Ethnobotanical study and conservation status of medicinal plants used by traditional healers in Toormang Valley, Northern Pakistan

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Abstract

Background: Due to the lack of basic health facilities and poor economic situation, the traditional use of plants for curving diseases is very common in rural areas of developing and underdeveloped countries across the globe. In the current study, we aimed to document the ethnomedicinal knowledge and conservation status of medicinal plants in the Toormang Valley, Dir Lower, located in Northern Pakistan.

Methods: Ethnobotanical interviews, questionnaires, and group discussions, were carried out from 2018 to September 2020. In this study, 113 native participants were interviewed. Qualitative data were analyzed by using Relative Frequency of Citation (RFC) and Family importance value (FIV).

Results: During multiple field surveys (i.e. 2018–2020), we reported 91 ethnomedicinal important plants belonging to 78 genera and 44 families. Family Asteraceae occupied the leading position by contributing 9 species. Leaves were the most frequently used part of herbal formulation. The local inhabitants used these medicinal plants against various diseases such as abdominal pain, external wounds, urinary disorders, vomiting, digestion, etc. The conservation status of medicinal plants in the research area revealed that rare were 53 species (58.24%), followed by vulnerable 25 species (27.47%), infrequent 12 species (13.18%) and only *Punica granatum* L. was an endangered species.

Keywords: Ethnomedicine; conservation status; Toormang Valley; Dir Lower; Northern Pakistan

1. Introduction

Ethnobotany is the study of how the native people of a region use their local plants as medicines. It has become the relationship between society and plants (Aumeeruddy, 1996). The science of ethnobotany can encompass several fields of research, including botany, pharmacology, medicine, biochemistry, nutrition, toxicology, agriculture, anthropology, and ecology. Thus, ethnobotanical studies have several methodologies and use (Alexiades, 1996). In 1896, John Harshberger, a US botanist, invented the term "ethnobotany" (Cox, 2000; Awan et al. 2013). It is believed that the concepts behind ethnobotanical medicine began in Greece and were subsequently embraced by the Arabs. After that, these concepts were learned and promoted by Indians and Europeans (Ahmad, 1999; Khan and Musharaf, 2014).

Herbal medications have been used in healthcare since ancient times. The first ethnomedicinal plants were recorded in Rigveda (4500–1600) BC and Ayurveda (2500–600) BC (Jan *et al.* 2020). Wild plants have been a source of nourishment for humans for thousands of years. These plants were used by the tribal peoples for the production of textiles and for the preparation of medicines to survive in harsh environmental conditions. The term "herbal medicine" refers to the practice of using plants or plant parts such as roots, stems, leaves, flowers, and seeds to treat illnesses (Iriti *et al.* 2010).

Medicinal plants are plants that have been shown to have active biochemical constituents and to help treat illnesses in living beings. These plants have been given the name "medicinal plants" (Ali *et al.* 2017). Medicinal plants and herbs are used as medicine all over the world, and nearly every country has benefited from their effective healing and medicinal properties (Serrentino, 1991). Folk medicinal knowledge of medicinal plants and their usage by indigenous people is valuable for conservation and medication development (Kantati *et al.* 2016). It is estimated that approximately 25% of current drugs are derived from plants (Imanshahedi and Hosseenzadeh, 2006). A World Health Organization (WHO) report claimed that 80 percent of people in underdeveloped countries get their basic health care from native medicinal plants because modern health care services are either not available or not good enough (World Health Organization, 2002; Calixto, 2005). In most countries, traditional medicine is the primary method of health care. Researchers have found that medicinal plants are helpful in herbal medicine because they are flexible, accessible, low-cost, and have minimal harmful effects (Payyappallimana, 2010).

Medicinal plants are used to make more than 25% of the world's medicines and drugs (Malik *et al.* 2010). There are 422,000 species of flowering plants in the world, and roughly 50,000 of these plant species have been used for therapeutic purposes around the world (Govaerts, 2001; Schippmann *et al.* 2002; Jan *et al.* 2020). According to the WHO, there are about 252 basic medicines that are necessary for providing basic medical care, and 11% of these are made from various types of medicinal plants (Rates, 2001). People treat ailments with medicinal plants based on their indigenous knowledge and cultural traditions (Vandebroek and Thomas, 2003). The traditional knowledge of older people says that ethnomedicine comes mostly from plants that are used to treat illnesses. So, information about medicinal plants have been passed down orally from generation to generation (Shinwari, 2010; Hussain *et al.* 2022). This verbal conversation helps in spreading indigenous knowledge about medicinal plants, but it also changes over time as it is passed from one person to the next (Balick and Cox, 1996).

Ethnobotanical surveys are used to assemble and document the indigenous knowledge of medicinal plants obtained from local elderly people and specialists. This information is then used to describe plants that have the potential to be used as a source of medications to treat various diseases (Sarwat and Ahmad, 2012). The local people in Pakistan use many different plants as medicine to treat different health problems (Pie and Manandhara, 1987; Zandial, 1994; Ibrar *et al.* 2007; Mahmood *et al.* 2013). For clinical purposes, many studies have been conducted to record the local knowledge of Pakistani people about using medicinal plants as medicine (Shehzad and Qureshi, 2001; Dar, 2003; Ajaib *et al.* 2010). Nowadays, a wide range of ailments can be treated with traditional medicinal plants (Davidson-Hunt, 2000).

The term "conservation" has two meanings: active and passive. In an active sense, conservation means doing all actions to ensure a higher probability of survival in the future for a useful thing that must be conserved. Many factors in the plant world need to be conserved, such as plant diversity (Jamal, 2009). Conservation in its passive sense means referring to all of the activities and procedures that have nothing to do with conserving the environment. Passive conservation can readily be turned into active conservation by incorporating conservation measures into people's daily lives (Chunlin and Shengii, 2003).

Human involvement and erroneous behavior have made plant conservation a serious problem. They cause deforestation, resource shortages, extinctions, and environmental

deterioration. Humans and their actions threaten biodiversity (Hamilton and Hamilton, 2006). Several researchers have investigated the conservation status of plants in some regions of Pakistan. Flora conservation was challenging due to a lack of information and proper programs. However, modern experts are looking into the problems, and it is expected that planning for the future will keep the plants from going extinct (Khalid, 2017). The literature shows that science-based work has not been done on ethnobotany and conservation of medicinal plants in the Toormang Valley, Dir Lower. Therefore, ethnomedicine and the conservation of the valley need to be explored.

