession No.:HBJU-16898	Shandga l	Shrub	Seeds, leaves	MED	Skin problems	Seeds are rubbed with water on a hard substance to form paste which is applied externally on affected parts for curing scabies, itch and skin boils (66)*.	86	0.4	Rhinorrhoea, sneezing, cough, cold, headache, toothache, fever, rheumatism, sciatica, syphilis, cooling agent during nose bleeding [42,56,61,62,82].
						Neurological problems.	Leaves are dried, powdered and the powder is applied inside the nostril and inhaled as a remedy for headache (20).			
					VET	Digestive problems	Leaves are ground to paste which is given orally to goats and sheep for deworming, improving digestion and as appetiser (128).	128	0.6	New Record
162	<i>Robinia pseudoacacia</i> L. Family:Fabaceae Accession No.:HBJU-16799	Rubeen	Tree	Branches, leaves	MED	Digestive problems	Leaves are crushed and eaten as a remedy for constipation and gastric upset (10).	10	0.1	Diuretic, wounds, digestive disorders [35,42].
					VET	General and unspecified	Leaves are fed to goats and sheep to promote general health (12).	12	0.1	New Record
					PUP	Tools	Branches are used for making bongadi (25).	25	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	113	0.5	
163	<i>Rosa brunonii</i> Lindl. Family:Rosaceae Accession No.:HBJU-16859	Kojein	Climber	Fruits, stem, leaves	EDB	Raw	Fruit eaten raw, tender twigs eaten raw after peeling.	60	0.2	[1,12,38,75,92].
					PUP	Miscellaneous Products	<i>Chhonka</i> is made from stem (22).	22	0.1	

					SMR	MBE	A large ring, locally known as <i>taradh</i> , is made from fresh stem and three wooden fire torches (<i>mashal</i>) are tied to it at 3 different positions. The person suffering from witchcraft and black magic is made to pass through this ring thrice by the Shaman to get rid of evil powers (94).	94	0.5	
					FOD	Fresh	Leaves are used as fodder/forage for the goats.	150	0.7	
164	<i>Rosa indica</i> L. Family:Rosaceae Accession No.:HBJU- 17573	Gulab	Herb	Flowers	SMR	SRR	The flowers are offered to the God while worshipping (110).	110	0.6	
165	<i>Rosa macrophylla</i> Lindl. Family:Rosaceae Accession No.:HBJU- 16860	Ban- gulab	Shrub	Flowers, Branches	MED	Digestive problems	Decoction prepared by boiling flowers in water is taken orally for curing constipation (16)*.	30	0.1	Eye troubles, burns, scurvy, internal fever [42,47].
						Skin problems	Tender twigs are burnt at one end and the burnt end is rubbed on a hard substance so that the juice comes out, which is applied externally on the affected parts as a remedy for scabies and skin eruptions (6)*.			
						Urological problems	Flowers of <i>Rosa macrophylla</i> and that of <i>Viola canescens</i> are boiled together in water which and the decoction is taken empty stomach for treatment of kidney stone and other renal problems (8)*.			
					EDB	Preserved	Murabba is prepared from flowers.	55	0.2	[92].

						foods				
166	<i>Rubia cordifolia</i> L. Family:Rubiaceae Accession No.:HBJU-16866	Ridwal	Herb	Aerial parts, leaves, roots	MED	Skin problems	Leaf or root paste is applied externally as a treatment for ringworm (<i>dadri</i>) and other skin infections (82).	82	0.4	Skin disease, discoloration of skin and freckles, astringent, menorrhagia, mental disorder, burns, antiphlogistic, antispasmodic, stomachache, anti dysentery, deworming, jaundice, bronchitis, rheumatism, haemorrhage, remove stone from kidney, gall bladder, urinary bladder, lowers blood pressure, check bleeding from cuts and injuries [32,42,45,91,93].
						General and unspecified	The paste of leaves or roots is applied topically in case of fire burns for preventing blistering and helping wound healing.			
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	90	0.4	
167	<i>Rubus ellipticus</i> Sm. Family:Rosaceae Accession No.:HBJU-16861	Aakhe di	Shrub	Fruits, leaves	MED	General and unspecified	Fruits are eaten for their cooling effect on the body (10).	10	0.1	Wound healing, pain reliever, antioxidant, constipation, aperient [36,46,52].
					EDB	Raw	Fruits eaten raw, nutraceutical.	86	0.4	[1,12,37,38,64,73,75,85,92,97].
					FOD	Fresh	Fresh leaves are used as fodder/forage for goats.	90	0.4	
168	<i>Rubus niveus</i> Thunb. Family:Rosaceae Accession No.:HBJU-16862	Aakhedi	Shrub	Fruits, leaves	MED	General and unspecified	Fruits are eaten for their cooling effect on the body (10)*.	10	0.1	Dysentery [42].
					EDB	Raw	Fruits eaten raw, nutraceutical.	99	0.4	[1,37,50,60,69,73,75,78,85,92].
					FOD	Fresh	Fresh leaves are used as fodder/forage for goats.	87	0.4	
169	<i>Rumex acetosella</i> L. Family:Polygonaceae Accession No.:HBJU-16842	Chukru	Herb	Leaves	MED	Digestive problems	Leafy vegetable is consumed as appetizer and recommended in case of liver heat (22)*.	22	0.1	New Record
					EDB	Vegetable	Leaves are cooked as vegetable, nutraceutical.	45	0.2	

170	<i>Rumex hastatus</i> D. Don. Family:Polygonaceae Accession No.:HBJU-16843	Amloda	Herb	Aerial parts, leaves	MED	Digestive problems	Vegetable and chutney made from the leaves are consumed in case of liver heat, as appetiser and for improving digestion (50)*.	50	0.2	Wounds, cuts, burns, removes leech from ear, antiphlogistic, counter poisoning effect due to insect or poisonous substance intake, allergy caused by sting of <i>Urtica dioica</i> , fungal infection, weed or insect intoxication, acne, skin disease, fever, cough, asthma [32,36,42,46,52,59,62,91]
					VET	Foot & Mouth disease	Leaves are ground to paste which are given orally to cows, bulls, goats and sheep for treatment of Foot and Mouth Disease, locally known as <i>kharedu</i> (112).	112	0.5	New Record
					EDB	Chutney	Chutney made from leaves (22).	60	0.2	[1,6,12,38,64,68,73,75,85, 88].
						Vegetable	Leaves cooked as vegetable, nutraceutical (38).			
FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	85	0.4						
171	<i>Rumex nepalensis</i> Spreng. Family:Polygonaceae Accession No.:HBJU-16844	Harbal	Herb	Aerial parts, roots, leaves	MED	Skin problems	Fresh roots are crushed to paste which is applied topically as a treatment for skin boils and ringworm (locally known as <i>dadri</i>) (62).	80	0.4	Back pain, joint pain, bodyache, headache, skin diseases, cough, abdominal pain, constipation, insect bites, wounds, cuts, burns, astringent, hair loss [28,42,43,62,65,80,93,99]
						General and unspecified	Leaves are chewed to paste which is applied topically as antidote on affected parts in case of snake bite (18)*.			

					VET	Digestive problems	Roots are crushed and administered orally to goats and sheep in case of abdominal swelling (111).	111	0.5	Tympany, bloat, fever, juvenile infections, antiseptic, liver disorders, general weakness, cough, Foaming from mouth, Swellings [8,44,66,74,84,103].
					EDB	Vegetable	Leaves cooked as vegetable.	61	0.3	[6,11,12,37,38,64,75,78,81,85,92,95,97,100].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	80	0.4	
172	<i>Sageretia thea</i> (Osbeck) M.C. Johnst. Family:Rhamnaceae Accession No.:HBJU- 16849	Dhren ko lu	Shrub	Fruits, leaves	EDB	Raw	Fruits eaten raw.	57	0.2	New Record
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	30	0.1	
173	<i>Santalum album</i> L. Family:Santalaceae Accession No.:NL	Chandan	Tree	Branches	SMR	SRR	A garland made by tying small pieces of <i>Santalum album</i> wood with thread is put around the neck of dead person (13). One small piece of wood is used for cremation of dead person by his close relatives (18). The wood is rubbed against a flat stone with water to form a paste which is applied on the forehead as a sacred mark (<i>tilak</i>) generally after performing pooja (59).	90	0.5	
174	<i>Sapindus mukorossi</i> Gaertn. Family:Sapindaceae Accession No.:17791	Rethde	Tree	Fruits	PUP	Miscellaneous products	Fruits are used as soap for washing clothes (12).	12	0	

175	<i>Selinum vegeatum</i> (Edgew.) C.B Clarke. Family:Apiaceae Accession No.:HBJU-16760	Bhutkes hi	Herb	Leaves, roots	MED	Digestive problems	Leaves are crushed to powder which is given orally in case of <i>muhari</i> , a distinct local ailment in new born and small babies in which the symptoms include development of white coloured thin layer (<i>tikri</i>) on the upper surface of the tongue accompanied by loose motions, flatulence, vomiting and uneasiness (42)*.	42	0.2	Arthritis, abdominal pain, nerve sedative [42,79].
					SMR	MBE	Dry roots are burnt in red hot cinders and the affected person is fumigated to get rid of demons, black magic and bad evils (27). Dry roots are considered auspicious, placed along with vermilion (<i>sindhoor</i>) in a small box and worshipped with incense for economical well being, peace and prosperity of the family (15).	42	0.2	
176	<i>Sesamum indicum</i> L. Family:Pedaliaceae Accession No.:NL	Til	Herb	Seeds	SMR	SCR	Seeds are considered to be holy, mixed in water which is used for taking bath for purity of the body after attending funeral ceremony (86).	86	0.5	
177	<i>Silene edgeworthii</i> Bocquet. Family:Caryophyllaceae Accession No.:HBJU-16786	Chunch uni	Herb	Roots	MED	Digestive problems	Roots are boiled in water and decoction is prescribed orally as a treatment for diarrhoea (9).	9	0	Medicinal [31].
178	<i>Sinapis alba</i> L. Family:Brassicaceae Accession No.:NL	Sheti Sharoon	Herb	Seeds	SMR	MBE	Seeds are used for driving out the evil powers from the affected person and houses (32).	32	0.2	
179	<i>Sinopodoph yllum hexandrum</i> (Royle) T.S.Ying.	Ban Kakru	Herb	Aerial parts, fruits,	MED	General and unspecified	The root paste is applied topically for wound healing (48).	48	0.2	Ulcers, cuts, wounds, tumours, purgative, epigastric, skin diseases, diarrhoea, constipation [42,53,67].

