MEDICINAL PLANTS DIVERSITY AND ABUNDANCE IN MOIST TEMPERATE FORESTS OF DUNGA GALI FOREST SUB-DIVISION, GALIES FOREST DIVISION, ABBOTTABAD

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ABSTRACT

Medicinal plants are major source of ingredients being used for basic health care needs. A great proportion of people use medicinal plants to cure their ailments globally. Present study was conducted to assess the medicinal plants diversity and abundance in moist temperate forest of Dunga Gali forest sub-division, Galies Forest Division, Abbottabad. The study recorded 22 plant species belonging to 20 families. The highest (Relative Density) RD was 13.6% for *Valeriana wallichii* while the lowest was 0.1% for *Arisaema wallichianum* and *Podophyllum emodi*. The RF 12.6% was highest for *Adiantum capillus-veneris* followed by 10.9% for *Viburnum nervosum*. Lowest (Relative Frequency) RF was found to be 0.4% for *Podophyllum emodi*. The maximum (Relative Cover) RC was 11% for *Valeriana wallichii* and *Viburnum nervosum* while the minimum RC was 0.3% for *Arisaema wallichianum* and *Podophyllum emodi*. The values of (Importance Value Index) IVI and (Summed Dominance Ratio) SDR were highest for *Valeriana wallichii*, 34.3 and 11.4, respectively while the lowest were 0.8 and 0.3 for *Podophyllum emodi*. Perhaps, the most important thing for local people is that the abundance of the most valuable medicinal plant species *Valeriana wallichii* and *Bergenia ciliata* is significantly higher on many areas. The study has suggested that protection from grazing, logging, firewood collection and plantation/reforestation may be a source of improvement of ground vegetation.

Key words: Medicinal Plants, Diversity, Dunga Gali, Abbottabad.

INTRODUCTION

Medicinal plants have centuries old usage for basic health care needs and a source of livelihood especially for rural communities. A great proportion of people (70-95%) living in developing countries use medicinal plants to cure their ailments. Approximately 53,000 plant species are being used medicinally on global level and their sale accounts for 15-30% of the total income of rural households (Hamilton, 2004).

Pakistan has been bestowed by nature with a great variety of geographical landscapes with a total geographic area of 796,095 km^2. Altitudinal range varies from sea level on the south of the country to as high as 8611m on the north. Forest area covers only 5.1% of the country's total geographic area, out of which mountainous coniferous forest constitutes 54% of the total forest area (Bukhari *et al*., 2012). About 6000 higher plants species are reported from

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the country, one third of which are non-timber species (Haq *et al*., 2010) out of which 600 species are being used for curing ailments (Shinwari, 2010).

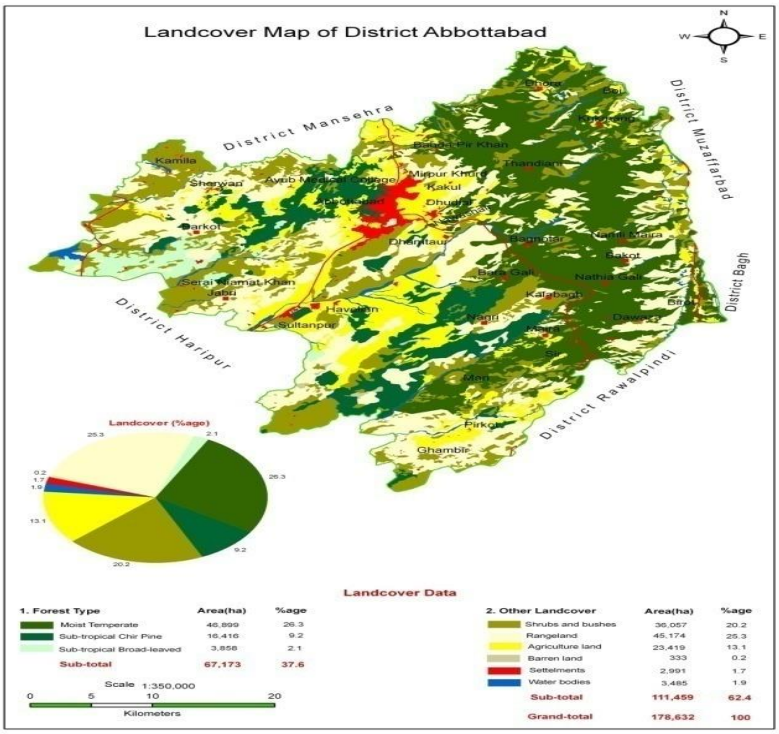
Medicinal plants have a vital role in the livelihood of people residing in the rural areas. As rural communities have less health facilities as compared to the people living in developed urban areas, people use wild plants as traditional medicine. Commercial harvesting of medicinal plants for extraction of different types of active ingredients employ about 10% of the local people on full time and approximately 30% are employed part time (Ahmad, 2003; Shinwari, 2010).