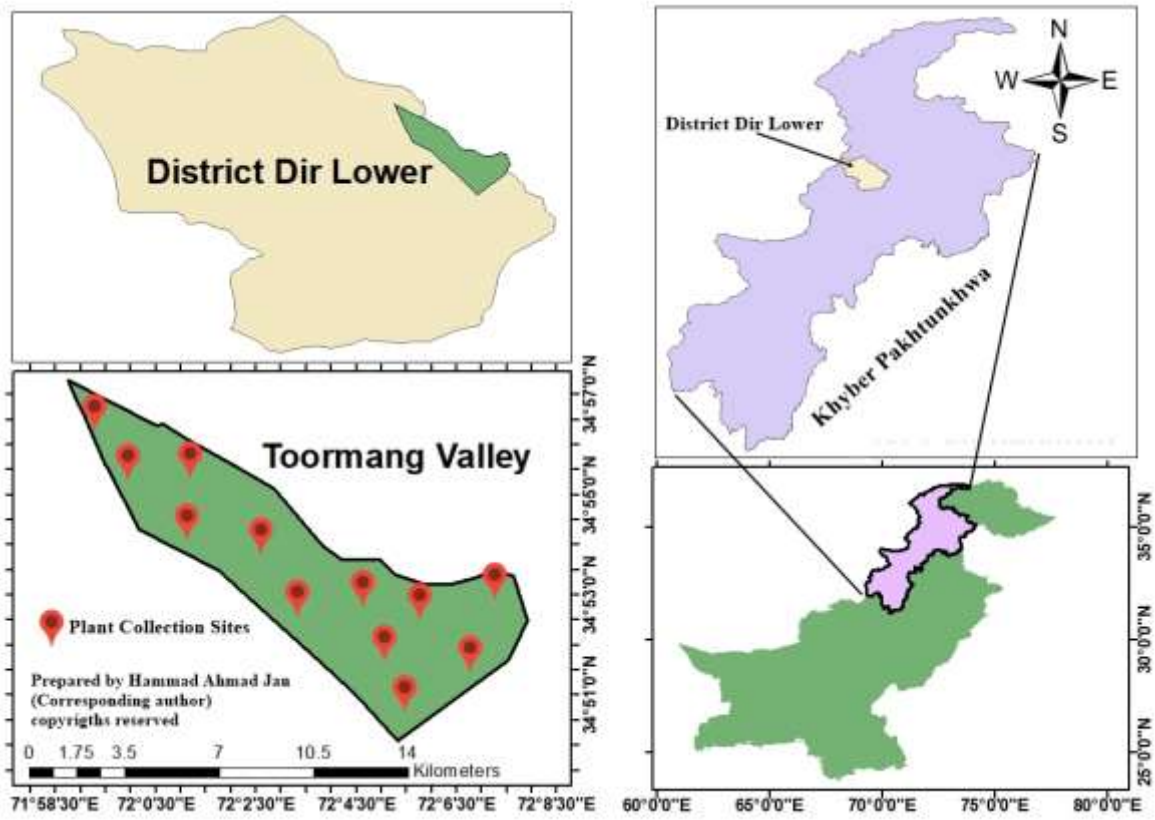

Fig. 1. Map of the study area

2. MATERIALS AND METHODS

Data collection

The field trips were arranged to a different location in Toormang valley from November 2018 to September 2020. About 113 informants were interviewed. The ethnomedicinal data was collected through face-to-face interviews, group discussion, and

semi-structured questionnaires, and informants were selected through snow ball and free listing method (Ghorbani *et al.* 2011; Jan *et al.* 2022). Detailed interviews were mostly followed by free listing. We encouraged the local population to enlarge the free listing. The collected ethnomedicinal data was cross-checked among the informants to confirm the genuineness of the data. Prior verbal consent was always obtained from each informant (Abidin *et al.* 2022; Mir *et al.* 2022). All the informants were interviewed in their native language (Pashto). The informants' demographic characteristics were also documented. The interviews from the male informants were taken in the field, Hujra, or Baithaks, and the interviews from female informants were taken at homes. To document the present status of traditional knowledge the local herbalists (hakims) were also interrogated in their herbal shops. For the index use the questionnaire was analyzed in two ways: firstly, responses of the informants have been documented and in the second step the binary values for the questions were considered, 0 value was allotted to answer "NO" and value 1 allotted to the answer "YES" (Andrade- Cetto, 2009).

For enhancing understanding of the gathered information on collected medicinal plants available in the study area un-ceremonious dialogues and walks in the field were held with key informants comprising herdsmen, farmers, teachers, housewives, shepherds, and students (from school to university). The informants' age ranged from 21-85. The knowledge they delivered us was documented unerringly according to the technique of Mengistu and Hager, (2008). To verify the authenticity of the collected data about medicinal plants it was cross-checked at various communities either by presenting the plant's fresh or dry specimen, telling the local name/s of the plant, or displaying the photograph/s of the plant to the informants.

Plant collection, preservation, and identification

The collection of medicinal plants was done in different seasons from 2018 to 2020. In each season at least four to five field trips were arranged randomly to collect the maximum plants. In each field trip after plant collection with the help of a local guide, we meet with the local informants to document the local traditional knowledge about medicinal plants. It was noted that some plant species were not native to the study area but are used in local recipes to cure various illnesses. These medicinal plants were also collected and documented. Forman and Birdson, (1989) technique was followed for the preservation of collected medicinal plants. Appropriate photographs of the vegetative parts, fruits, and flowers were captured of the medicinal plants in the field with the help of the digital camera Fuji. During the interview self and informants' photographs were captured. Similar self-photographs were captured during plant collection. To identify collected medicinal plants help was taken from the

available literature. The botanical names were confirmed from the Flora of Pakistan Tropicos (www.tropicos.org/Project/Pakistan). The International Plant Names Index (IPNI: http://www.ipni.org), The Plants list (http://www.theplantlist.org/), and medicinal plants name service (http://mpns.kew.org/mpns-portal/) websites were visited for correct botanical names of plants. For future reference, all the medicinal plant specimens collected acquiesced to the Herbarium of the Department of Botany, Islamia College Peshawar, Pakistan.

Relative frequency citation

RFC is a useful index for determining the ethnobotanical significance of plants (Jan *et al.* 2022). The (RFC) was calculated as follows:

$$\mathrm{RFC} = \frac{\mathrm{FC}}{\mathrm{N}}$$

In the formula RFC stands for relative frequency citation, FC represents the number of respondents who listed the native plants and N denotes the total number of respondents (Ugulu *et al.* 2009). The RFC value varies from 0 (no respondent mentioned the plant as effective) to 1 (every respondent suggests that the plant is beneficial) (Sadeghi and Mahmood, 2014; Ahmad *et al.* 2021).

Family importance value and conservation status

Family importance value (FIV) reflects the local significance of wild species families. The family importance value (FIV) was evaluated using the given formula.

$$\mathrm{FIV} = \frac{\mathrm{FC(Family)}}{\mathrm{N}} \times 100$$

FIV stands for family importance value, FC shows the frequency of citation of plant family and N represents the total number of participants (Vitalini *et al.* 2013; Ullah *et al.* 2019).

The conservation status of medicinal plants was listed according to IUCN standards (ICUN, 2001). The plants were assigned specific values based on the following criteria and then placed in the relevant category.

