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Life form, biological spectrum and ethno-medicinal uses of the flora of Taloqa hills, Western himalayas, Muzaffarabad

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Abstract

The present paper gives an account of different life form categories, biological spectrum and ethnobotanical uses of the flora of Taloqa hills Muzaffarabad. The flora of Taloqa hills consists of 395 plant species belonging to 66 families. The biological spectrum showed that hemicryptophytes (24.55%) were the dominant life form of the area. They were followed by therophytes (24.30%), nanophanerophytes (21%), megaphanerophytes (16%), geophytes (9%) and lianas (5%) respectively. The leaf size spectra comprised of microphylls (42%), leptophylls (28%), Nanophylls (21%), Mesophylls (7%), and Megaphylls (2%). The hemicryptophytic dominance indicates that the area has hemicryptophytic type of phytoclimate. A total of 20 medicinally important plants belonging to 18 families were recorded to be used locally for the treatment of 68 different ailments and diseases in the study area. The area is under high anthropogenic pressure so strict safety measures needs to be taken to protect biodiversity in the area.

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Introduction

Himalaya is a mega diversity center of the world which supports about 18,440 species of plants, of which 25.3% are endemic (Singh and Hajra, 1996; Samant*et al.,* 1998) Most of the species are used as source of medicine and food. Species richness increases considerably due to the invasion of plant species from alpine belt (Gottfried *et al.,*1998). The well known cause for declining plant species diversity are habitat loss, narrow distribution range, low population size, fragmentation degradation of population and genetic variation (Kala, 2000; Weekley and Race, 2001; Vergeer *et al.,*2003; Kala, 2005). The life form spectra are supposed to be an indication of micro and macroclimate (Shimwell, 1971). The leaf size knowledge may help in the understanding of physiological processes of plants and plant communities (Oosting, 1956). Life form and leaf size spectra indicates climatic and human disturbance of a particular area (Cain and Castro, 1959). The life form and leaf size spectra are significant physiognomic feature that comprise generally in vegetation studies. In Pakistan very little work has been made (Malik *et al.*, 2007; Perveen *et al.*, 2008; Hadi *et al.*, 2009; Abbas *et al.,* 2010; Qureshi and Ahmad, 2010).

Currently there is a great interest in drugs of natural origin simply because they are considered as green medicines and green medicines are always regarded to be harmless. Another factor which emphasizes the use of herbal medicines is the incidences of harmful nature of synthetic drugs/allopathic medicines which are supposed to be harmful for human beings and environment. The advantage of natural drugs is their easy accessibility, economic and less or no side effects. Twenty five percent (25%) of modern medicines are developed from plants sources used traditionally; and research on traditional medicinal plants lead to discovery of about 75% of herbal drugs claimed by World Health Organization (WHO) (Mian-Ying *et al.*, 2002). Keeping in view the importance of vegetation and its uses, present was aimed to record life forms, leaf spectra and ethnobotanical uses of plants from Taloqa Hills, Western Himalayas, Muzaffarabad, Pakistan.

Materials and methods

Study area and physiography

Muzaffarabad is located in the western side of great Himalaya. The population of Muzaffarabad is 0.770 million according to census 2006. The area is mainly hilly and mountainous. The average elevation of investigated area differs from 800 -1800m from mean sea level and lies in between 34.17° to 35° latitude and 73.581° to 75° longitude.