Most of the reported medicinal plants are found in the North West mountainous forests of the country (Shinwari, 2010). Anthropogenic activities like; deforestation, overgrazing, land use change and management practices are major threat to the existence of the under story medicinal plants in these forests. Loss and degradation of natural old-growth forest is related to a decline in the composition, abundance and diversity of species (Siddiqui *et al*., 1999) and particularly understory medicinal plants. Diversity and ecosystems of the country are subject to habitat loss as nearly about 14.7% of the forest habitat disappeared between 1990 and 2005 (Tahir *et al*., 2010).

Study Area

The study was carried out in the Khyber Pakhtunkhwa (KP) province. Forests cover 20.3% of the province (Bukhari *et al*., 2012) and stretch across the Himalayas, Hindu Kush and Karakurum mountain ranges. The study covers the moist temperate forests of Dunga Gali forest sub-division, Galies Forest Division, Abbottabad. The sub-division lies within reach of the monsoon and have a mean annual precipitation of 1,500 mm. There is snow cover between November and March and the mean annual temperature is 12°C (WWF-P, 2004). The major ethnic groups of the area are Karalls and Abbasis (Hazaary-wall), who speak Hindku and or Potohari.

The society is predominantly male dominated due to a high illiteracy rate among women. Pleasant weather and dense vegetation in and around the area attract large numbers of tourists in summer to the some main places viz. Nathiagali, Dunga gali and Ayubia, while people often come in winter to enjoy the snow fall. Local men usually conduct business while women do most of the house keeping, agriculture, and collection of fuelwood and fodder.



Source: GIS & RS laboratory, PFI, Peshawar

METHODOLOGY

The survey was conducted compartment-wise in moist temperate forests. Sample plots were selected in a systematic manner in the entire study area. In each compartment, an imaginary center was located and plots were taken in all four directions from this center after 330 steps. The methodology was followed by a little modification in the shape of the plot as described by Zaman *et al*., 1972. In each compartment circular plots with a radius of 18m i.e. 0.1ha area was laid out. For the survey of medicinal plants, a strip (transact) of 36m x 1m ($36m^2$) was laid out inside the main plot as adopted by Adnan & Holscher, 2012. The Quadrat method was used for data collection of medicinal plants by dividing transact into 9 quadrats of $2m^2$ (2mx1m) each. In each plot, species diversity, species density and species cover was estimated. In all, 84 plots were taken in different compartments of the study area. The data on species diversity, density and cover were recorded on pre structured forms for each plot. The medicinal plants were identified in local names with the help of staff of the Forest Department and local people. Unidentified plants were identified using facilities available in the Medicinal Plants Herbarium of Pakistan Forest Institute.

Data analysis

Phyto-sociological attributes (Quantitative = that can readily be measured) of the Medicinal plant species including, relative density (RD), relative frequency (RF) and relative cover (RC) were estimated as described by Hussain, 2015:

Relative Density

It is the proportion of a density of a species to that of a stand as whole. It was calculated by the following formula:

$$\% \text{ RD} = \frac{\text{Total No. of individuals of a species in all quadrats}}{\text{Total No. of individuals of all species in all quadrats}} \text{x100}$$

Relative Frequency

It is the proportion of the total frequency of a species to the sum of the frequency of all the species in the area. It was determined by the following formula:

$$\% \text{ RF} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \text{x100}$$

Relative cover

Relative cover of a species is the proportion of the total of a species to the sum of the cover of all the plants of all species in the area. It was calculated by the following formula:

$$\%\text{RC} = \frac{\text{Total cover of all plants of a species}}{\text{Total cover of all plants of all species}} \text{x100}$$

Importance Value Index (IVI) & Summed Dominance Ratio (SDR)

The Importance Value Index (IVI) for each plant species was determined by summing up the relative cover, relative density and relative frequency. Similarly, Summed Dominance Ratio (SDR) for each species was estimated from importance value index (IVI) as adopted by Bajwa *et al.*, 2017. The formulae for IVI and SDR are:

$$\text{IVI} = \sum [\text{RD (\%)} + \text{RF (\%)} + \text{RC (\%)}]$$

$$\text{SDR} = \frac{\text{Importance Value Index}}{3} \text{x100}$$

RESULTS AND DISCUSSION

Results

Results indicated a rich diversity in the plants of medicinal value found in the study area. 22 medicinal plants species were found which belongs to 20 families.