1= Availability class es

0-Uncommon or very rare

1- Less common or rare

2-Occasional

3-Abundant

2= Collection status

0- More than 1000 kg/yr

1- Consumed from 500-1000 kg/yr

2-Consumed from 300-500 kg/yr

3- Consumed from 100-200 kg/yr

3= Growth behavior

0- Regrowth in more than 3 years

1- Regrowth within 3 years

2- Regrowth within 2 years

3- Regrowth within 1 years

4- Regrowth in a season

4= Parts used

0- Root/ Whole plant

1-Bark

2- Seeds, Fruits

3- Flowers

4-Leaves/Gums/Latex

5= Total scores

1. 0-4 Endangered
2. 5-8 Vulnerable
3. 9-12 Rare
4. 13-14 Infrequent

5 15- 16 Dominant

Results

Medicinal plants reported

The present survey was conducted to explore the ethnobotanical information of medicinal plants, including 91 species that fall into 78 genera and 44 families (**Table 5**). Ethnomedicinal information for each species, including habit, local name, botanical name, utilization of plant parts, application of each plant, conservation status, the relative frequency of citation (RFC), and family importance value (FIV). The family Asteraceae comprised most of these medicinal plants, including 9 species (9.89%), followed by the family Rosacea with 8 species (8.79%), Solanaceae with 6 species (6.59%), Lamiaceae and Cucurbitaceae each had 5 species (5.49%), Poaceae had 4 species (4.39%), Apiaceae, Brassicaceae, Rutaceae, and Chenopodiaceae each had 3 species (3.29%), and the rest of the 25 families consisting of only one species (**Table 1; Fig 1**).

Floristic diversity and life forms

Most of the medicinal plants of the Toormang valley are herbaceous. A total of 91 medicinal plants were identified, of which herbs were 58 species (63.73%) followed by trees 20 species (21.97%), and shrubs 13 species (14.28%) (Table 2; Fig 2).

Plant parts used for traditional medicines

During the survey, mostly the elderly people had great knowledge of the traditional uses of medicinal plants. According to them, different plant parts are used for medicinal purposes. The most commonly used plant parts are leaves (35.0%), followed by fruit (20.5%), seeds (12.8%), whole plant (11.9%), root (5.12%), bark (4.27%), gums (2.56%), flowers (2.56%), bulbs (1.7%), latex (1.7%), spikes (0.85%), and resins (0.85%) as shown in (Table 3.6; Fig 3.11). The decoction is the most popular method of administration. Some medicinal plant species powders were effective, while, on the other hand, the fresh forms of medicinal plants were also used as crude drugs (Table 1; Fig 3).

Relative frequency citation (RFC)

The largest RFC values were reported for *Olea ferruginea, Punica granatum, Ajuga parviflora*, *Aloe vera,* and *Fumaria indica* (0.29 each), followed by *Solanum nigram*, *Rosa indica, Juglens regia*, *Momordica charantia,* and *Ammi visnaga* (0.27 each), *Allium sativum*, *Brassica campestris* (0.25 each), *Mentha arvensis*, *Abelmoschus esculentus* (0.23 each), *Foeniculum vulgare* (0.22), and *Papaver somniferum* (0.20) (Table 1; fig 4).

Family importance value (FIV)

The highest FIV value was recorded for the family Lamiaceae (98.2), followed by Rosaceae (95.6), Solanaceae (76.1), Asteraceae (63.7), Apiaceae (56.3), Cucurbitaceae (45.1), Alliaceae and Mimosaceae each family (42.5), Brassicaceae (38.9), Oleaceae (33.6), Rutaceae (31.8), Xanthorrhoeraceae, Fumaraceae, Polygonaceae each (29.2), Moraceae and Malvaceae each (28.3) as in (Table 1; fig 5).

Conservation status of medicinal plants

Among 91 ethnomedicinally important medicinal plants, about 53 species (58.24%) were reported as Rare, 25 plant species (27.47%) were Vulnerable, 12 species (13.18%) Infrequent, while *Punica granatum* (1.09%) was declared endangered, as shown in Table 2 and fig 6. The findings also revealed that neither species followed the IUCN rules of dominance. A few rare species were *Alismaplantago-aquatica, Hordium vulgare, Cymbopogon commutatus, Justicia adhatoda, Achyranthus aspera, Foeniculum vulgare, Ammi visnaga, Periploca aphylla, Sonchus oleraceaus, Parthenium hysterophorus,*

Nasturtium officinal, Eruca sativa, Opuntia dillenii, Ajuga parviflora, Mentha arvensis, Salvia meorcuftiana, Platanus orientalis, Pinus roxburbii, Pyrus malus and *Rubus fruicosus.* Several medicinal plants species were reported as vulnerable plant species like *Ziziphus jujube, Eriobotrys japonica, Prunus armenica, Capsicum frutescans, Celtis australis, Urtica dioca, Solanum tuberosum, Cotoneaster nummularia, Ziziphus sativa, Olea ferruginea, Morus alba, Fumaria indica, Diospyros lotus, Narcissus tazetta* and *Cynodoan dactylon* (Table 1).

Discussion

The present survey revealed that the majority of medicinal plants belong to the families Asteraceae, Rosacea, and Solanaceae. Our results are in line with Haq *et al.* (2011), Murad *et al.* (2011), Wali *et al.* (2019), and Rashid *et al.* (2022) who also revealed that the highest number of medicinal plants were observed in the family Asteraceae, followed by the families Solanaceae, Poaceae, and Moraceae, which could be due to their broader diversity and abundance in the research area. It has been found that many of the medicinal plants collected in this study are present in other parts of the country as mentioned by other researchers (Ibrar *et al.* 2003; Shah *et al.* 2006; Qureshi *et al.* 2007; Abbasi *et al.* 2010; Bano *et al.* 2013; Arshad *et al.* 2014; Amjad *et al.* 2015 and Hussain *et al.* 2018; Abdin *et al.* 2022).

The major traditional uses of medicinal plant parts were leaves, followed by fruit and seeds. Our results are supported by Dolatkhahi *et al.* (2014), Kona *et al.* (2016) and Jan *et al.* (2020) who reported leaves as the major plant part used, followed by fruits, while leaves are also the major plant part reported by Mohammed *et al.* (2016). Similarly, Ullah *et al.* (2020) investigated the ethnomedicinal flora of Dir Lower and reported that most inhabitants of the region use leaves, fruits, flowers, and bark for the therapy of different diseases.

Our result shows that the majority of the medicinal plants were used for medical use, such as the leaves of *Calendula officinalis* be quite effective in kidney stones, *Coriandrum sativum* as antispasmodic, the latex of *Periploca aphylla* as an antibiotic, the oil of *Brassica campestris* is used for the massage of hair and body, *Opuntia dillenii* as a laxative, *Convolvulus arvensis* as purgative, *Chenopodium album* root used in jaundice and urinary disease, *Cucumis melo* as Antidiabetic, *Pinus roxburbii* resin Increase the efficiency of the digestive tract. *Viola biflora* leaves were effective in joint inflammation. *Allium sativum,*