	Family:Berberidaceae Accession No.:HBJU-16777			roots	VET	General	Roots are pounded into paste which is applied externally as antidote against snake bite of cattle (47).	47	0.2	Warts, tumours, eye wounds, snake bite [9,22,74]
180	<i>Skimmia anquetilia</i> N.P. Taylor & Airy Shaw. Family:Rutaceae Accession No.:HBJU-16867	Shindgali	Shrub	Leaves	MED	Digestive problems	Dried leaves are crushed and prescribed orally as a remedy for loose motions* and abdominal pain (26). Leaves are used as an ingredient in cooked watery rice (<i>kachoti</i>) which is eaten as anthelmintic (60)*.	103	0.5	Asthma, whooping cough, stomach ache [79].
						Respiratory problems	Crushed dried leaves are prescribed orally as a remedy for cough (17).			
					VET	Digestive	Leaf decoction is given to lambs and calves in case of indigestion and bloats (102).	102	0.5	Pyrexia, indigestion, digestive & liver disorders, cough, cold, fever, Lung disease, fractures [29,44,54,66,84,103].
181	<i>Solanum pseudocapsicum</i> L. Family:Solanaceae Accession No.:HBJU-17020	Pipla	Herb	Fruits	MED	Skin	Fruit is pounded into paste which is applied topically on poisonous swelling (32).	32	0.2	Antimicrobial [42].
182	<i>Solanum tuberosum</i> L. Family:Solanaceae Accession No.:17792	Kabli	Herb	Stem	MED	General and unspecified	A fresh tuber is cut into two pieces and its juicy inner cut side is rubbed on affected parts in case of fire burn to relieve pain and to prevent formation of burn blisters(22).	22	0.1	Headache, blemishes, fire burns [24,36,99].
						SMR	Tubers are cooked without salt and eaten during religious fasting (100).			
183	<i>Solanum villosum</i> Mill. Family:Solanaceae	Kanya	Herb	Aerial parts, leaves,	MED	Digestive problems	Fruits are eaten in case of liver complaints (10).	85	0.4	New Record

	Accession No.:HBJU-16875			fruits.		Musculoskeletal problems	Dried leaves are crushed and eaten early morning for making bones stronger (44).			
						Neurological problems	Fresh leaves are ground to paste and a thin layer of the paste is applied externally on forehead for getting relief from headache (16).			
						Skin problems	This paste is applied topically around the centre of hard skin boils or furuncles. It reduces swelling and cures boils by extracting pus through their centre (15).			
					EDB	Raw	Fruits eaten raw, nutraceutical (75).	75	0.3	[75,95].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	15	0.1	
184	<i>Solena heterophylla</i> Lour. Family:Cucurbitaceae Accession No.:HBJU-17783	Ban Kakru	Climber	Fruits	EDB	Vegetable	Unripe fruit cooked as vegetable (110).	136	0.6	
						Raw	Ripe fruit eaten raw (26).			
185	<i>Sorbaria tomentosa</i> (Lindl.) Rehder. Family:Rosaceae Accession No.:HBJU-16863	Kirdhae	Shrub	Stem, leaves, flowers	VET	Digestive problems	Crushed flowers are given to cattle as a remedy for abdominal pain and loose motions (154).	154	0.7	New Record
					PUP	Tools	Stems are used in makig bongadi and kuradu (29).	29	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	25	0.1	

186	<i>Spiraea canescens</i> D.Don. Family:Rosaceae Accession No.:HBJU-16864	Pribri	Shrub	Stem, leaves, aerial parts	VET	Respirator y/pulmonary problems.	Leaves are crushed and given orally to cows and bulls as a remedy for cough (44).	56	0.3	New Record
						General and unspecified	Aerial parts given orally to cows and bulls as a remedy for general weakness (12).			
					PUP	Tools	<i>Konkdi</i> and loath are made from stem (40).	53	0.2	
						Artefacts	<i>Jaabu</i> is made from stem (13).			
					SMR	SRR	Gaddis and Sippis offer <i>nuala</i> (Shiv pooja followed by feast) to Bhagwan shiv Ji when their wish is fulfilled. During solemnisation of <i>nuala</i> ceremony, 5 woolen threads are hanged down the ceiling which are attached midway to a ring made from fresh stem of <i>Spiraea canescens</i> . The wool is twisted around the hanging threads and the attached ring which are together known as <i>Shiv mala</i> and worshipped by offering raw sheep wool (114).	114	0.6	
FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	145	0.7						
187	<i>Stellaria media</i> (L.) Vill. Family:Caryophyllaceae Accession No.:HBJU-16789	Fukku	Herb	Aerial parts	MED	Endocrine, metabolic and nutritional problems	Vegetable prepared from aerial parts is consumed to control diabetes (24)*.	24	0.1	Skin infection, itchy skin, allergy, pulmonary diseases, cough, cold, swelling, as plaster on fracture and swelling, arthralgia, antipyretic, antacid, antispasmodic, cardiovascular disorder [45,76,80,83,91,98].

					EDB	Vegetable	Aerial parts cooked as vegetable, nutraceutical.	80	0.3	[6,40,64,69,81,85,88].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	78	0.4	
188	<i>Swertia purpurascens</i> (D. Don) C. B. Clarke. Family: Gentianaceae Accession No.: HBJU-16804	Chiraita	Herb	Leaves	MED	Digestive problems;	Dried leaf powder of <i>Swertia purpurascens</i> mixed with dried leaf powder of <i>Fumaria parviflora</i> and <i>Ajuga parviflora</i> and dried root powder of <i>Picrorhiza kurroa</i> and <i>Aconitum heterophyllum</i> are prescribed internally as a remedy for loss of appetite, liver complaints and mouth sores and ulcers (70).	86	0.4	New Record
						Neurological problems	The above powder mixture is taken internally in case of headache (10).			
						General and unspecified	The above powder mixture is taken internally in case of cold and fever (6).			
189	<i>Tagetes patula</i> L. Family: Asteraceae Accession No.: HBJU-17007	Gutta	Herb	Flowers	SMR	SRR	Flowers are offered to the God or deity while worshipping and the garland of flowers is put around the neck of religious idols (136).	136	0.8	
190	<i>Tagetes minuta</i> L. Family: Asteraceae Accession No.: HBJU-17006	Ban gutta	Herb	Flowers, leaves	MED	Digestive problems	Decoction of the flowers is taken internally as a remedy for bloats and acidity (37).	37	0.2	Gripping of stomach, body massage, earache [42,46].
					PUP	Miscellaneous products	Leaves and flowers are placed in the stored grains and flour to repel insect pests (15).	15	0.1	

191	<i>Tamarindus indica</i> L. Family:Fabaceae Accession No.:NL	Amla	Tree	Fruits	VET	Foot & Mouth disease	Fruits decoction given orally to cattle in case of Foot and Mouth disease (127).	127	0.6	Weed intoxication, snakebite, FMD [27,48].
192	<i>Taraxacum officinale</i> F.H.Wigg. Family:Asteraceae Accession No.:HBJU-16774	Hindri	Herb	Leaves	MED	Pregnancy, child bearing and family planning (women).	Leaf vegetable is prescribed to the women for postpartum recovery as a light and easy to digest food (87).	87	0.4	Stomach ache, indigestion, diarrhoea, dysentery, abdominal swelling, gastric ulcers, hepatoprotector, jaundice, tightening of veins, blood purifier, fracture, dislocation of joints, joint pain, gout, back pain, fever, cold, analgesic, as tonic, given to women postpartum, enhance lactation, energizer, given to pregnant women to reduce labour pains, foment, chest infection, cough, antipyretic, dermatological disorder, warts, fungal infection, gall bladder and urinary tract disorder, diuretic, kidney disorder, gall stones, diabetes, swelling, chronic mouth ulcer, boils, blisters, burns [24,28,32,35,36,42,45,47, 53,62,65,67,82,83].
					EDB	Vegetable	Leaves cooked as vegetable, nutraceutical.	112	0.5	[1,6,11,14,18,40,68,69,75, 78,81,85,88,97,100]
193	<i>Themeda anathera</i>	Aalo/f	Herb	Aerial parts	PUP	Tools	<i>Boukri</i> is made from aerial parts (180).	180	0.7	

	(Nees ex Steud.) Hack. Family:Poaceae Accession No.:HBJU-16831	aatah			SMR	SCR	A broom (locally known as <i>boukri</i>) made from a local grass <i>Themeda anathera</i> is used by groom's assistant during <i>Jogi</i> ceremony in boys' marriage for covering the dried fruit of <i>Lagenaria sps.</i> tied on groom's back. The grass used for making this broom is cut during sharad navaratri (autumn navaratri) (64).	64	0.4	
					FOD	Fresh, dry	Aerial parts are used as fodder/forage for the cattle.	192	0.9	
194	<i>Thymus serpyllum</i> L. Family:Lamiaceae Accession No.:HBJU-16813	Ban jawain	Herb	Aerial parts	MED	Digestive problems	Aerial parts are eaten raw for curing abdominal pain, flatulence and indigestion (40).	54	0.3	Laxative, flatulence, stomach ache, blood purifier, skin problems, boils, skin rashes, burns, kidney stones, urinary troubles, menstrual disorder, cuts and wounds, asthma, cough, cold [47,53,86,90,93],[42,45,56,61,90,98].
						General and unspecified	Aerial parts are brewed to tea which is given to the women during post-partum period for protection against common cold (14).			
					VET	Digestive	Aerial parts are given to goats and sheep as a remedy for loose motions (76).	76	0.4	Throat infections, fever, common cold, to generate heat [2,8,9,103].
					EDB	Beverages	Aerial parts brewed in water as tea, nutraceutical (20).	42	0.2	[50].
						Flavouring agents	Aerial parts used as condiment (22).			
195	<i>Toxicodendron succedaneum</i> (L.) Kuntze. Family:Anacardiaceae	Ulkhar	Tree	Stem, branches	PUP	Tools	<i>Mach</i> is made from the branches (5).	23	0.1	
						Containers/storage products	<i>Kutroshu</i> and <i>ganarh</i> are made from the branches (13).			

	Accession No.:HBJU-16750					Artefacts	<i>Manja</i> is made from branches (5).			
196	<i>Trifolium dubium</i> Sibth. Family:Fabaceae Accession No.:HBJU-17559	Ghaa	Herb	Aerial parts	FOD	Fresh	Aerial parts used as fodder/forage for cattle.	64	0.3	
197	<i>Trifolium pratense</i> L. Family:Fabaceae Accession No.:HBJU-17560	Shatala	Herb	Aerial parts, leaves	VET	General and unspecified	Aerial parts re used as fodder/forage for cows for increasing milk yield (55).	55	0.3	Galactagogue [51,66,105].
					EDB	Vegetable	Leaves cooked as vegetable.	25	0.1	
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	64	0.3	
198	<i>Trifolium repens</i> L. Family:Fabaceae Accession No.:HBJU-17561	Ghaa	Herb	Aerial parts, leaves	VET	General and unspecified	Aerial parts re used as fodder/forage for cows for increasing milk yield (54).	54	0.3	Galactagogue [51,66,72,103].
					EDB	Vegetable	Leaves cooked as vegetable.	30	0.1	
					FOD	Fresh	Aerial parts used as fodder/forage for cattle.	64	0.3	
199	<i>Trigonella foenum-graecum</i> L. Family:Fabaceae Accession No.:17794	Mathray	Herb	Seeds	VET	General and unspecified	Roots of <i>Acorus calamus</i> are crushed together with roots of <i>Angelica glauca</i> and seeds of <i>Trigonella foenum-graecum</i> , mixed with salt and given orally as a galactagogue to cows and goats for increasing milk yield (10).	10	0.1	Diarrhea, fever, abortion, galactagogue [27,44,51,57,72,74,105].
200	<i>Tripidium rufipilum</i> (Steud.) Welker,	Kash	Herb	Leaves	PUP	Artefacts	Leaves are used for making <i>chakotu</i> (21).	21	0.1	

	Voronts. & E.A Kellogg. Family:Poaceae Accession No.:HBJU- 17570				SMR	SRR	The plant is considered sacred (116).	116	0.6	
201	<i>Triticum aestivum</i> L. Family:Poaceae Accession No.:HBJU- 16832	Kanak	Herb	Seeds, aerial parts	VET	Pregnancy and calving	Corn flour and wheat flour are mixed together and a cake (<i>roti</i>) is prepared from it which is broken into small pieces, mixed with jaggery and <i>ghee</i> and given to cows after calving for post partum recovery (10).	10	0.1	Retention of placenta, weakness, galactagogue, Improvement in health [27,72].
					PUP	Container s/storage products	Aerial parts sre used in making <i>koolhi</i> (61).	61	0.2	
					SMR	SRR	For 10 days after the death of a person, one of his male blood relatives who performed funeray rites, sleeps on paddy or wheat straw spread over the floor as bedding material and covered with a woolen blanket (35). The Gaddi and Sippi tribes treat small pox disease by worshipping and offereing prayers to goddess Sitala. A sacred feast (locally known as <i>bhoj</i>) consisting of pakora (locally known as <i>chidwe</i>) made from crushed <i>Vigna mungo</i> seeds, and chapatis (locally known as <i>luchi</i>), made from <i>Triticum aestivum</i> flour by applying mustard oil is offered to goddess Sitala (18).	114	0.6	