Table 5.1 Phyto-sociological attributes of medicinal plants species found in Dunga Gali Forest Sub division

S.No.	Species	RD (%)	RF (%)	RC (%)	IVI (%)	SDR (%)
1	*Achillea santolina*	2.8	3.8	3.5	10.1	3.4
2	*Adiantum capillus-veneris*	9.6	12.6	8.5	30.7	10.2
3	*Arisaema wallichianum*	0.1	0.8	0.3	1.2	0.4
4	*Asparagus adscendens*	3.4	2.1	2.5	8.0	2.7
5	*Atropa acuminata*	4.5	4.2	4.8	13.5	4.5
6	*Berberis lycium*	7.4	8.4	8.5	24.3	8.1
7	*Berginia ciliata*	4.0	2.9	4.3	11.2	3.7
8	*Bistorta amplexicaulis*	2.7	2.9	2.3	7.9	2.6
9	*Cannabis sativa*	2.2	1.7	3.5	7.4	2.5
10	*Fragaria vesca*	7.8	7.1	5.5	20.4	6.8
11	*Geranium wallichianum*	7.4	6.7	6.8	20.9	7.0
12	*Girardinia heterophylla*	1.1	2.1	1.8	4.9	1.6
13	*Hedra nepalensis*	4.2	5.0	4.5	13.7	4.6
14	*Indigofera oblongifolia*	6.1	7.1	7.8	20.9	7.0
15	*Podophyllum emodi*	0.1	0.4	0.3	0.8	0.3
16	*Punica granatum*	0.4	0.8	0.5	1.7	0.6
17	*Rosa moschata*	1.8	1.7	2.8	6.3	2.1
18	*Skimmia laureola*	3.7	4.2	3.8	11.6	3.9
19	*Swertia chirata*	2.6	2.5	2.5	7.6	2.5
20	*Valeriana wallichii*	13.6	9.6	11.0	34.3	11.4
21	*Viburnum nervosum*	10.7	10.9	11.0	32.6	10.9
22	*Viola serpens*	3.9	2.5	3.8	10.1	3.4

The highest RD was 13.6% for *Valeriana wallichii* while the lowest was 0.1% for *Arisaema wallichianum* and *Podophyllum emodi.* The RF 12.6% was highest for *Adiantum capillus-veneris* followed by 10.9% for *Viburnum nervosum.* Lowest RF was found to be 0.4% for *Podophyllum emodi.* The maximum RC was 11% for *Valeriana wallichii* and *Viburnum nervosum* while the minimum RC was 0.3% for *Arisaema wallichianum* and *Podophyllum emodi.* The values of IVI and SDR were highest for *Valeriana wallichii,* 34.3 and 11.4 respectively while the lowest were 0.8 and 0.3 for *Podophyllum emodi.*

The graphical representation of the results obtained is given as under:

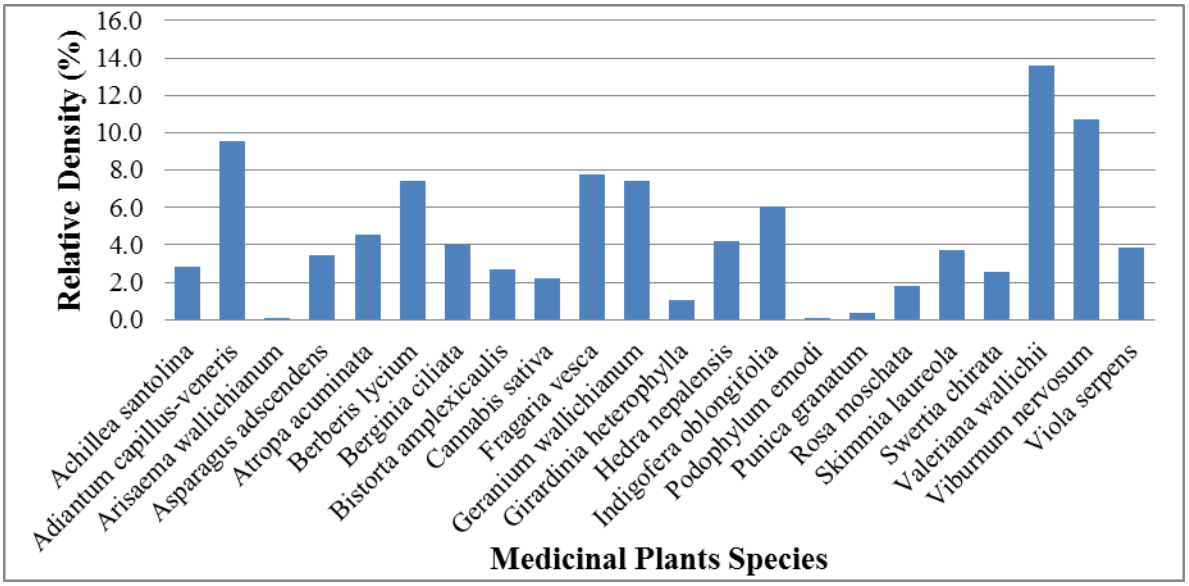


Fig. 5.1. Relative Density of medicinal plants species found in Dunga Gali Forest Sub-Division

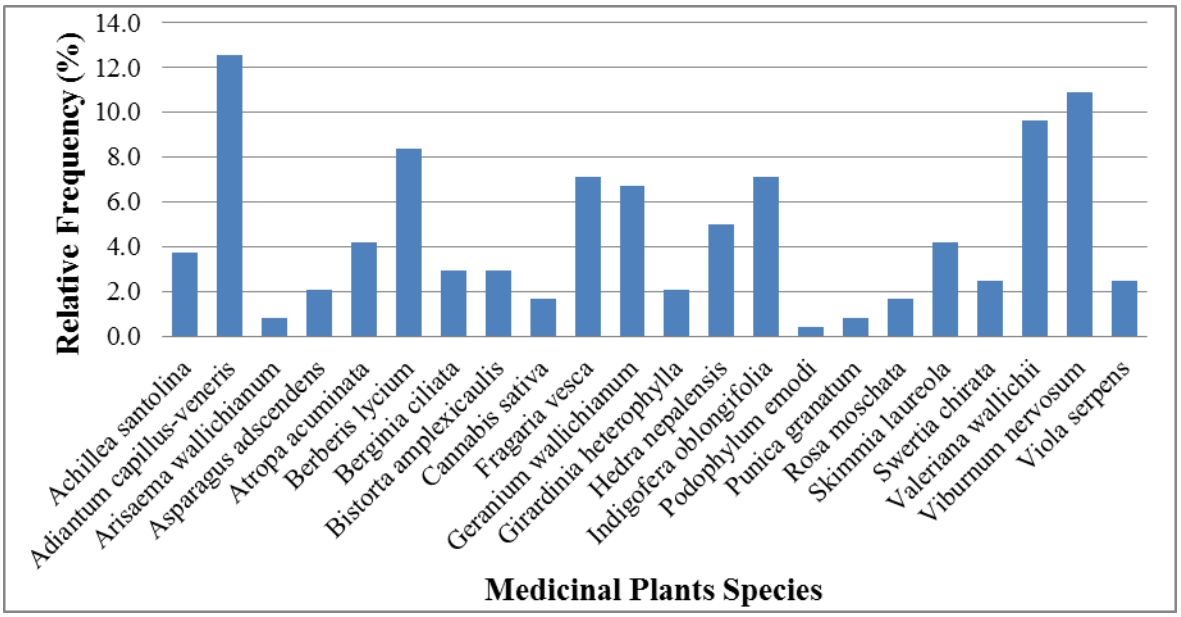


Fig. 5.2. Relative Frequency of medicinal plants species found in Dunga Gali Forest Sub-Division