Allium cepa, Narcissus tazetta, Alismaplantago-aquatica, Cynodon dactylon, Justicia adhatoda, Ammi visnaga, Nerium oleandes, Artemisia scoporia, Taraxacum officinals, Opuntia dillenii, and *Juglans regia* were recorded to be used in various types of disease such as antidiuretic, carminative, blood pressure, constipation, cleaning of teeth and gums, diarrhea, skin irritation, hepatitis, cough and asthma, expectorant, stomach problems, hepatic disorders, snake bite, backbone pain, abdominal pain, throat sore, constipation, and headache. A similar result is supported by Mussarat *et al.* (2014), who that *Allium cepa, Coriandrum sativum*, and *Foeniculum vulgare* were effective for stomach problems, carminatives, and cholera. Sher *et al.* (2021) reported that the leaves of *Viola biflora* are used to cure constipation. Ahmad *et al.* (2021) reported the ethnomedicinal uses of plant species that are used for the treatment of different diseases like jaundice, expectorant, hepatitis, carminative, laxative, emetic, and scorpion bites. Our findings are in agreement with Irfan *et al.* (2018), who also reported ethnomedicinal uses of medicinal plants for various purposes such as diarrhea, abdominal pain, analgesic, kidney stones, toothache, blood purifiers, dysentery, and healing of wounds. A similar study was conducted previously on the ethnomedicinal survey of Kahuta, Punjab (Qureshi and Khan, 2001), therapeutic plants from the Shawer Valley, Swat (Hussain *et al.* 2006), the ethnomedicinal profile of plants from the Chapursan Valley, Gilgit Baltistan (Wazir *et al.* 2004), a checklist of some of the therapeutic plants from the Siran Valley, Mansehra (Shah and Khan, 2006), A diverse range of medicinal plant species from Wari, Upper Dir (Manan *et al.* 2007), an ethnobotanical survey of plants from Kabal, Swat (Ahmad *et al.* 2011), Use of traditional medicinal plants from Maidan Valley, District Dir lower (Irfan *et al.* 2018), and medicinal plants used as ethnomedicinal remedies by rural populations of Kaghan Valley to treat gastrointestinal disorders (Jamal *et al.* 2017).

Relative frequency of citation (RFC) shows us more about the local significance of specific medicinal plants such as *Olea ferruginea, Ajuga parviflora*, and *Aloe vera* for the therapy of different kinds of ailments. Ahmad *et al.* (2014) worked on the ethnobotanical study of medicinal plants and observed the largest RFC values for *skimmia laureola, origanum vulgare,* and *Geranium wallichianum*. Ali (2016) also found the highest values of RFC for *Juglans regia, Skimmia laureola,* and *Olea ferruginea.*

The family importance value (FIV) was determined to illustrate the significance of every plant family, like the Lamiaceae, Rosaceae, and Solanaceae, based on the number of plants in a family used as medicine. Our results are in agreement with Ali *et al.* (2018), who

observed that the families Lamiaceae, Rosaceae, and Solanaceae had the highest FIV value in the Hindukush range, District Swat. My findings also agreed with the previous research on FIV values reported by Hussain *et al.* 2006; Ibrar *et al.* 2007; Sher *et al.* 2011; Ahmad *et al.* 2013; and Ahmad *et al.* 2014).

The conservation status of medicinal plants represents a deprived image as a result of biotic stress. In the current research, 91 medicinal plants were assessed for their conservation value according to the IUCN (2001) guidelines. The result revealed that rare species were (58.24%) followed by vulnerable (27.47%), infrequent (13.18%) and *Punica granatum* were reported as endangered species. Ullah and Rashid (2014) also reported 13 species as vulnerable, 21 as endangered, and 11 as critically endangered species from the Mankial valley. The majority of rare species reported were frequently harvested for medicinal aims, while tree species like *Pinus roxburghi* were used to make wood. So, special attention is required for the conservation of rare species, otherwise, they will be endangered soon. The majority of the locals depend on these supplies to earn money. Due to the lack of education, imbalanced grazing, and individuals harvesting these medicinal plants in an unhealthy manner, which has a significant impact on the important medicinal plant species, Therefore, the most significant aspect is to increase awareness of the residents and conserve these medicinal plants. The residents rely on most of these species for timber and fuelwood purposes. It was found that anthropogenic activities had reached their peak and impaired biodiversity at an enormous rate. Many factors affect biodiversities, such as abiotic stress, habitat loss, over-collection, fuel demand, and overgrazing (Kettle and Koh, 2014; Steege *et al.* 2015; Corlett, 2016). However, in the present study, the main threats to biodiversity were the demand for fuels, the promoted values of medicinal plants as well as the conversion of land to agriculture and farmland.

Conclusion

The study showed that the area has a great diversity of plants used for different ailments. The plants' utilization and cutting increase day by day for different purposes. The diseases are increasing day by day; they may cause a great threat to the flora of the Toormang valley**.** The survey aims to make people aware of valuable plants and to protect them from extinction. The old people are aware of the accurate knowledge of medicinal plants. It is needed to preserve this knowledge for the next generation.

Table 1. Ethnomedicinal species, FIV, RFC, Applications as well as their conservation status in Toormang valley

S.no	Botanical name	Family	Local name	Habit	Part used	Application	1	2	3	4	5	Conservation status	FC	RFC	FIV
1	*Allium sativum* L.	Alliaceae	Ooga	H	Bulb/ Ls	Decrease blood pressure, stimulant, expectorant, antiseptic	3	0	4	0	2	Vulnerable	29	0.25	42.5
2	*Allium cepa* L.		Piaz	H	Bulb, Ls	Expectorant, diarrhea, dysentery, anti-nicotine	3	0	4	0	2	Vulnerable	19	0.16	
3	*Narcissus tazetta* L.	Amaryllidaceae	Guli nargas	H	Wp	Healing of wounds, blood purification	3	2	3	0	2	Vulnerable	5	0.04	4.42
4	*Alismaplantago-aquatica* L.	Alismataceae	Ghua jabai	H	Ls	Tonic, digestive disorders, hepatitis B	2	2	4	4	3	Rare	2	0.01	1.76
5	*Hordium vulgare* L	Poaceae	Verbashe	H	Spike	Diabetes						Rare	3	0.02	27.4
6	*Cymbopogon commutatus* (Steud.) Stapf		Lemon grass	H	Ls	Digestion.	3 1	0 2	4 4	2 4	3 3	Rare	21	0.18	
7	*Cynodon dactylon* (L.) Pers		Kabal	H	Wp	Stomach ulcer stop internal bleeding.	3	0	4	0	2	vulnerable	3	0.02	
8	*Sorghum halepense* (L.) Pers		Dadam	H	Wp	Blood diseases	2	2	4	0	2	vulnerable	4	0.03	
9	*Justicia adhatoda* L.	Acanthaceae	Bekkan	S	Ls	Asthma, Female menstrual problems.	2	2	3	4	3	Rare	31	0.27	27.4
10	*Achyranthus aspera* L.	Amaranthaceae	Azghakay	H	Wp	dry cough, kidney stone, leaves hair tonic.	3	2	4	0	3	Rare	5	0.04	4.42
11	*Coriandrum sativum* L.	Apiaceae	Dhania	H	S	Eye diseases, stimulant, diuretic, antispasmodic,	3	0	4	2	3	Rare	11	0.09	59.3
12	*Foeniculum vulgare* Mill *Ammi visnaga* (L) Lam		Kaga	H	S, Ls	Leaves urinary problems, carminative, laxative, Seeds	1	3	3	2	3	Rare	25	0.22	
13			sperkai	H	S	Cough Digestion, Female problems	2	2	4	2	3	Rare	31	0.27	
14	*Nerium oleandes* L	Apocynaceae	Gamderay	S	Wp	Eye infection,	2	0	3	0	2	Vulnerable	5	0.04	4.42
15	*Calotropis procera* (Aiton) Dryand		Spalmay	S	Latex, Ls	Latex for snake bite, leaves bandage for swelling of	2	3	4	4	4	Infrequent	25	0.22	31.8