						SCR	During <i>Jogi</i> ceremony in boys' marriage, the groom dresses like Bhagwan Shiv Ji and puts on large ear rings, known as <i>Shiv Ji ri mundra</i> , made from flour of <i>Triticum aestivum</i> mixed with turmeric powder (15).			
						MBE	A mixture of seven seeds and grains known as <i>satanna</i> , as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46).			
202	<i>Ulmus wallichiana</i> Planch. Family:Ulmaceae Accession No.:HBJU-16877	Marali	Tree	Stem, branches, leaves, bark	VET	Pregnancy and calving	Bark is boiled in water and decoction is administered orally to cows for expelling retained placenta after calving (111).	111	0.5	New Record
					PUP	Tools	<i>Mach</i> and <i>shangi</i> are made from branches (5).	53	0.2	
						Containers/storage products	<i>Kunala</i> is made from stem (48).			
					FOD	Fresh, dry	Leaves are used as fodder/forage for the cattle.	168	0.8	
203	<i>Urtica dioica</i> L. Family:Urticaceae	Nikki aen	Herb	Aerial parts, leaves, roots	MED	Digestive problems	Vegetable of leaves is eaten in case of constipation (68).	84	0.4	Irregular periods, wounds, antiseptic, styptic, rheumatism, joint pain, gout,

	Accession No.:HBJU-16880					Skin problems	Roots of <i>Girardinia diversifolia</i> and <i>Urtica dioica</i> are pounded together into paste which is applied externally to treat hard skin boils or furuncles. It reduces swellings and also extracts pus from the boils (16).			arthralgia, body pain, arthritis, skeletal muscles disorder, sprain, swelling, bone fracture, haemorrhages, to excite activity in paralysed limb, headache, antiinflammatory, acidity, gastric problem, blood purifier, tonic for female reproductive health, regulate menstrual cycle, epistaxis, uric acid excretion, urinary tract infection, skin infection, dandruff, asthma, whooping cough, fever, lose body weight [28,30,32,35,39,42,43,45,53,56,61,62,67,79,80,83,86,91,96,98,99].
					VET	Urological problems	Roots are crushed, mixed with maize dough and given orally to cattle in case hematuria (90).	90	0.4	Hematuria, joint pain, sterility, galactagogue [44,66,72,84].
					EDB	Vegetable	Tender leaves are boiled in water, drained and cooked as vegetable, nutraceutical.	20	0.1	[14,16,37,64,68,69,75,78,81,92].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	88	0.4	
204	<i>Verbascum thapsus</i> L. Family:Scrophulariaceae Accession No.:HBJU-16872	Gidad tamaku	Herb	Flowers, leaves, aerial parts	MED	Digestive problems	Leaves are crushed and eaten as a remedy for constipation (8).	18	0.1	Migraine, swelling, pneumonia, sore throat, otalgia, aphrodisiac, emollient, pulmonary diseases, cough, asthma, bronchitis, pharyngitis, constipation, bloats, stomach pain, skin diseases, boils, abscess, burns, styptic, healing [25,28,34,35,36,42,45,46,47,59,76,79,80,83,91,93,98].
						Eye problems	Dried flowers are ground to powder which is sprinkled into the eyes in case of eye injury for relieving pain, reducing redness and swelling and for treatment for cataract (10)*.			
					VET	Digestive problems	Leaves are pounded into paste which is administered orally to the cattle in case of constipation and colic pain (22).	155	0.7	Pyrexia, loose motion, flatulence, stomachache [2,8,9,44].
						General and	Aerial parts are crushed and given			

						unspecified	internally to lambs for treatment of fever (25)*.			
						Skin problems	Aerial parts are crushed, boiled in water and decoction applied topically in case of mange of goats and sheep (108)*.			
205	<i>Viburnum cotinifolium</i> D.Don. Family:Adoxaceae Accession No.:HBJU-16748	Ban toondh a y	Shrub	Roots, leaves	MED	General and unspecified	Roots are ground to paste which is applied topically as an antidote against snake bite and scorpion sting (11)*.	11	0.1	Kawashiorkar and Marasmus [47].
					FOD	Fresh	Leaves are used as fodder/forage for goats and sheep.	125	0.6	
206	<i>Viburnum grandiflorum</i> Wall.ex DC. Family:Adoxaceae Accession No.:HBJU-16749	Toondh ay	Shrub	Roots, fruits, leaves, branches	MED	Digestive problems	Tender twigs are chewed as tooth brush for cleaning teeth. It also has antiseptic properties which kill dental germs and help in maintaining oral hygiene (40)*.	51	0.2	Stomachache, analgesic, whooping cough, typhoid, laxative, blood purifier, fractures, skin infection, cooling agent during summers [39,42,47,67,79,80,90,96]
						General and unspecified	Roots are ground to paste which is applied topically as an antidote against snake bite and scorpion sting (11)*.			
					VET	General	Root paste is applied locally for wound healing (70).	70	0.3	New Record
					EDB	Raw	Fruits eaten raw.	87	0.4	[1,12,14,37,38,40,64,68,75,78,81,85,92].
					PUP	Tools	<i>Shangi</i> is made from the branches (28).	28	0.1	
					FOD	Fresh	Leaves are used as fodder/forage for the cattle.	140	0.7	
207	<i>Vicia sativa</i> L. Family:Fabaceae Accession No.:HBJU-16800	Kuksh ein	Herb	Aerial parts, seeds	EDB	Raw	Seeds eaten raw.	50	0.2	[64,69].
					FOD	Fresh	Aerial parts are used as fodder/forage for the cattle.	30	0.1	

208	<i>Vigna mungo</i> (L.) Hepper. Family:Fabaceae Accession No.:HBJU-17011	Maah	Herb	Fruits, seeds	VET	General and unspecified	<i>Darakal</i> formed as mentioned above in case of <i>Oryza sativa</i> is served to the cows as galactagogue for increasing milk yield (8).	8	0	Facilitates the normal conception & eases the labor pain, galactagogue, weakness [8,27,57,103].
					SMR	SRR	The Gaddi and Sippi tribes treat small pox disease by worshipping and offering prayers to goddess Sitala. A sacred feast (locally known as <i>bhoj</i>) consisting of pakora (locally known as <i>chidwe</i>) made from crushed <i>Vigna mungo</i> seeds, and chapatis (locally known as <i>luchi</i>), made from <i>Triticum aestivum</i> flour by applying mustard oil is offered to goddess Sitala (88).	88	0.5	
209	<i>Vigna unguiculata</i> (L.) Walp. Family:Fabaceae Accession No.:HBJU-17588	Rongi	Climber	Seeds	SMR	MBE	A mixture of seven seeds and grains known as satanna, as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46).	46	0.3	
210	<i>Viola canescens</i> Wall. Family:Violaceae Accession No.:HBJU-16881	Banaksha	Herb	Flowers	MED	Respiratory problems.	Flowers are boiled in milk and the decoction is taken internally as a remedy for sore throat (49).	49	0.2	Chest pain, cough, sore throat, loose phlegm in chest, pulmonary problems [34,42,90].
					EDB	Beverages	A hot drink is prepared by boiling fresh or dried flowers in water or milk.	102	0.4	New Record

211	<i>Viola odorata</i> L. Family:Violaceae Accession No.:HBJU-17028	Banaksha	Herb	Flowers	MED	Respiratory problems.	Flowers are boiled in milk and the decoction is taken internally as a remedy for sore throat (97).	97	0.5	Respiratory infections, cough, asthma, cold, bronchitis, chest congestion, fever, headache, gastric problem, constipation, digestive disorder, liver disorder, jaundice, tonsillitis, sore throat, oral ulcer, throat infection, diuretic, blood purifier, skin diseases, cervicalgia, voice hoarseness, muscular pain [24,33,35,36,42,43,46,47,53,65,76,79,80,83,86,89,91,93,98].
					EDB	Beverages	A hot drink is prepared by boiling fresh or dried flowers in water or milk.	87	0.4	[12,40,64,68,75,85,88].
212	<i>Xanthium strumarium</i> L. Family:Asteraceae Accession No.:17794	Kanwal kandal	Herb	Roots	MED	Musculoskeletal problems	The roots of <i>Xanthium strumarium</i> and <i>Dactylorhiza hatagirea</i> are rubbed on a flat stone (locally known as <i>shill</i>) to form a thin paste in which 1-2 drops of seed oil of <i>Prunus armeniaca</i> are added. The affected parts are gently massaged with this thin paste to alleviate orthopaedic and rheumatic pain (10).	10	0.1	Skin boils, abscess [42,56].
213	<i>Zanthoxylum armatum</i> DC. Family:Rutaceae Accession No.:HBJU-16868	Timru	Tree	Fruits, stem, branches	MED	Digestive problems	Tender twigs are chewed as tooth brush, locally known as <i>bedi</i> , for cleaning teeth. It helps in gum protection and maintaining oral hygiene (46).	46	0.2	Body pain, jaundice, antihelminthic, stomach ache, cold, fever, skin diseases, itching, toothache, tooth decay, halitosis, asthma, blood purifier [32,36,46,47,59,91,93].
					EDB	Raw	Fruits eaten raw.	45	0.2	[1,11,64,73,78,85].
					PUP	Tools	<i>Molh</i> is made from the branches (51).	51	0.2	

214	<i>Zea mays</i> L. Family:Poaceae Accession No.:HBJU-16833	Kukdi	Herb	Aerial parts, fruits, cob sheath.	VET	Pregnancy and calving	Corn flour and wheat flour are mixed together and a cake (<i>roti</i>) is prepared from it which is broken into small pieces, mixed with jaggery and ghee and given to cows after calving for post partum recovery (4)*.	9	0	Galactagogue, FMD [27,84].
						General	<i>Darakal</i> formed as mentioned above in case of <i>Oryza sativa</i> is served to the cows as galactagogue for increasing milk yield (5).			
					PUP	Artefacts	<i>Chakotu</i> and <i>pand</i> are made from aerial parts (42).	65	0.2	
						Miscellaneous Products	<i>Shota</i> is made from cob sheath (23).			
					SMR	MBE	A mixture of seven grains and seeds known as <i>satanna</i> , as described above in case of <i>Glycine max</i> , is used for protection of house against ghosts and bad evils (46)	46	0.3	
FOD	Fresh, dry	Aerial parts are used as fodder/forage for the cattle.	185	0.9						
215	<i>Ziziphus oxyphylla</i> Edgew. Family:Rhamnaceae Accession No.:HBJU-16850	Ber	Tree	Leaves, stems, fruits	MED	General and unspecified	In case of snake bite, the fresh leaves are chewed by the person who removes poison from the body of affected person by sucking poison through the bite injury. Leaves are chewed repeatedly before every suck which protects the person who sucks the poison from its harmful effect (43)*.	43	0.2	Pain, diabetes, fever [91].
					EDB	Raw	Fruits eaten raw.			
					PUP	Tools	<i>Kaanghi</i> is made from the stem (20).	20	0.1	

GYMNOSPERMS										
216	<i>Abies pindrow</i> (Royle ex D.Don) Royle. Family:Pinaceae Accession No.:HBJU-16883	Rae	Tree	Branches, resin, bark	MED	Skin problems	Resin is applied externally for healing cracked hands and feet (10)*.	10	0.1	Anti inflammation, rheumatism, cough, cold, bronchitis, asthma, ulcer, joint pain, fever [32,36,43,47,80,91,96].
					VET	General and unspecified	Tender branches are fed to the goats and sheep as general tonic for good health (9).	9	0	New Record
					PUP	Miscellaneous Products	<i>Naadu</i> is made from the bark (25).	25	0.1	
					FOD	Fresh	Tender branches are used as fodder/forage for the goats and sheep.	15	0.1	