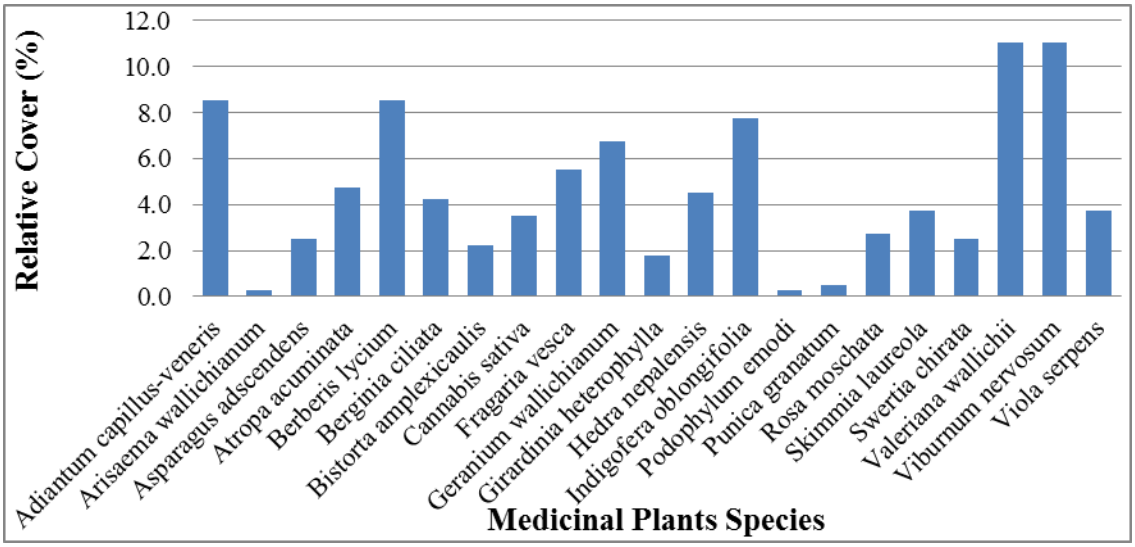


Fig. 5.3. Relative Cover of Medicinal Plants species found in Dunga Gali Forest Sub division

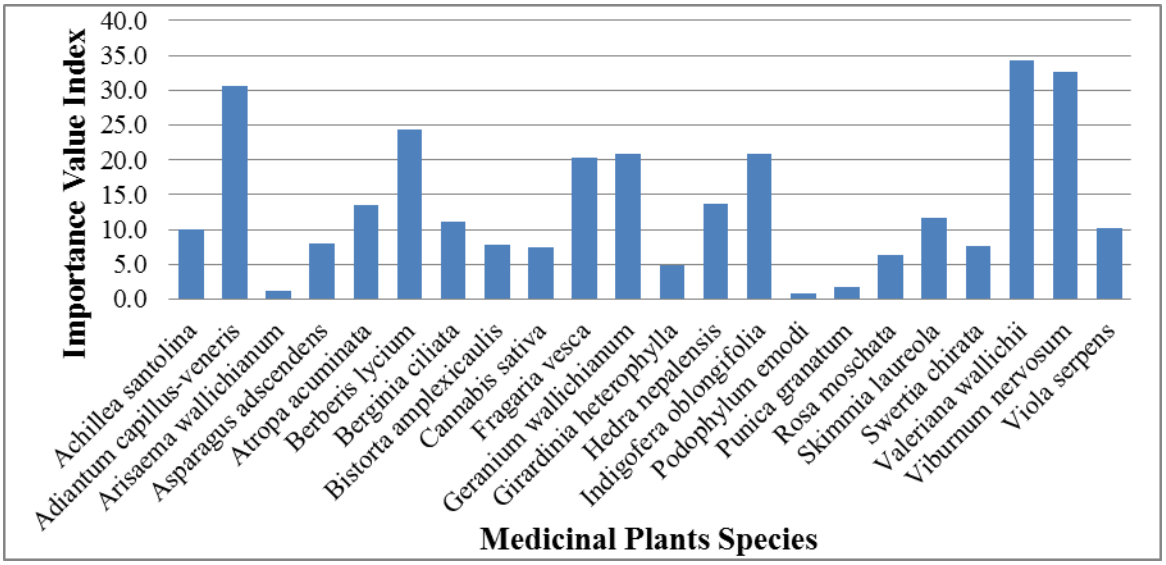


Fig.5.4. Importance Value Index of Medicinal Plants species found in Dunga Gali Forest Sub division