16	*Periploca aphylla* Dcen	Asclepiadaceae	Barara	S	Latex	rheumatic joints Antibiotic.	1	3	3	4	3	Rare	11	0.09	
17	*Artemisia scoporia* Waldst & Kit.		Jawaky	H	Wp	Fever, vomiting, motion of	3	0	4	0	2	Vulnerable	7	0.06	
18	*Calendula officinalis* L.		Zeyar gully	H	Ls	children Kidneys stone	3	3	4	4	4	Infrequent	2	0.01	
19	*Helinthus annus* L. *Lactuca sativa* L.		Sun flower Salad	S H	S Ls	Seeds prevent cancer, Seeds oil used in cough, cold, heart	2	2 3	4 4	2 4	3 4	Rare Infrequent	17 2	0.15 0.01	
20	*Sonchus oleraceaus* L.		Shawda pai	H	wp	diseases	3	2	4	0	3	Rare	27	0.23	
21	*Conyza canadensis* (L)Cronquist		Malloch	H	Ls	Antirheumatics Give cattle for enhancement of milk.	3	2	4	4	4	Infrequent	2	0.01	63.7
22	*Parthenium hysterophorus* L	Asteraceae	Sqaboty	H	Wp	Astringent, diuretic, stimulant.	3	2	4	0	3	Rare	7	0.06	
23	*Taraxacum officinals* F.H.W		Halak genaiy	H	R, Ls	Anti-malaria	3	3	4	4	4	Infrequent	5	0.04	
24	*Chrysanthemum cinerariaefolium* Vis			H	Ls		3	1	4	4	3	Rare	3	0.02	
25			Guly dawode			Disorder of bowels, Kidneys & liver. As a cooling agent.									
26	*Brassica campestris* L. *Nasturtium officinal* R.		Sharsham	H	S	Oil is used a massage of hair & body	3	0	4	2	3	Rare	29	0.25	
27	Br.		Tarmera	H	Wp	Purgative, emetic, constipation, anthelmintic.	3	2	4	0	3	Rare	11	0.09	38.9
28	*Eruca sativa* Mill	Brassicaceae	Jamama	H	S	Stimulant prevent infection of eyes	3	3	4	2	3	Rare	4	0.03	
29	*Cannabis sativa* L.	Cannabaceae	Bang	H	Ls	Constipation, stomach disorder	3	1	4	4	3	Rare	3	0.02	2.65
30	*Opuntia dillenii* Haw	Cactaceae	Zaqum	S	Wp	Anemia, carminative, asthma, stomach disorder, laxative	1	3	3	0	2	Rare	7	0.06	6.19
31	*Convolvulus arvensis* L	Convolvulaceae	Purvathic	H	Ls, R	Purgative	3	3	4	4	4	Infrequent	2	0.01	1.76
32	*Chenopodium album* L		Surmay	H	Ls, R	Leaves are laxative, root	3	2	4	4	4	Infrequent	3	0.02	

	Spinaceae oleracea L					urinary disease, jaundice.									
33	*Chenopodium murale* L		Palak	H	Ls	Increase iron level.	1	2	4	4	3	Rare	9	0.07	
			Chawlai	H	Wp		3	2	4	0	3	Rare	7	0.06	
34		Chenopodiaceae				Stomach painincrease the passage of urine.									16.8
35	*Cucumis melo* L		Peta kado	H	Fr	Antidiabetic	3	2	4	2	3	Rare	3	0.02	
36	*Cucurbita maxima* Duch.ex.Lam.		Torai												
37	*Luffa cylindrical* (L)		Karila	H	Fr	Antihepatitic	3	2	4	2	3	Rare	3	0.02	
38	Roem	Cucurbitaceae													
	Momordica charantia L.														
39	*Cucumis sativa* L.		Badrang	H	Fr	Antidiabetic	2	2	4	2	3	Rare	9	0.07	45.1
				H	Fr	Antidiabetic	2	2	4	2	3	Rare	31	0.27	
				H	Fr	Refrigerant.	1	2	4	2	3	Rare	5	0.04	
40	*Cuscuta reflexa* awRoxb	Cuscutaceae	Maraz botai	H	Wp	Wash sores, itching areas of the body.	1	3	4	0	2	Vulnerable	3	0.02	2.65
41	L	Ebenaceae	Toor amlok	T	Fr	Dysentery, sore throat.	3	1	2	2	2	Vulnerable	13	0.11	11.5
42	*Quercus baloot* Griffth	Fagaceae	Seray	T	Fr	Tonic, dysentery	3	2	2	2	3	Rare	11	0.09	9.73
43	*Fumaria indica* (Hausskn) Pugsley	Papaveraceae	Krachy	H	Wp	Antipyretic, skin infection, blood purifier, pimples, anti-allergic, abdominal pain.	3	1	4	0	2	Vulnerable	33	0.29	29.2
44	*Juglans regia* L	Juglandaceae	Ghoz	T	S, Br	Seeds tonic, Bark cleaning of teeth & gums.	3	0	2	2	2	Vulnerable	31	0.27	27.4
45	*Ajuga parviflora* Bth		Buty	H	Ls	Inflammation, diabetes, allergy, control B.P	3	0	4	4	3	Rare	33	0.29	
46	*Mentha arvensis* L		Podina	H	Ls	Carminative, vomiting, improve digestion.	3	1	4	4	3	Rare	27	0.23	
47	*Mentha longifolia* (L.) L.	Lamiaceae	Inaly	H	Ls	Stimulant, stomach acidity, aromatic, carminative.	3	1	4	4	3	Rare	15	0.13	98.2
	Ocimum bascillicum L.														
48	*Salvia meorcuftiana*		Kashmal	S	Ls, S		3	2	4	4	4	Infrequent	19	0.16	
49	Wall.ex.Bth		Khardag	H	S	Antiseptic, anti-	3	2	4	2	3	Rare	17	0.15	