217	<i>Cedrus deodara</i> (Roxb.) G. Don. Family:Pinaceae Accession No.:HBJU-16884	Gaid	Tree	Stem, branches, bark, resin, leaves	MED	Digestive problems	The small pieces of finely split, resinous softwood of <i>Cedrus deodara</i> , locally known as <i>jangni</i> , are placed in an earthen pitcher with a small hole at its bottom. The main opening of the pitcher is covered with a lid and the pitcher is then placed on a metal container kept in a pit in the soil. The outer surface of the pitcher is coated with a thick layer of mud and the pitcher is surrounded by dry barks of <i>Cedrus deodara</i> which are set on fire. The heat thus generated results in extraction of resin from the resinous wood in earthen pitcher which pours down into the metal container from the pitcher through the hole at its bottom. Gargles with warm resin are recommended for oral and dental health as it provides protection against germs and makes gums and teeth strong (14)*.	34	0.2	Fever, headache, dysentery, diarrhoea, pulmonary disorder, skin diseases, itching, skin rashes, skin allergies, ulcers & piles, arthritis, wounds, external ulcers, burning sensation of soles, herpes, kill lice [24,25,34,35,45,46,52,56,79,91,96,99].
						Musculoskeletal problems	A small piece of cloth or cotton, soaked in hot resin, is tied over the joints to get relief from arthritis pain (10).			
						Skin problems	Resin mixed with mustard oil is applied locally in case of scabies, itch and skin boils (4).			
						General and unspecified	Resin is applied externally for healing infected wounds, locally known as barm (6).			

					VET	Digestive problems	Resin mixed with butter milk (<i>lassi</i>) and salt is administered orally to goats and sheep for deworming, improving digestion and as an appetiser (25)*.	152	0.7	Alopecia, vomiting, pleuritis, lice & ticks, mange, foot & mouth disease (FMD), broken horn, Insect repellent [27,29,44,48,51,57,72,103,104,105]
						Skin problems	Resin is applied topically as a treatment of mange, a skin disease locally known as <i>chaid</i> , in goats and sheep (95).			
						General and unspecified	Tender branches of young trees are fed to the goats and sheep as general tonic for good health (12)*. Resin mixed with salt is given orally to lambs as a remedy for the habit of eating soil (7). The inner part of the bark is boiled in water and the decoction is given orally to goats and sheep for alleviating pain due to internal injury (13).			
					PUP	Tools	Daa, khangu, maandh, aernoti, balli, belnu, charkha, firki aeti- bali, firki dagdu-bali, jandri, khaddi, dabotan-1, dabotan-2, jandra, kuranu, maanj and masheen are made from the stem and branches (375).	1180	4.3	
						Containers/storage products	Charh, ganarh, kunala, kund, kuthar, kutroshu, sandook, toon (375)			
						Construction Products	Baad, faantu, gaali, gaien, oda, tapri, tarangadi (375).			
						Atreifacts	Manja (25).			
						Miscellaneous Products	Naadu, ker, shidh (30).			

					SMR	SRR	A long wooden log of <i>Cedrus deodara</i> is placed over a water stream as a small bridge in the name of dead person on the occasion of his death anniversary or half death anniversary. Similarly a hollowed out long wooden trough, locally known as <i>charh</i> , is installed near a source of water for holding drinking water which is used by humans as well as cattle. It is a common belief that these practices help the departed soul in crossing the rivers and getting drinking water on his his way to heaven (104). Wood of <i>Cedrus deodara</i> is used in cremation pyre for the final disposition of dead body (88).	288	1.6	
						SCR, MBE	During wedding ceremony 5 wooden parrots, locally known as <i>tootey</i> , made from <i>Cedrus deodara</i> wood, are affixed on top of the main entrance of the house. It is believed that the parrots guard the house against ghosts and evil eyes (32).			
						MBE	Bark used to ward off ghosts and influence of black magic and bad evils from the affected person by a process, locally known as <i>nahaun</i> as described above in case of <i>Alnus nitida</i> (56).			
						TAB	Cutting of <i>Cedrus deodara</i> trees in the local sacred grooves is a taboo (8).			
					FOD	Fresh	Tender branches are used as	15	0.1	

							fodder/forage for the cattle.			
218	<i>Juniperus communis</i> L. Family:Cupressaceae Accession No.:HBJU-16882	Bethal	Shrub	Seeds, leaves	MED	Musculoskeletal problems	Seed oil is massaged on affected parts for alleviating orthopaedic pain (10)*.	10	0.1	Stomach ache, intestinal swelling, rheumatism [30,96].
					PUP	Miscellaneous Products	Leaves are used as <i>deshi dhoop</i> (41).	41	0.2	
219	<i>Picea smithiana</i> (Wall.) Boiss. Family:Pinaceae Accession No.:HBJU-16885	Tos	Tree	Branches, resin	MED	Skin problems	Resin is applied externally for healing cracked heels (10).	10	0.1	Cracked heels, wounds [3].
					PUP	Artefacts	Manja is made from branches (38).	38	0.1	
220	<i>Pinus roxburghii</i> Sarg. Family:Pinaceae Accession No.:HBJU-16886	Drab Chill	Tree	Resin, seeds, leaves, branches	MED	General and unspecified	The resin is applied topically in case of fire burn. It prevents blistering and reduces the time of wound healing (11)*.	11	0.1	Kidney and bladder complaints, crack cream [46,52].
					VET	General	Resin is applied externally for healing infectious wounds and fire burns (130).	130	0.6	External parasites, broken horn, wound [27,44,48].
					EDB	Raw	Seeds eaten raw.	37	0.2	[1,12,37,38,85,95].
					PUP	Tools	<i>Mach, kaanghi, kuranu</i> are made from the branches. Paroulu made from leaves (109).	174	0.6	
						Artefacts	<i>Manja</i> is made from the branches (65).			

					SMR	SRR	A tiny broom known as <i>paroulu</i> , made from the needles of <i>Pinus roxburghii</i> , is swiftly moved to- and-fro repeatedly for blowing air into the burning charcoal in a small earthen pot, locally known as <i>daeru</i> , in which incense (<i>dhoop</i>) is burnt while performing pooja (112).	112	0.6	
221	<i>Pinus wallichiana</i> A.B.Jacks. Family:Pinaceae Accession No.:HBJU-16887	Chil	Tree	Resin, seeds, stem, branches, leaves.	MED	General and unspecified	The resin is applied topically in case of fire burn of human. It prevents blistering and reduces the time of wound healing (84)*.	84	0.4	Skin disorder, sores, boils, respiratory troubles, cough, cold, cracked heels, muscular pain, cuts, wounds, fractures, skin boils, styptic, influenza, wormicide, intestinal infection [24,33,34,39,43,45,56,79,91,98].
					VET	General and unspecified	Resin is applied externally for healing infectious wounds and fire burns (150)*.	150	0.7	Anthelmintic [51,72,104].
					EDB	Raw	Seeds eaten raw.	37	0.2	New Record
					PUP	Tools	<i>Mach, kaanghi</i> and <i>kuranu</i> are made from the branches (32).	480	1.7	
				Containers/storage products		<i>Toon, kuthar, sandook</i> and <i>ganarh</i> are made from the stems (83).				
				Construction Products		Leaves are used as <i>othan</i> (300).				
				Artefacts		<i>Manja</i> is made from the branches (65).				
					SMR	SCR	The fresh branches of <i>Pinus wallichiana</i> , locally known as <i>champu</i> , are used for making toran - a decorated gateway to the lawn of wedding house for welcoming the baratis and other	20	0.1	

							guests (12).			
222	<i>Taxus baccata</i> Thunb. Family:Taxaceae Accession No.:HBJU-16888	Dunnu	Tree	Branches, bark	MED	General and unspecified	Stem bark is brewed to tea which is taken internally for heating the body and is assumed to be most refreshing and energetic (25).	25	0.1	Spasmodic pain, cardio tonic, diaphoretic, emmenagogue, purgative, indigestion, herbal tea, high fever, asthma, bronchitis, cough, expectorant, anticancer, contraceptive [32,34,35,42,61,91,96].
					EDB	Beverages	Stem bark is brewed to tea, nutraceutical.	20	0.1	[12,14,38,78,85].
					PUP	Tools	<i>Haladi</i> is made from the branches (15).	15	0.1	
PTERIDOPHYTES										
223	<i>Adiantum capillus-veneris</i> L. Family:Pteridaceae Accession No.:HBJU-16890	Muhari-ri-dawa	Fern	Aerial parts	MED	Digestive problems	Aerial parts are ground to powder which is given orally in case of <i>muhari</i> , a distinct local ailment in newborn and small babies in which the symptoms include development of white coloured thin layer (<i>tikri</i>) on the upper surface of the tongue accompanied by loose motions, flatulence, vomiting and uneasiness (28)*.	28	0.1	Fever, rhinitis, cough, expectorant, chest congestion, head ache, kidney infection, demolucant, abdominal pain, hair tonic [35,43,46,53,56,65].
224	<i>Asplenium trichomanes</i> L. Family:Aspleniaceae Accession No.:HBJU-16891	Jalanhaar	Fern	Leaves	MED	General and unspecified problems	Leaves are dried, pounded into powder which is strained through the cloth and then sprinkled on the affected parts in case of fire burns to relieve pain, prevent formation of burn blisters and for wound healing (11).	11	0.1	Chest pain [34].
225	<i>Diplazium esculentum</i> (Retz.) Sw. Family:Athyriaceae	Kasrod	Fern	Leaves, roots	MED	Endocrine, metabolic and nutritional	Vegetable of young fronds is recommended for diabetic patients (48).	48	0.2	Constipation [3].

	Accession No.:HBJU-16889					problems				
					VET	Digestive problems	Fresh roots are crushed and given as a dose to cows and bulls in case of loose motions (70).	70	0.3	New Record
					EDB	Vegetable	Tender leaves cooked as vegetable, nutraceutical.	144	0.6	[6,11,16,50,64,68,75,78,85,92,100].
						Preserved foods	Tender leaves are used for making pickle.			
226	<i>Diplazium maximum</i> (D.Don) C.Chr. Family:Athyriaceae Accession No.:HBJU-17023	Kasrod	Fern	Leaves	MED	Endocrine, metabolic and nutritional problems	Vegetable of young fronds is recommended for diabetic patients (10).	10	0.1	Diuretic, antimicrobial [80].
					EDB	Vegetable	Tender leaves cooked as vegetable, nutraceutical.	137	0.6	[11,12,14,38,85].
						Preserved foods	Tender leaves are used for making pickle.			
227	<i>Pteris biaurita</i> L. Family:Pteridaceae Accession No.:HBJU-16892	Kakei	Fern	Roots, leaves	MED	General and unspecified	Roots are crushed and given orally as emetic to a person who has consumed poison for inducing vomiting to get rid of ingested poison (10).	10	0.1	New Record
					VET	Digestive problems	Roots are crushed and administered orally to cattle for treatment of loose motions (68).	68	0.3	New Record