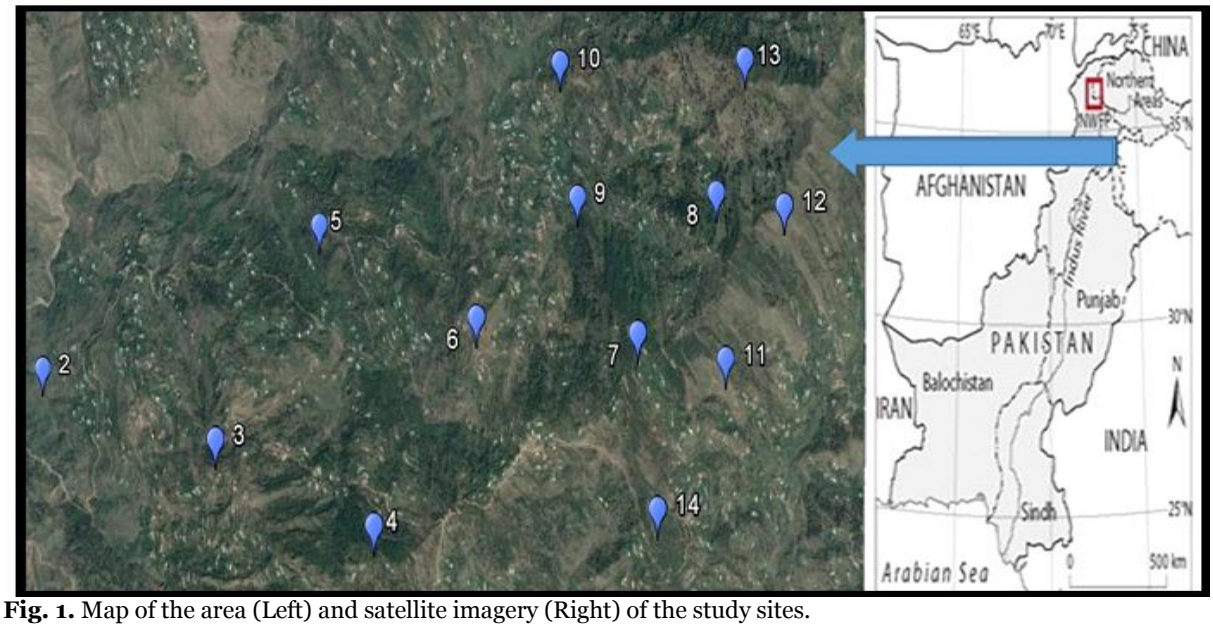

Fig. 1. Map of the area (Left) and satellite imagery (Right) of the study sites.

The climate of the area can be classified into sub-tropical to temperate on the basis of rainfall, temperature, snowfall and Hail. June and July are the hottest months of the year. Winter season starts from mid of November to end of February. December and January are the coldest month of the year.

The area is well within the reach of monsoon. High rainfall occurs during the rainy season. The source of water in the area is perennial Nallahs. Lithology is sand stone, shale and Mudstone.

The average maximum and minimum temperature of years (2002-2013) varies from 36.68 ºC to 2.59 ºC respectively. The average rainfall of year is 121.22mm. The maximum rainfall occurs during the months of June, July and August which is 159.77 mm, 288.03 mm and 199.52 mm respectively. October, November and December receives least rainfall (36.21 mm, 38.46 mm, and 66.32 mm).

Methods of vegetation sampling

Fifteen communities were established and quadrat method was used for sampling the vegetation. For the size of quadrat minimal area curve was used.

The size of quadrate was 10 × 10m², 5 × 2m² and 1 × 1m² for trees, shrubs and herb layer respectively (Malik, 2005). Quadrats were laid randomly in all stands. Number of quadrate in a stand was 5 for trees, 10 for shrubs and 15 for herbs, respectively. Total numbers of quadrats in all stands were 75 for trees, 150 for shrubs and 225 for herbs.

Life forms

The life forms such as Megaphanerophytes, Nanophanerophytes, Chamaephytes, Hemicryptophytes, Therophytes, Geophytes and Lianas were classified by using methods developed by Raunkir (1934).

Biological spectra

A leaf spectrum is useful in classifying association. Leaf size aspect was determined by using Raunkir's diagram (Raunkir, 1934).

Ethnobotanical uses of plant species

The field study was carried out over a period of approximately 2 years (2013–2014) using semi-structured interviews with 71 informants and local herbalists (most of the informants belonged to an age between 50 and 70 years) and designed questionnaire in fifteen remote locations in the study area.