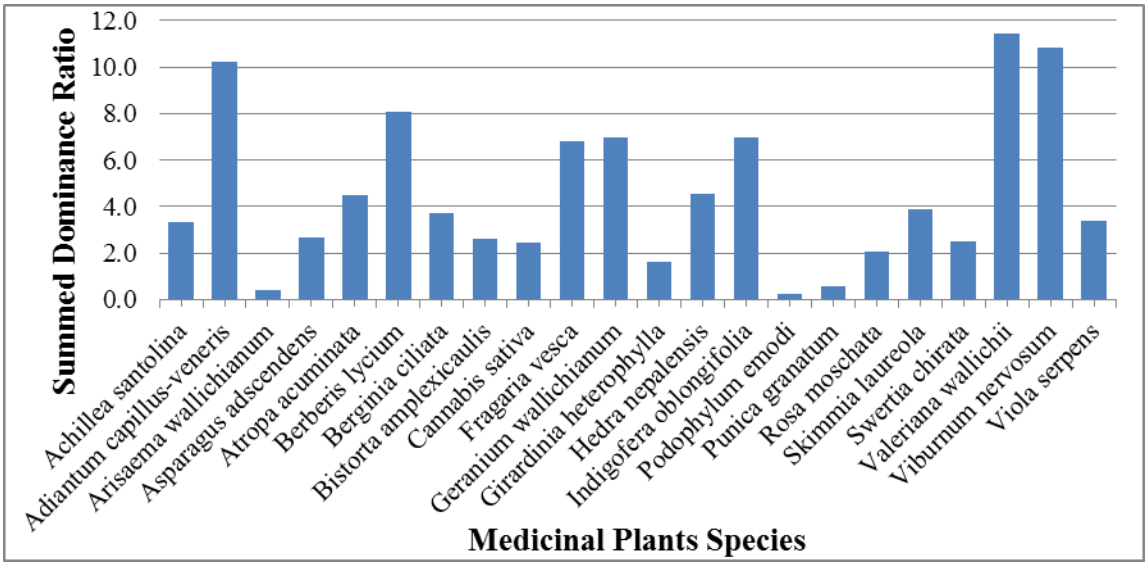


Fig. 5.5. Summed Dominance Ratio of Medicinal Plants species found in Dunga Gali Forest Sub division

Discussion

Previous studies have already suggested that protection from grazing, logging, firewood collection and plantation/reforestation may be a source of improvement of ground vegetation. In present study, most of the sites have been found with a good density, diversity and cover of most of the medicinal plants species. Perhaps, the most important thing for local people is that the abundance of the most valuable medicinal plant species *Valeriana wallichii* and *Bergenia ciliata* is significantly higher on many areas.

Thus, protection and conservation practices can thereby not only contribute to the habitat restoration in the area, but also to the livelihoods of locals depending on medicinal plants. However, from the rural community perspective, it has been observed that they will not accept any approach unless they are being involved in all development, management and conservation interventions for the sustainability of forest resources, particularly in medicinal plants.

It has been concluded that there is high proportion of studied medicinal plants compared to other sites investigated under the study.

A note on the plants of Medicinal value found in the Dunga Gali Forest Sub-division.

Plants that have some kind of medicinal value found in the study area are listed below with a short description of each.