					PUP	Construction Products	Leaves are used as <i>othan</i> (40).	45	0.2	
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						Miscellaneous Products	Leaves are used as <i>shota</i> (5).			
FUNGI										
228	<i>Boletus edulis</i> Bull. Family:Boletaceae Accession No.:HBJU-16893	Buthapad	Mushroom	fruiting bodies	MED	Endocrine, metabolic and nutritional problems	Vegetable of fruiting bodies is recommended for diabetic patients (10).	10	0.1	New Record
					EDB	Vegetable	Fruiting bodies are eaten after cooking as vegetable, nutraceutical (44).	74	0.3	[19].
						Miscellaneous	Fruiting bodies are eaten after roasting (30).			
229	<i>Geopora arenicola</i> (Lev.) Kers. Family:Pyronemataceae Accession No.:HBJU-16906	Kundi	Mushroom	Fruiting bodies	MED	Endocrine, metabolic and nutritional problems	Vegetable of fruiting bodies is recommended for diabetic patients (60).	60	0.3	New Record
					EDB	Vegetable	Fruiting bodies are cooked as vegetable, nutraceutical (161).	161	0.7	[19,68,75,81].
230	<i>Geopora sumneriana</i> (Cooke) M. Torre. Family:Pyronemataceae Accession No.: HBJU-17024	Kundi	Mushroom	Fruiting bodies	MED	Endocrine, metabolic and nutritional problems	Vegetable of fruiting bodies is recommended for diabetic patients (26).	26	0.1	New Record
					EDB	Vegetable	Fruiting bodies are cooked as vegetable, nutraceutical (154).	154	0.6	[19]
231	<i>Morchella conica</i> Pers. Family:Morchellaceae Accession No.:HBJU-16894	Thunthu	Mushroom	fruiting bodies	EDB	Pulao	Used as an ingredient in Pulao (61).	61	0.3	[19]

232	<i>Morchella crassipes</i> (Vent.) Pers. Family: Morchellaceae Accession No.: HBJU-17025	Thunthu	Mushroom	fruiting bodies	EDB	Pulao	Used as an ingredient in Pulao (61).	61	0.3	New Record
233	<i>Morchella esculenta</i> (L.) Pers. Family: Morchellaceae Accession No.: HBJU-16895	Thunthu	Mushroom	fruiting bodies	EDB	Pulao	Used as an ingredient in Pulao (61).	61	0.3	[11,12,14,19,38,40,68,70,75,81,94,95,100,101].
234	<i>Rhizopogon roseolus</i> (Corda) Th.Fr. Family: Rhizopogonaceae Accession No. HBJU-17027	Dudhkatta	Mushroom	Fruiting bodies	EDB	Raw	Fruiting bodies eaten raw (50).	50	0.2	[14,19]
235	<i>Sparassis crispa</i> (Wulf.) Family: Sparassidaceae Accession No.: HBJU-16896	Bhedshedi	Mushroom	Fruiting bodies	MED	Endocrine, metabolic and nutritional problems	The vegetable prepared from fresh fruiting bodies is recommended for diabetic patients (11).	11	0.1	New Record
					EDB	Vegetable	Fruiting bodies are cooked as vegetable, nutraceutical (87).	87	0.4	[81]
236	<i>Sparassis radicata</i> Weir. Family: Sparassidaceae Accession No.: HBJU-16897	Bakarshedi	Mushroom	Fruiting bodies	MED	Endocrine, metabolic and nutritional problems	The vegetable prepared from fresh fruiting bodies is recommended for diabetic patients (11).	11	0.1	New Record
					EDB	Vegetable	Fruiting bodies are cooked as vegetable, nutraceutical (87).	87	0.4	[19].
Abbreviations used in the Table: MED- Ethnomedicinal usage; VET-Ethnoveterinary usage; PUP-Plant derived utility products; EDB-Edible; SMR-Socio magico religious; FOD-Fodder/Forages; SRR-Sacred and religious rites; SCR-Socio-cultural rituals; MBE-Magical belief and exorcism; TAB-Taboos, NL-Not growing locally										

References in the Table:

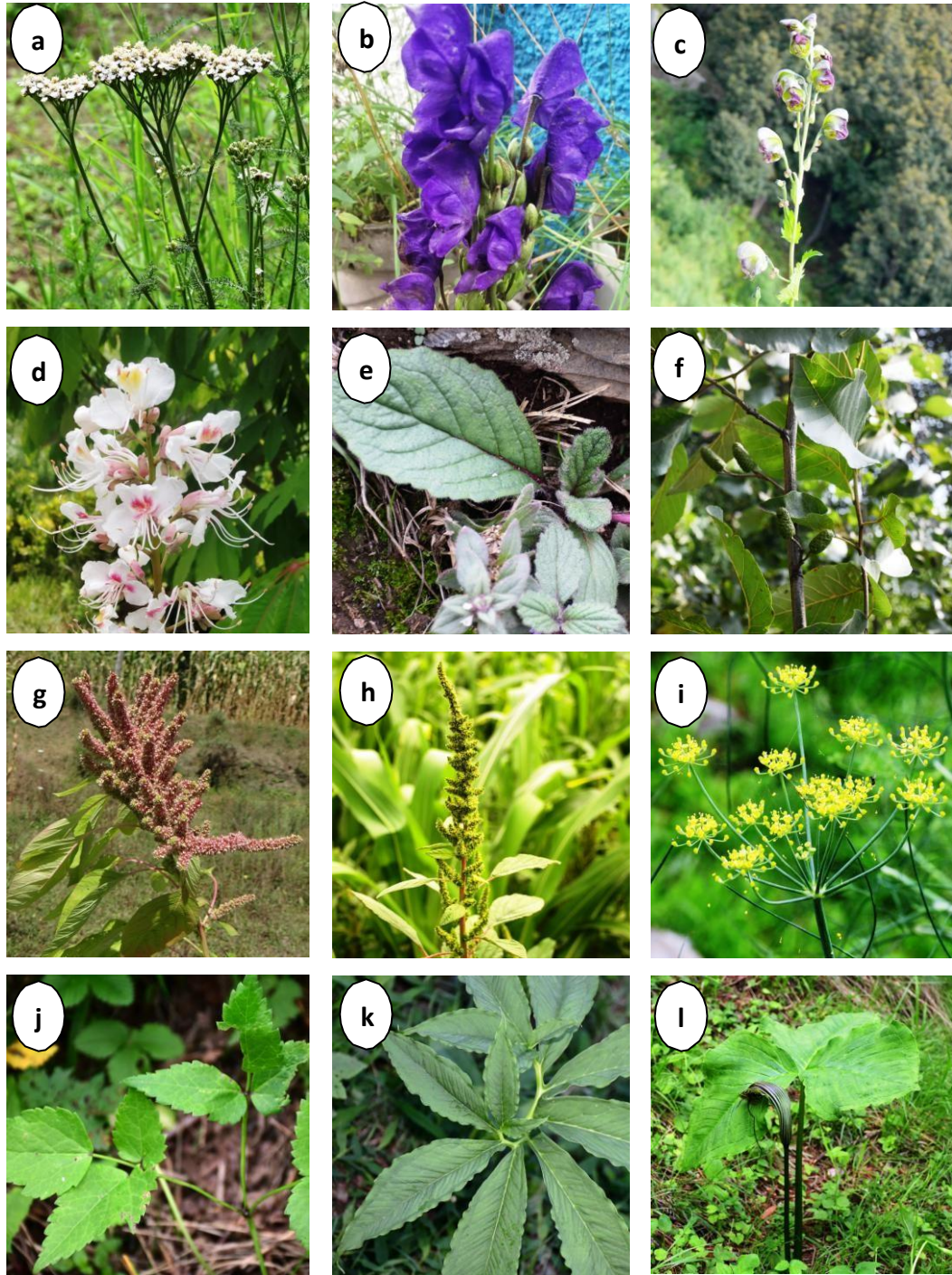
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Annexure-II

Publications

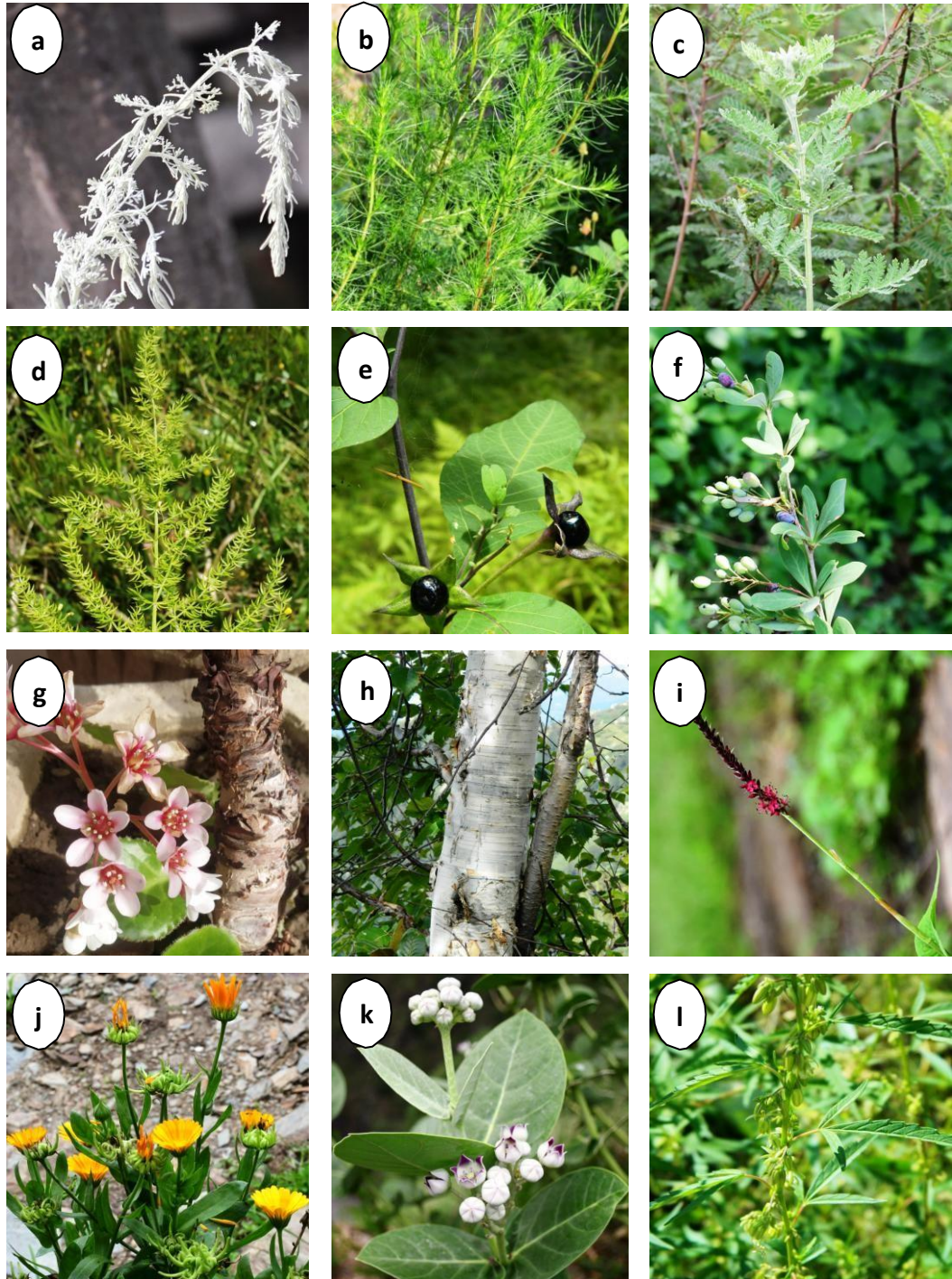
1. Singh, B. P., Devashree, Y., Sharma, V., & Manhas, R. K. (2023). Diversity of wild edible plants and fungi consumed by semi- nomadic Gaddi and Sippi tribes in Doda district of Union Territory of Jammu and Kashmir. *Ethnobotany Research and Applications*, 25, 1-33.
2. Papers presented in Conferences.
 - (i) Oral presentation on the title: “Ethnobotanical appraisal of magico-religious plants used by Gaddi tribe of Bhaderwah valley, N.W Himalaya, J&K, India” in two days International Conference on the theme “Science for Survival: To Explore the Unexplored Dimensions” organized by Govt. College for Women Udhampur, J&K, India w.e.f 10th to 11th February, 2023.
 - (ii) Oral presentation on the title: “Ethnobotanical survey of dietary and medicinal wild fruits eaten raw by Gaddi tribe of some villages of Bhaderwah (J&K), India” in International Conference on Sustainability: Life on Earth 2021 (ICS-LOE 2021)”, organized by Department of Botany and Zoology, School of Bio-engineering and Biosciences, and Institute of Forest Productivity, Ranchi, Jharkhand, at Lovely Professional University, Punjab, w.e.f 17th to 18th December, 2021.