Females were also interviewed. During the survey, plant specimens were also collected from the study area. The plant specimens were pressed, dried and mounted on herbarium sheets. The collected specimens were identified with the help of floristic literature (Nasir and Ali, 1970-1989; Ali and Qaiser, 1993-2009; Qureshi, 2004).

Results

Fifteen plant communities were established in the study area for the investigation of life form and biological spectrum. These communities were given name on the basis of leading dominant, co-dominant and associative species which is based on IVI values. This study also includes the ethno pharmacological uses of some selected plants from the study area.

Life Forms

The overall life forms and life forms in each community distributed in the area were presented in percentage as shown in Fig. 2 and Fig. 3. It was found that, Hemicryptophytes are dominated vegetation (24.55%) in studied area, followed by Therophytes (24.30%), Nanophanerophytes (21%), Megaphanerophytes (16%), geophytes (9%) and lianas (5%) respectively. Among the communities, Hemicryptophytes were dominant in *Olea-Dichanthium-Cynodon* community, *Acacia-Ajuga-Taraxacum* community, *Quercus-Geranium-Arundo* community, *Pinus* community and *Pinus-Pinus* community. Therophytes were dominant in *Dalbergia-Vinca-Bauhinia, Broussonetia-Zanthoxylum-Seteria, Quercus-Indigofera-Pinus, Pinus-Pinus* and *Pinus-Impatiens-Cynodon* communities. Nanophanerophytic were found dominant in *Dyospyrus-Phragmitis-Capsella* and *Celtis-Andropogon-Malva* communities.

Table 1. Ethnobotanical uses of medicinal plants with common name and family.

S. No.	Plant species	Common name	Family	Ethnobotanical uses
1	*Berberis lycium* Royle	Sumbal	Berberidaceae	Root powder may be used as blood purifier and skin ailments, it also prevent teeth decay, for healing of wounds and for repair of broken bones.
2	*Cannabis sativa* Linn	Bhang	Cannabaceae	A narcotic is obtained from the resin; it is used as narcotic, soothing, pain reliever and intoxicant. Its fiber is used by locals.
3	*Celtis eriocarpa* Decne	Batkarh	Ulmaceae	Its leaves and fruit are used to reduce bleeding during menstrual cycle and stem for sticks.
4	*Ficus carica* Linn	Injeer/ Phagwara	Fabaceae	It is used to eliminate kidney stones and obstructions of the liver and spleen. Constipation reliever as it is laxative. Leaves are used as fresh fodder for animals. Also used as fuel wood and in making various agricultural tools.
5	*Foeniculum vulgare Mill*	Sonf	Umbellifereae	It is one of the ingredients of carminatives also used in stomach ailments; decoction is said to be good for eyesight.
6	*Indigofera heterantha* wall.	Jand/ kainthi	Papilionaceae	Baskets are prepared with its branches. Epilepsy and neuropathic problems are treated with its extract. Its oil is used for treatment of psoriasis. Fresh leaves are also used as fodder for goats.
7	*Melia AZadirach* L.	Dhraek	Meliaceae	Its fruit and leaves are used to cure boils and skin ailments; also used for hair growth; bark is bitter stimulant, astringent,anthelmintic and antipyretic or febrifuge.
8	*Mentha longofolia* Linn.	Bareena	Labiateae	Carminative; a cooling medicine; used for flavouring dishes; gastric reliever and reduce acidity in the stomach. Prevent dyspepsia.
9	*Morus nigra* L.	Kala toot/ Shahtoot/ Toot siah	Moraceae	Fruit is edible and best source of income for local people; dry fruit is also exported; useful for sore throat. Reduce oral thrash and their extract is frequently used for the treatment of cough.
10	*Plantago lanceolata* Linn	Ispaghol	Plantaginaceae	Leaves are cooling, alternative and diuretic. The seeds are used to cure the stomach disorder. A decoction for making tea which is used for relieving coughs, ulcers, irritable bowl, cystitis and painful urination. Its leaves are used for the healing of wounds on the necks of ox during tillage practices.
11	*Plantago major* Linn.	Ispaghol/ Bati	Plantaginaceae	Its leaves are used as diuretic, anti-inflammatory agent; relieve constipation, diarrhea and dysentery. Seeds powder along with castor oil useful for headache.
12	*Punica granatum* Linn.	Daroo	Punicaceae	Fruit is edible; juice is used as stimulant in fever; its bark is used to kill the worms, reduce diarrhea and dysentery. It is also helpful in digestive disorders and stomach problems.
13	*Rumex haustatus* D. Don	Khatimal	Polygonaceae	Leaves are used as vegetables. It is used for the treatment of persistent diseases, especially that of gastrointestinal tract.
14	*Cuscuta reflexa* Roxb.	Aakaas bail/ Neildhari	Convolvulaceae	Juice is extracted and used for the treatment of jaundice. Paste is made by crushing of dried stem and is applied to treat headache and joint pain. Extract from fresh leaves is used for the growth of hairs.
15	*Rumex nepalensis* (Spreng.)	Hula	Polygonaceae	Aqueous extract of the plant is used to wash the body to ease body pain. Root Juice is helpful for reducing cough and cold.
16	*Zizyphus mauritiana* Lam.	Singli/ bayr	Rhamnaceae	A decoction of the root is used to treat in case of fever and menstrual abnormalities. Bark Juice is recommended for the cure of diarrhea and