						inflammatory. Prevent dysentery.									
50	*Punica granatum* L	Lytheraceae	Anar	T	Fr, S	Dried fruits for inflammation, diuretic, anthelmintic, cough, Leaves chest pain.	1	1	0	2	1	Endangered	33	0.29	29.2
51	*Abelmoschus esculentus* (L)Moench	Malvaceae	Bendi	H	Fr	Antirheumatic, anti-inflammatory & for thinking of sperm	3	0	4	2	3	Rare	27	0.23	
52	*Malva neglecta* Wall.		Panerak	H	Ls	Cough, flu, fever	3	2	4	4	4	Infrequent	5	0.04	28.3
53	*Melia azadaracha* L.	Meliaceae	Shanday	T	Ls, Br	Tonic, antiperiodic, ulcer & eczema	3	0	2	4	3	Rare	3	0.02	2.65
54	*Acacia modesta* Wall	Mimosaceae	Palosa	T	Gum, Ls	Tonic for mothers after delivery, leaves blood purifier	2	2	1	4	3	Rare	31	0.27	42.5
55	*Acacia nilotica* (L.) Delile		Kikar	T	Ls, Br, Gum	Leaves sexual debility, diarrhea, bark asthma, Gum nutritive tonic, diabetes mellitus	3	1	3	4	3	Rare	17	0.15	
56	*Ficus carica* L.	Moraceae	Enzar	T	Fr, Ls	Fruit Anemia, constipation,	3	0	2	4	3	Rare	21	0.18	28.3
57	*Morus alba* L		Spin toot	T	Fr	Leaves on wounds Laxative, emollient	3	0	3	2	2	Vulnerable	11	0.09	
58	*Psidum guajava* L	Myrtaceae	Amrod	T	Fr/ Ls/ Br	Fruit mild laxative, dysentery, Bark & leaves is Astringent.	1	3	3	2	3	Rare	19	0.16	16.8
59	*Mirabilis Jalapa* L.	Nyctaginaceae	Mazegar gully	H	Ls	External wounds	2	0	4	4	3	Rare	7	0.06	6.19
60	*Olea ferruginea* Royle.	Oleaceae	Khona	H	Ls/ R	Leaves throat disorder, mouth sore, cough, kidney problems, root diabetes	3	0	1	4	2	Vulnerable	33	0.29	
61	*Jasminum officinale* L		Chambeli	H	Fl	Headache, skin disease, & week eye sight.	2	2	4	3	3	Rare	5	0.04	33.6
62	*Papaver somniferum* L.	Papaveraceae	Qashqash	H	Fr, S	Diarrhea, dysentery, sedative, flu, antiallergic	1	3	4	2	3	Rare	23	0.20	20.3
63	*Platanus orientalis* L.	Platanaceae	Chinar	H	Ls	Constipation, healing of	3	0	2	4	3	Rare	5	0.04	4.42

						wounds, give relief in pain									
64	*Pinus roxburbii* Sargent	Pinaceae	Nakhter	T	Resins	Increase the efficiency of digestive tract	3	0	2	4	3	Rare	3	0.02	2.65
65	*Rumex dentatus* L.	Polygonaceae	Shalkhay	H	Ls	Wound, diuretic.	3	2	4	4	4	Infrequent	27	0.23	29.2
66	*Rumex hastatus* D.Don		Trewakay	H	R	Antipyretic, Cough.	3	2	4	4	4	Infrequent	6	0.05	
67	*Rananculus muricatus* L.	Rananculaceae	Zeargullay	H	Ls, S	Cough, asthma	2	2	4	4	3	Rare	5	0.04	4.42
68	*Ziziphus jujube* Mill		Bera	T	Ls	Antidiabetic	0	1	1	4	2	Vulnerable	13	0.11	
69	*Ziziphus sativa* Gaertn	Rhamnaceae	Markhana	T	Ls/Fr	Antidiabetic	2	0	2	4	2	Vulnerable	13	0.11	23.0
70	*Eriobotrys japonica* Thumb.Lindler		Alokat	T	Fr	Sedative						Vulnerable	13	0.11	
71	*Pyrus malus* L.		Mana	T	Fr	Emetic,Rheumatism,	3	1	1	2	2	Rare	11	0.09	
72	*Rosa webbiana* Wall.ex.Royle		Gangally gullab	S	Fl	constipation, strengthen bones.	1	3	3	2	3	Infrequent	13	0.11	
73	*Rosa indica* L		Sor gulab	S	Fl	Stomach disorder	3	3	4	3	4	Rare	31	0.27	
74	*Rubus fruicosus* L	Rosaceae	Karwara	S	Ls, Br	Eye diseases, children abdominal pain	2	1	4	3	3	Rare	7	0.06	95.6
75	*Prunus armenica* L.		Khobani	T	Gum	Cough, diarrhea, Bark diabetes	3	2	3	4	3	Vulnerable	3	0.02	
76	*Prunus domistica* L.		Alocha	T	Fr	Anti- cancer.	2	0	1	2	2	Vulnerable	15	0.13	
77	*Cotoneaster nummularia* Fish & Mey		Mamanra	H	Fr	Laxative.	2	0	1	2	2	Vulnerable	15	0.13	
						Anti- hepatitis.	1	1	3	2	2				
78	*Citrus indica* L.		Narang	S	Fr	Digestion	3	1	2	2	2	Vulnerable	15	0.13	31.8
79	*Citrus limetta* Risso	Rotaceae	Lembo	S	Fr, Ls	Digestion, vomiting, stomach problems, & dry cough	2	1	2	2	2	Vulnerable	21	0.18	

80	*Dodonea viscosa* (L.) Jacq	Sapindaceae	Ghuaraskay	T	S, Ls	Chest infection, external wounds	3	0	4	4	3	Rare	3	0.02	2.65
81	*Capsicum annum* L.		Marchaki	S	Fr	Hunger causing agents, digestion, increase blood pressure	3	0	4	2	3	Rare	11	0.07	
82	*Capsicum frutescans* L.		Tor merch	T	S	Stimulant, skin irritation & flavoring foods						Vulnerable	13	0.11	
83	*Datura stramonium* L. *Lycopersicum esculantum*	Solanaceae	Bathora	H	Ls, Fr, S	Leaves skin disorders, Flowers ear pain, Seeds	0	3	2	2	2	Rare	17	0.15	76.1
84	*Solanum nigrum* L		Tamater	H	Fr	sedative.	2	2	4	4	3	Rare	3	0.02	
85	*Solanum tuberosum* L		Karmacho	H	Ls, Fr	Nutritive, eye sight improvement, Urinary disorder, & for place of	3	0	4	2	3	Rare	31	0.27	
86			Allo	H	R	burning.	2	2	4	4	3	Vulnerable	11	0.07	
						Leaves kidney disorder, skin diseases, diarrhea, Fruit tonic, diuretic	2	2	2	0	2				
						For growth of children									
87	*Celtis australis* L	Ulmaceae	Tagha	T	Br	Curing urticaria	2	2	1	1	2	Vulnerable	5	0.04	4.42
88	*Urtica dioca* L	Urticaceae	Sezonkay	H	Wp	Abdominal pain.	3	0	4	0	2	Vulnerable	5	0.04	
89	*Viola biflora* L.		Banefsha	H	Ls	On wound & joint inflammation.	1	2	4	4	3	Rare	7	0.06	10.6
90	*Vitis venifera* L.	Vitaceae	Angur	H	Ls	External body wounds	3	0	3	4	3	Rare	19	0.16	16.8
91	*Aloe vera* (L) Burm.f.,Fl.	Xanthorrhoeceae	Kamal pana	H	Ls	Colic pain, healing wounds, stomach acidity, constipation	1	2	4	4	3	Rare	33	0.29	29.2