PLATE I



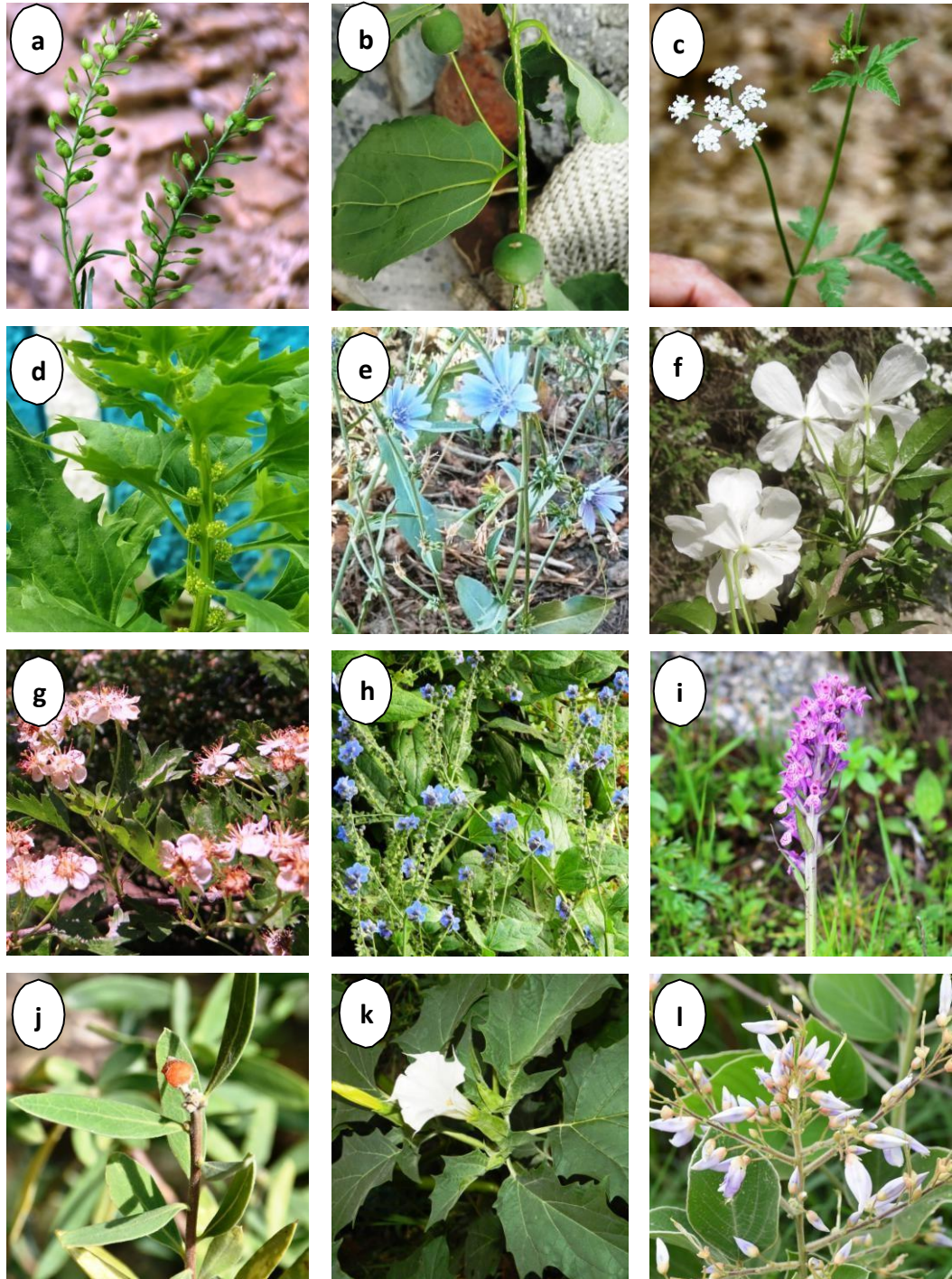
(a) *Achillea millefolium* L. (b) *Aconitum ferox* Wall. ex Ser. (c) *Aconitum heterophyllum* Wall. ex Royle. (d) *Aesculus indica* (Wall. ex Cambess.) Hook. (e) *Ajuga parviflora* Benth. (f) *Alnus nitida* (Spach) Endl. (g) *Amaranthus caudatus* L. (h) *Amaranthus spinosus* L. (i) *Anethum graveolens* L. (j) *Angelica glauca* Edgew. (k) *Arisaema jacquemontii* Blume. (l) *Arisaema propinquum* Schott.

PLATE II



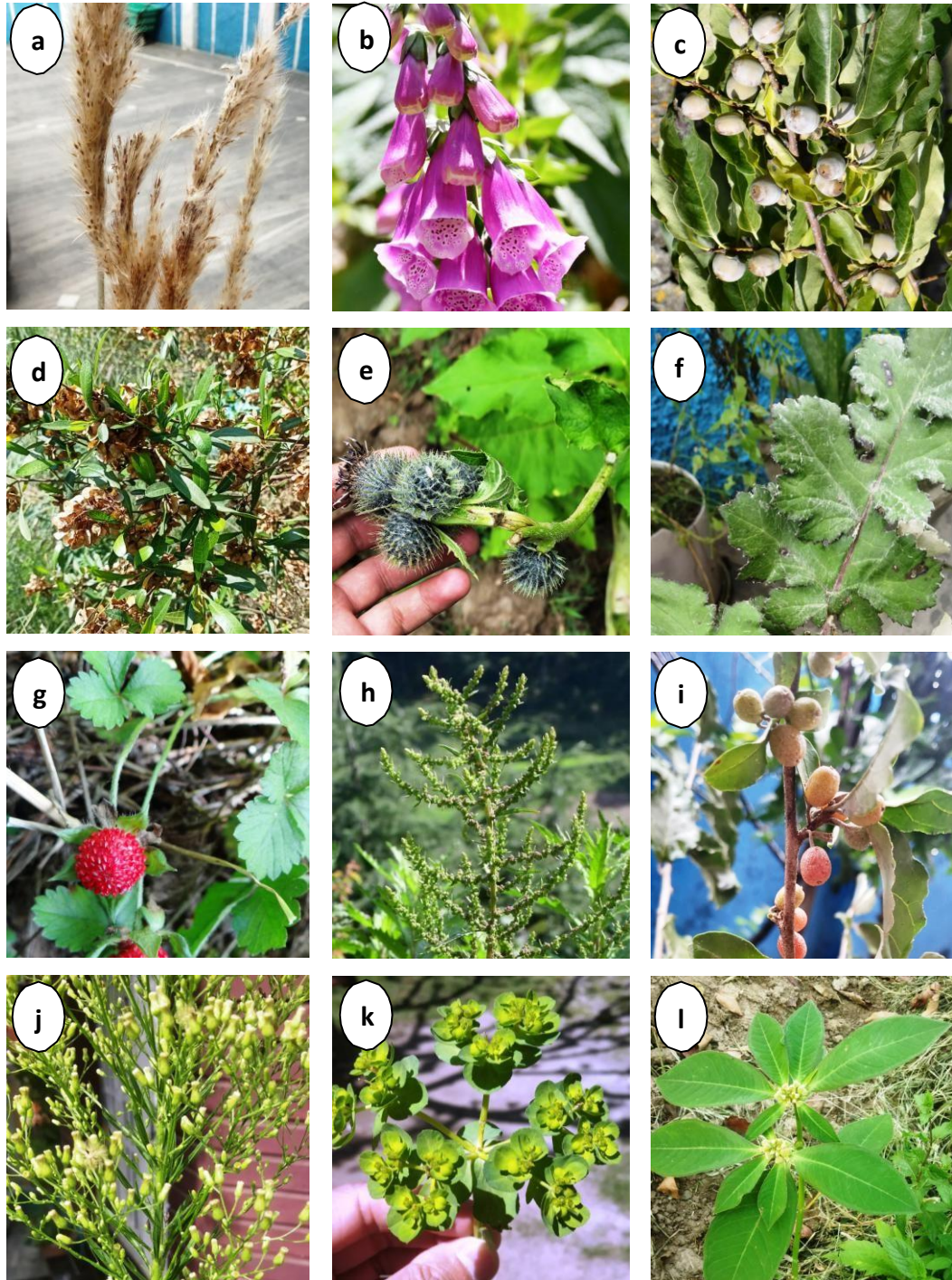
(a) *Artemisia maritima* L. (b) *Artemisia scoparia* Waldst. And Kit. (c) *Artemisia vestita* Wall. ex Besser. (d) *Asparagus filicinus* Buch.-Ham. ex D.Don. (e) *Atropa acuminata* Royle ex Lindl. (f) *Berberis lycium* Royle. (g) *Bergenia ciliata* (Haw.) Sternb. (h) *Betula utilis* D.Don. (i) *Bistorta amplexicaulis* (D.Don) Greene. (j) *Calendula officinalis* L. (k) *Calotropis procera* (Aiton) Dryand. (l) *Cannabis sativa* L.

PLATE III



(a) *Capsella bursa-pastoris* (L.) Medik. (b) *Celtis australis* L. (c) *Chaerophyllum villosum* Wall. ex. DC. (d) *Chenopodium foliosum* Asch. (e) *Cichorium intybus* L. (f) *Clematis montana* Buch.-Ham. ex DC. (g) *Crataegus songarica* K.Koch. (h) *Cynoglossum lanceolatum* Forssk. (i) *Dactylorhiza hatagirea* (D.Don) Soo. (j) *Daphne oleoides* Schreb. (k) *Datura stramonium* L. (l) *Desmodium elegans* DC.