S.No.	Botanical Name	Local Name	Family	Parts used	Medicinal uses
1	*Achillea santolina*	Bui	Asteraceae	Flowers	The constituents give yarrow antiseptic, stomachic, antispasmodic, astringent and diaphoretic properties. Herbalists use an infusion for digestive upsets, diarrhoea, flatulence, menstrual disorders, colds and fevers.
2	*Adiantum capillus-veneris*	Kakhpai	Polypodiaceae	Aerial Parts	Used to treat coughs, bronchitis, catarrh, sore throat and chronic nasal catarrh.
3	*Arisaema wallichianum*	Sanp booti	Araceae	Roots and tubers	Used for bites (snakes, scorpion, etc.) and eczema. Dried rhizome is used for chest problems.
4	*Asparagus adscendens*	Bantutra	Liliaceae	Roots	Demulcent, galactagogue, tonic. Useful in diarrhoea and general disability.
5	*Atropa acuminata*	Angoor-i-shifa	Solanaceae	Leaves/Roots	It is prescribed by medical practitioners as antispasmodic, sedatives, and analgesics and as antidotes to various poisons. Atropine is used in ophthalmology.
6	*Berberis lycium*	Sumblu	Berberidaceae	Stem bark, Root bark, Berries	Ameliorate conditions such as gallbladder pain, gallstones and jaundice. Its strongly antiseptic property helps amoebic dysentery, cholera and other similar gastro intestinal infections.
7	*Bergenia ciliata*	Zakhm-e-Hayat	Saxifragaceae	Root	Tonic, used in fever, diarrhoea and pulmonary affections, antiseptic, bruished and applied to boils and opthalmia.
8	*Bistorta amplexicaulis*	Masloon	Polygonaceae	leaves, roots and tubers	Expectorant, laxative, antipyretic, anti-inflammatory, gynae, antispasmodic
9	*Cannabis sativa*	Bhang	Cannabaceae	Leaves, seeds and stem	Sedative, anodyne, ear-ache, malaria, anthrax, sore throat, piles and scabies.
10	*Fragaria vesca*	Jangali meva	Rosaceae	Whole Plant	Digestive, backache, vomiting, astringent, diuretic
11	*Geranium wallichianum*	Ratan jot	Geraniaceae	Leaves and roots	Relieves post-delivery pains, weakness, joints and muscles pain especially back ache.
12	*Girardinia heterophylla*	Ker	Urticaceae	Whole plant	Kidney diseases, rashes, skin diseases, diuretic, rheumatism, jaundice, antihelmintic, astringent.
13	*Hedera nepalensis*	Alabambal	Araliaceae	Leaves	Antidiabetic, increase milk yield in animals
14	*Indigofera oblongifolia*	Kainthi	Fabaceae	Whole plant	Given in epilepsy and nervous disorders. Used in bronchitis and as ointment in sores, old ulcers and haemorrhoids.
15	*Podophyllum emodi*	Ban Kakri	Berberidaceae	Roots and tubers, seeds and or fruits	Intestinal diseases, stomach, skin, tonic, liver and spleen.
16	*Punica granatum*	Jangli anar	Lythraceae	Rind, Bark, Fruit	Used for tapeworm infestation. The rind and bark is also strongly astringent and occasionally have been used to treat diarrhea.

17	*Rosa moschata*	Jangli gulaab	Rosaceae	Leaves, flowers	Astringent, tonic, antihelmintic, applied to wounds and injuries, vomiting, diarrhoea and nausea.
18	*Skimmia laureola*	Nair	Rutaceae	Leaves	Chicken pox, measles, stomach and liver problems, fever, headache
19	*Swertia chirata*	Chiraita	Gentinaceae	Whole Plant	Diabetes, typhoid, anticancer, pneumonia and malaria
20	*Valeriana wallichii*	Mushk Bala	Valerianaceae	Roots and rhizome	Body pains, stomach pain, carminative, cholera, epilepsy, used in dysentery and nourishing
21	*Viburnum nervosum*	Guch	Caprifoliaceae	Bark, Root bark	Antispasmodic, astringent, hypotensive. It is used inproprietary preparations for cardiovascular disorders, diarrhoea, coughing spasms and stomatitis, and in gynecology.
22	*Viola serpens*	Banafsha	Violaceae	Leaves, seeds and flowers	Cough chest infection, asthma, headache, and constipation and urinary bladder swellings.

CONCLUSION

Forests are the resource that control the environmental pollution and provide livelihood not only to the local communities but to others as well. In the past, the area was under heavy deforestation and overgrazing pressure, which has reduced regeneration of overstory valuable tree species and associated ground flora. Overgrazing has deteriorated the habitat, as there was no effective control on grazing land. Collection of medicinal plants was carried out without considering any set procedures, by the local people, for selling or for fuel wood purposes and also grazed heavily. There is an urgent need to conserve the resources for our own survival.

In this study, a great number of some of valued medicinal plants species has been observed in many areas in comparison to some other sites. Medicinal plants in some areas such as; *Valeriana wallichii, Adiantum capillus-veneris, Viburnum nervosum* and *Berberis lycium* etc. were found in great numbers.

The approach, to improve or restore the ill effects of resource misuse and economic degradation, should be in multiple directions from improving the economic standard to changing the attitudes of the local people should be adopted in future. The population cover and potential density of medicinal plants can readily be increased by establishing protected areas in adequate size. One important lesson learned from this study is that the establishment of a community based enterprise that depends on local biodiversity can be a strategy to provide more equitable returns to community groups and hence incentives for conserving the resource base.

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