Key: (C) =Number of respondents citing the plants; (FIV) =Family importance value; (RFC) = Relative frequency of citation

Table 2. Demographic characteristics of the Valley

S. No	Characteristics	Frequency	Percentage of species
1	**Vegetation**		
	Total species	91	-
	Total genre	79	-
	Total families	44	-
	Total Respondent	113	-
2	**Habit**	**No of species**	**%age of species**
	Herbs	58	63.73
	Trees	20	21.97
	Shrubs	13	14.28
3	**Part used**	**Species. No**	**%age**
	Leaves	41	35.0
	Fruit	24	20.5
	Seed	15	12.8
	Whole plant	14	11.9
	Roots	6	5.12
	Bark	5	4.27
	Gum	3	2.56
	Flower	3	2.56
	Bulb	2	1.7
	Latex	2	1.7
	Spike	1	0.85
	Resines	1	0.85
4	**FIV**	**Species. No**	**%age**
	Lamiaceae	5	98.2
	Rosaceae	8	95.6
	Solenaceae	6	76.1
	Asteraceae	9	63.7
	Apiaceae	3	56.3
	Cucurbitaceae	5	45.1
	Alliaceae	2	42.5
	Mimosaceae	2	42.5
	Brassicaceae	5	38.9
	Oleaceae	2	33.6
	Xanthorrhoeraceae	1	29.2
	Fumiraceae	1	29.2
	Polygonaceae	2	29.2
	Moraceae	2	28.3
	Malvaceae	2	28.3
5	**Species**	**FC**	**RFC Values**
	Olea ferruginea Royle	33	0.29
	Solenum nigrum L	31	0.27
	Brassica compestris L	29	0.25
	Mentha arvensis L	27	0.23
	Foeniculum vulgare Mill	25	0.22
6	**Conservation status**	**Species. No**	**%age**
	Rare	53	58.24
	Vulunarable	25	27.47
	Infrequent	12	13.18