PLATE IV



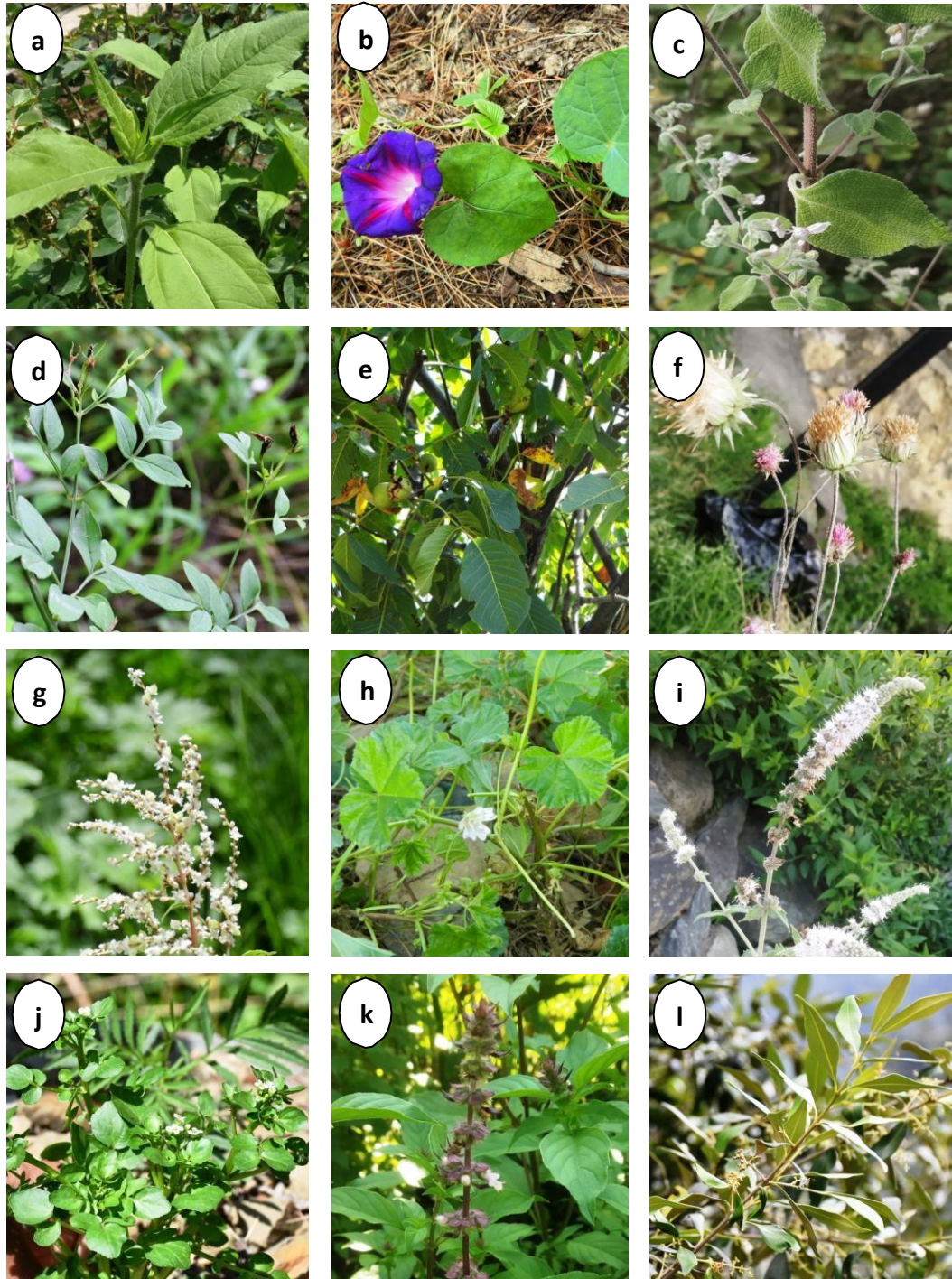
(a) *Desmostachya bipinnata* (L.) Stapf. (b) *Digitalis purpurea* L. (c) *Diospyros lotus* L. (d) *Dodonaea viscosa* Jacq. (e) *Dolomiaea costus* (Falc.) Kasana & A.K. Pandey. (f) *Dolomiaea macrocephala* DC. ex Royle. (g) *Duchesnea indica* (Andrew) Focke. (h) *Dysphania ambrosioides* (L.) Mosyakin & Clemants. (i) *Elaeagnus umbellata* Thunb. (j) *Erigeron bonariensis* L. (k) *Euphorbia helioscopia* L. (l) *Euphorbia heterophylla* L.

PLATE V



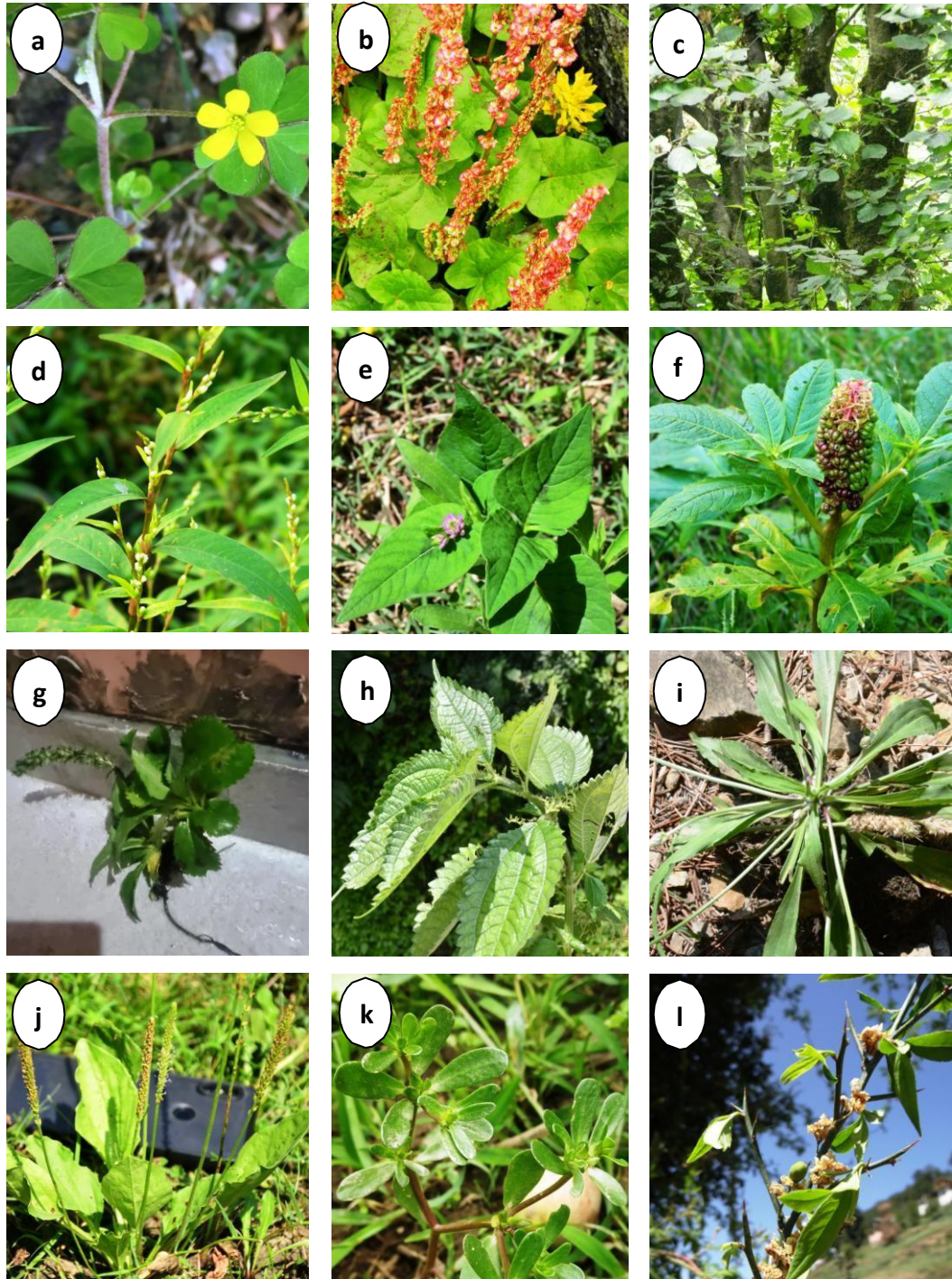
(a) *Euphorbia pilosa* L. (b) *Fagopyrum cymosum* (Trevir.) Meisn. (c) *Ficus palmata* Forssk. (d) *Fragaria vesca* L. (e) *Fraxinus excelsior* L. (f) *Fumaria parviflora* Lamk. (g) *Galium aparine* L. (h) *Geranium wallichianum* D.Don ex Sweet. (i) *Girardinia diversifolia* (Link) Friis. (j) *Hedera nepalensis* K.Koch. (k) *Impatiens glandulifera* Royle. (l) *Indigofera heterantha* Brandis.

PLATE VI



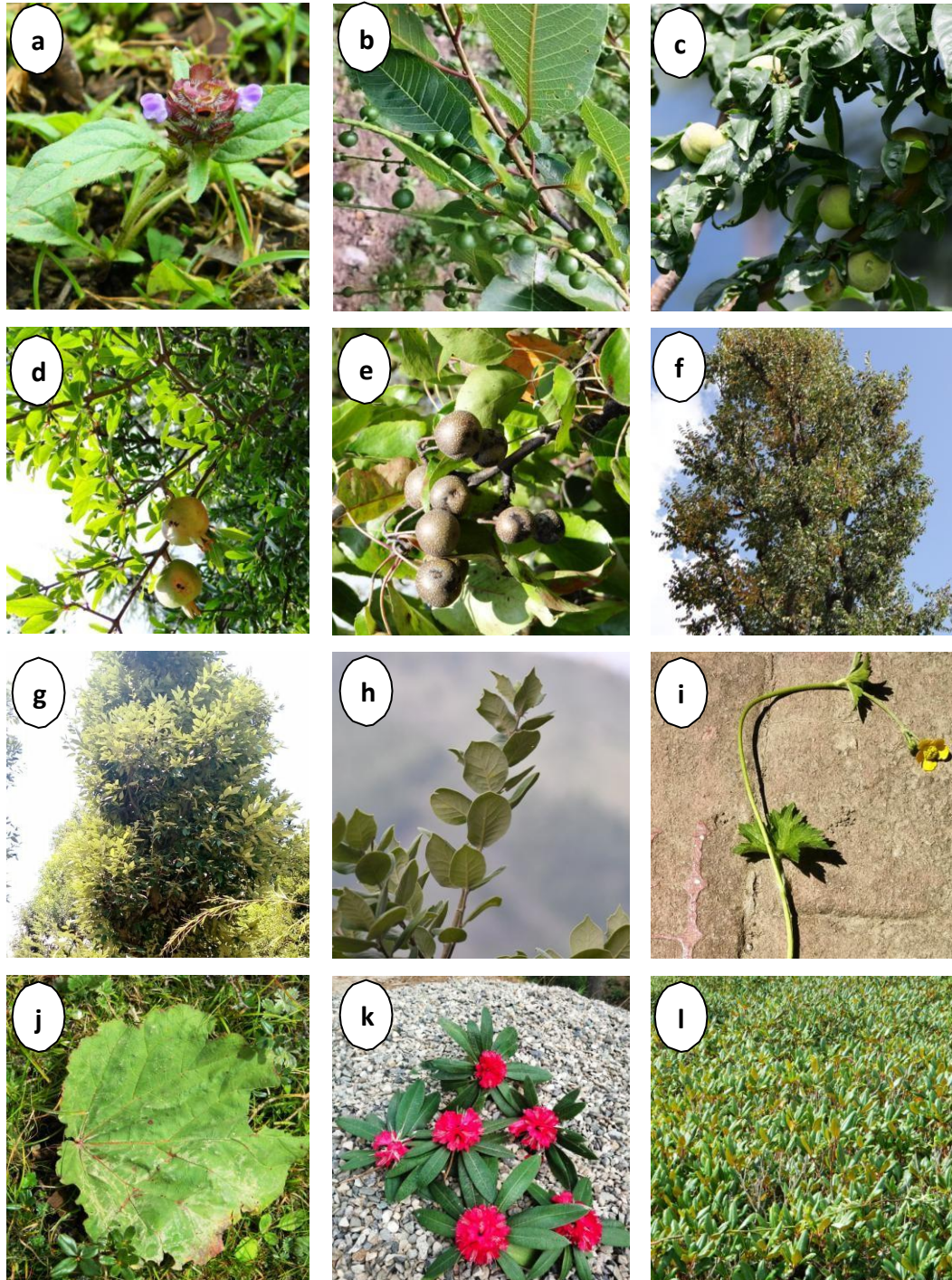
(a) *Ipomoea batatas* (L.) Lam. (b) *Ipomoea purpurea* (L.) Roth. (c) *Isodon rugosus* (Wall. ex Benth.) Codd. (d) *Jasminum officinale* L. (e) *Juglans regia* L. (f) *Jurinea heteromalla* (D.Don) N.Garcia, Herrando & Susanna. (g) *Koenigia polystachya* (Wall. ex Meisn.) T.M.Schust. & Reveal. (h) *Malva neglecta* Wallr. (i) *Mentha longifolia* (L.) L. (j) *Nasturtium officinale* W.T Aiton. (k) *Ocimum basilicum* L. (l) *Olea ferruginea* Royle.

PLATE VII



(a) *Oxalis corniculata* L. (b) *Oxyria digyna* (L.) Hill. (c) *Parrotiopsis jacquemontiana* (Decne.) Rehder. (d) *Persicaria hydropiper* (L.) Delarbre. (e) *Persicaria nepalensis* (Meisn.) Miyabe. (f) *Phytolacca acinosa* Roxb. (g) *Picrorhiza kurroa* Royle ex Benth. (h) *Pilea umbrosa* Wedd. ex Blume. (i) *Plantago lanceolata* L. (j) *Plantago major* L. (k) *Portulaca oleracea* L. (l) *Prinsepia utilis* Royle.

PLATE VIII



(a) *Prunella vulgaris* L. (b) *Prunus cornuta* (Wall. ex Royle) Steud. (c) *Prunus persica* (L.) Batsch. (d) *Punica granatum* L. (e) *Pyrus pashia* Buch.-Ham. ex D.Don. (f) *Quercus floribunda* Lindl. ex A.Camus. (g) *Quercus leucotrichophora* A.Camus (h) *Quercus semecarpifolia* Sm. (i) *Ranunculus sceleratus* L. (j) *Rheum australe* D. Don. (k) *Rhododendron arboreum* Sm. (l) *Rhododendron campanulatum* D.Don.

PLATE IX



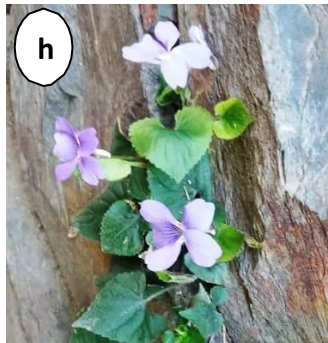
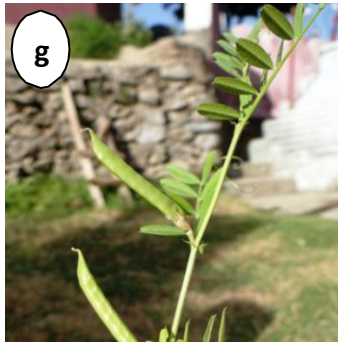
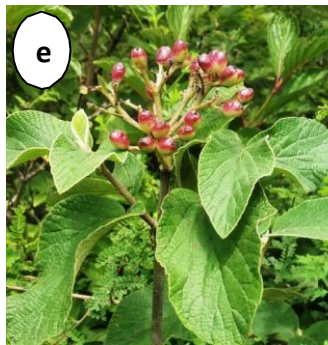
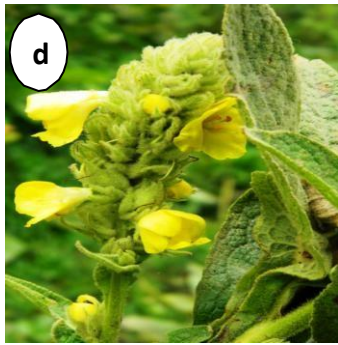
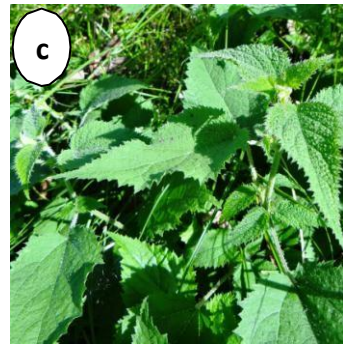
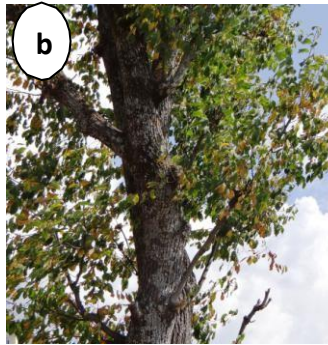
(a) *Robinia pseudoacacia* L. (b) *Rosa brunonii* Lindl. (c) *Rubia cordifolia* L. (d) *Rubus niveus* Thunb. (e) *Rumex hastatus* D. Don. (f) *Rumex nepalensis* Spreng. (g) *Sageretia thea* (Osbeck) M.C. Johnst. (h) *Silene edgeworthii* Bocquet. (i) *Sinopodophyllum hexandrum* (Royle) T.S. Ying. (j) *Skimmia anquetilia* N.P. Taylor & Airy Shaw. (k) *Solanum villosum* Mill. (l) *Solena heterophylla* Lour.

PLATE X



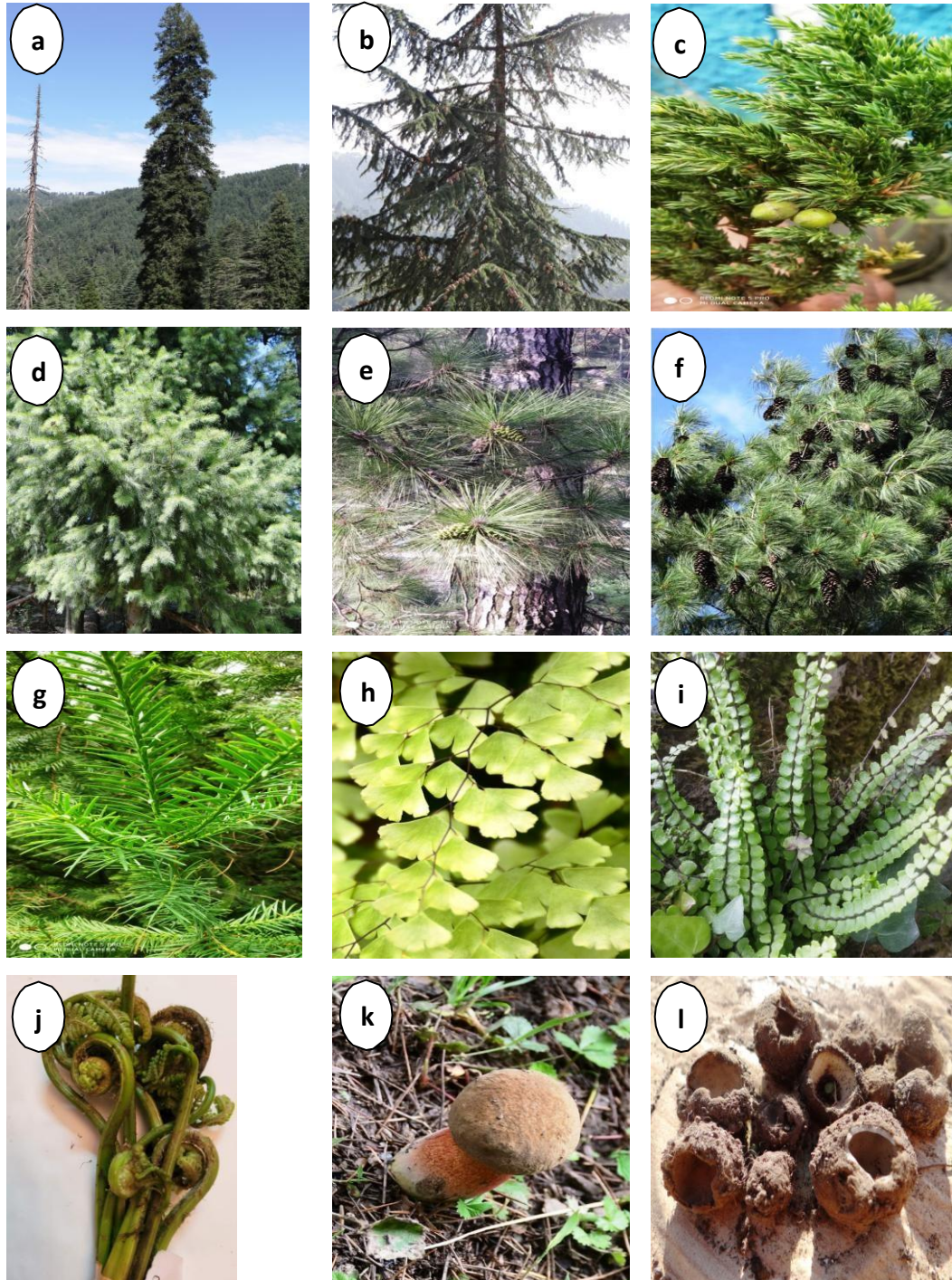
(a) *Sorbaria tomentosa* (Lindl.) Rehder. (b) *Spiraea canescens* D.Don. (c) *Stellaria media* (L.) Vill. (d) *Swertia purpurascens* (D.Don) C.B.Clarke. (e) *Tagetes minuta* L. (f) *Taraxacum officinale* F.H.Wigg. (g) *Themeda anathera* (Nees ex Steud.) Hack. (h) *Thymus serpyllum* L. (i) *Toxicodendron succedaneum* (L.) Kuntze. (j) *Trifolium dubium* Sibth. (k) *Trifolium pratense* L. (l) *Trifolium repens* L.

SLIDE XI



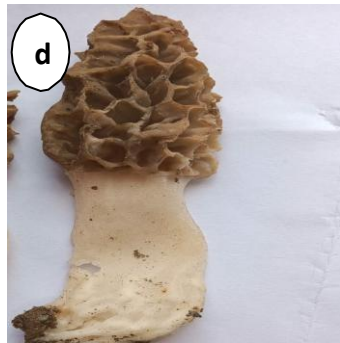
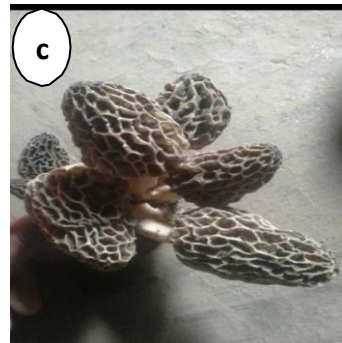
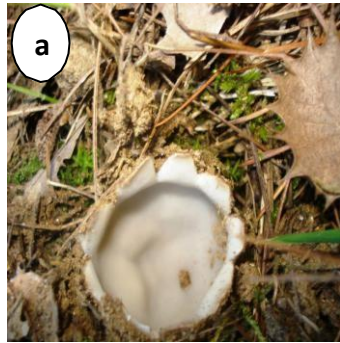
(a) *Tripidium rufipilum* (Steud.) Welker, Voronts. & E.A Kellogg. (b) *Ulmus wallichiana* Planch. (c) *Urtica dioica* L. (d) *Verbascum thapsus* L. (e) *Viburnum cotinifolium* D.Don. (f) *Viburnum grandiflorum* Wall.ex DC. (g) *Vicia sativa* L. (h) *Viola canescens* Wall. (i) *Zanthoxylum armatum* DC. (j) *Ziziphus oxyphylla* Edgew.

SLIDE XII



(a) *Abies pindrow* (Royle ex D.Don) Royle. (b) *Cedrus deodara* (Roxb.) G. Don. (c) *Juniperus communis* L. (d) *Picea smithiana* (Wall.) Boiss. (e) *Pinus roxburghii* Sarg. (f) *Pinus wallichiana* A.B.Jacks. (g) *Taxus baccata* Thunb. (h) *Adiantum capillus-veneris* L. (i) *Asplenium trichomanes* L. (j) *Diplazium esculentum* (Retz.) Sw. (k) *Boletus edulis* Bull. (l) *Geopora arenicola* (Lev.) Kers.

SLIDE XIII



(a) *Geopora sumneriana* (Cooke) M. Torre. (b) *Morchella conica* Pers. (c) *Morchella crassipes* (Vent.) Pers. (d) *Morchella esculenta* (L.) Pers. (e) *Rhizopogon roseolus* (Corda) Th.Fr. (f) *Sparassis radicata* Weir.