	Endengered	1	1.09

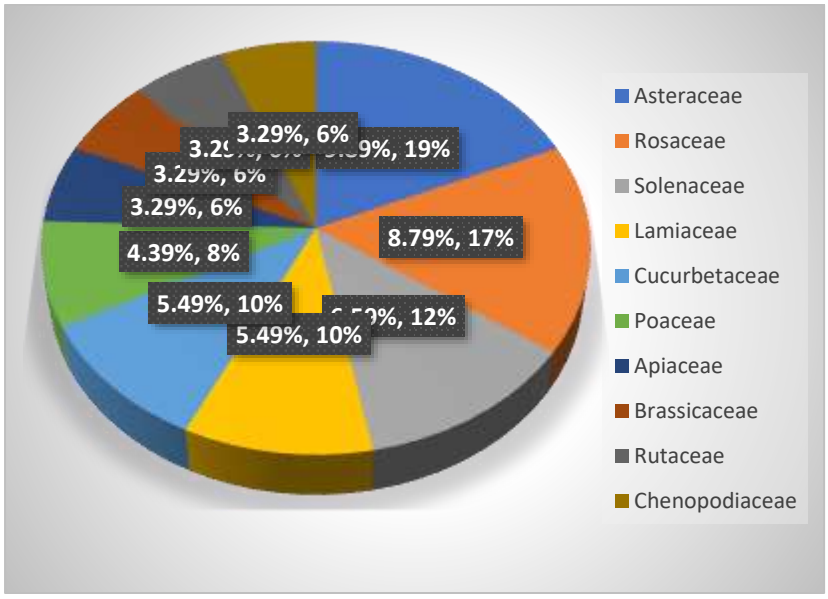

Fig. 2. Percentage of species based on their Family

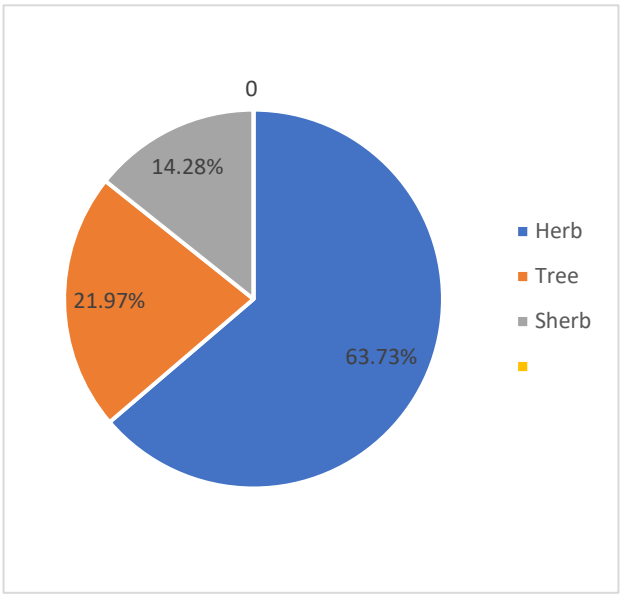

Fig. 3. Percentage of species based on their habit

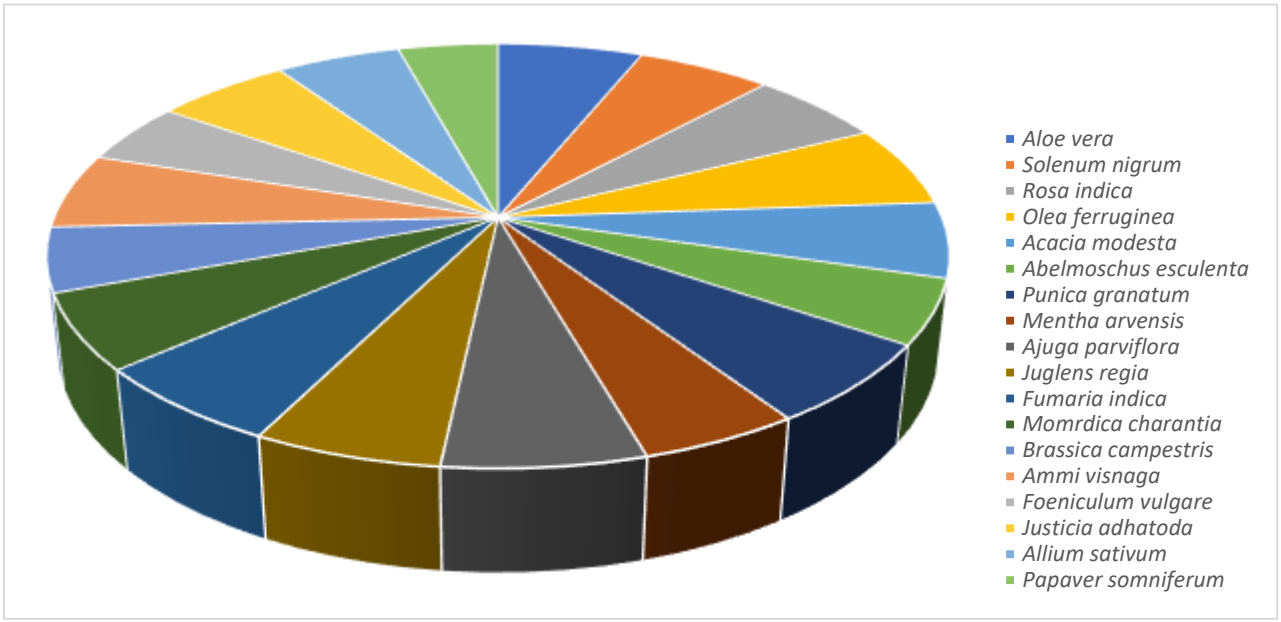

Fig. 1. Percentage of species based on their RFC

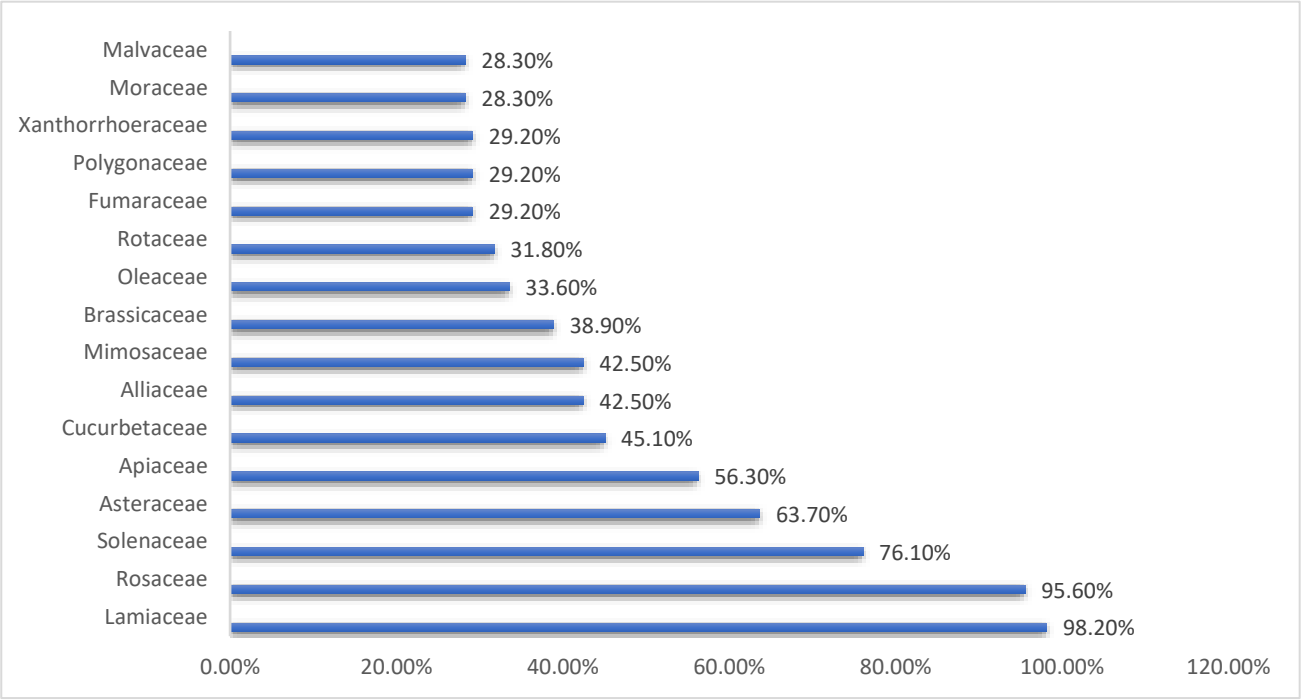

Fig. 2. Percentage of species based on their FIV

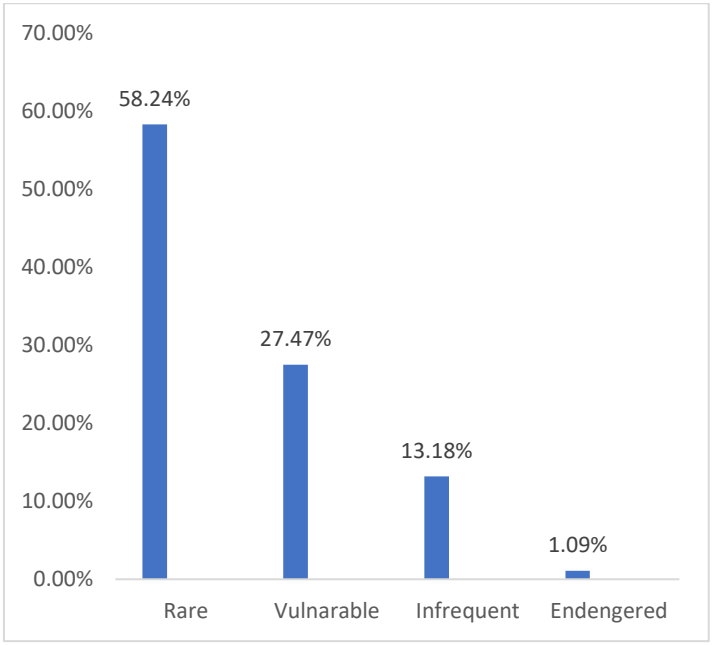

Fig. 3. Percentage of species based on their Conservation status

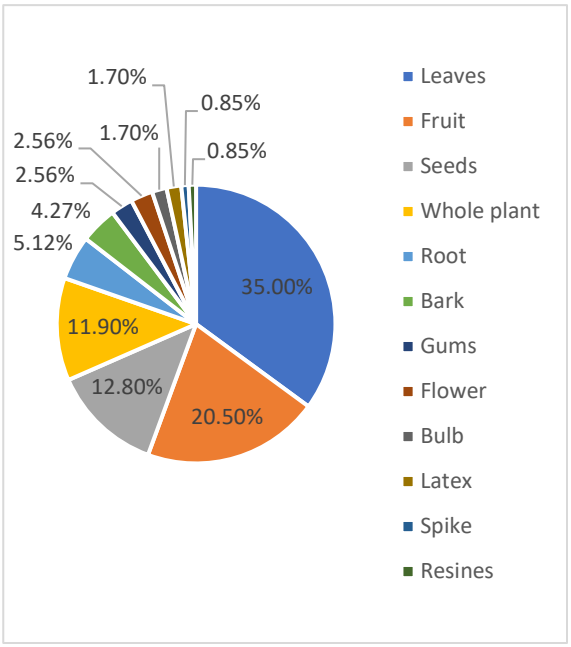

Fig. 7. Percentage of species based on their parts used

Conflict of Interest

The authors declared that the present study was performed in absence of any conflict of interest.

Acknowledgment

The present work is a part of Ph. D research project of the first author (Tahir Hameed). This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors are thankful to the local inhabitants of Toormang Valley for their cooperation during data collection.

Author Contributions

All authors listed above have equal, direct, and intellectual contributions and have approved the current work for publication in this journal. The research idea was perceived by Dr. Izhar Ahmad, the practical and field work was performed by Tahir Hameed with the help of Dr. Wahid Hussain and Dr. Shariat Ullah. Dr. Ahmad and Dr. Hussain also review the final manuscript.

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