				dysentery. Leaves are chewed to treat bleeding gums. Fruits are stimulant for digestion. Leaves are browsed by goats and sheep. The spiny branches are used for fencing.
17	*Justicia adhatoda* L.	Bhaikar	Acanthaceae	Decoction of leaves is taken early in the morning for the treatment of asthma, cough and fever. It is an important ingredient of cough syrups. It is antispasmodic as well. It is heart stimulant.
18	*Zanthoxylum armatum* Mill	Timber	Rutaceae	It is used as condiment along with *Mentha longifolia* and used for flavouring of dishes. Seeds are highly carminative and also used against stomach problems and dyspepsia. Branches are used as "Miswak" just like toothbrush. Leaves are browsed by goats and sheep. It is frequently used in pickles.
19	*Olea ferruginea* Royle	Kahu	Oleaceae	In old days its leaves are used to make tea. It is particularly used against cough, cold, flue and skin ailments. Helpful in preventing toothache and mouth ulcers. Branches are used as Miswak. The wood is very durable and is extensively used for constructing mud houses. Its logs are used for making agricultural tools. It is a source for fodder and fuel.
20	*Dodonaea viscosa* jacq.	Sanatha	Sapindaceae	It is used against toothache. Leaf extract is used to cure asthma, cough and cold. Dried branches are used as fuel wood.

Total species in all communities were 395 out of which 24.55% were Hemicryptophytes followed by 24.30% Therophytes and 21% Nanophanerophytes. Megaphanerophytes were 16%, geophytes were 9% and lianas were 5%.

Leaf size spectra

The overall leaf size spectra in the studied area and leaf size spectra in each community are shown in Fig. 4 and Fig. 5.

The leaf size spectra comprised of Microphylls (42%), Leptophylls (28%), Nanophylls (21%), Mesophylls (7%), and Megaphylls (2%). Among the communities, Nanophylls were found dominant in *Olea-Dichanthium-Cynodon* and *Broussonetia-Zanthoxylum-Seteria*.

Table 2. Number of species used to treat different ailments.

S. NO.	Ailments treated	Number of species
1	Stomach problems	10
2	Cough, fever, cold and flu	08
3	Tooth decay, bleeding gums and toothache	07
4	Diarrhea and dysentery	04
5	Blood purifier	03
6	Skin disease	03
7	Wound healing	03
8	Constipation	02

Communities

Leptophyllous type of vegetation was recorded dominant in *Dalbergia-Vinca-Bauhinia* Community. All other communities were dominated by Microphyllous vegetation.

It is evident from the results that the study area is dominated by Microphyllous type of vegetation. There were 395 species in all communities out of which 42% were Microphylls, 28% Leptophylls, 21% Nanophylls, 7% Mesophylls and 2% Megaphylls.

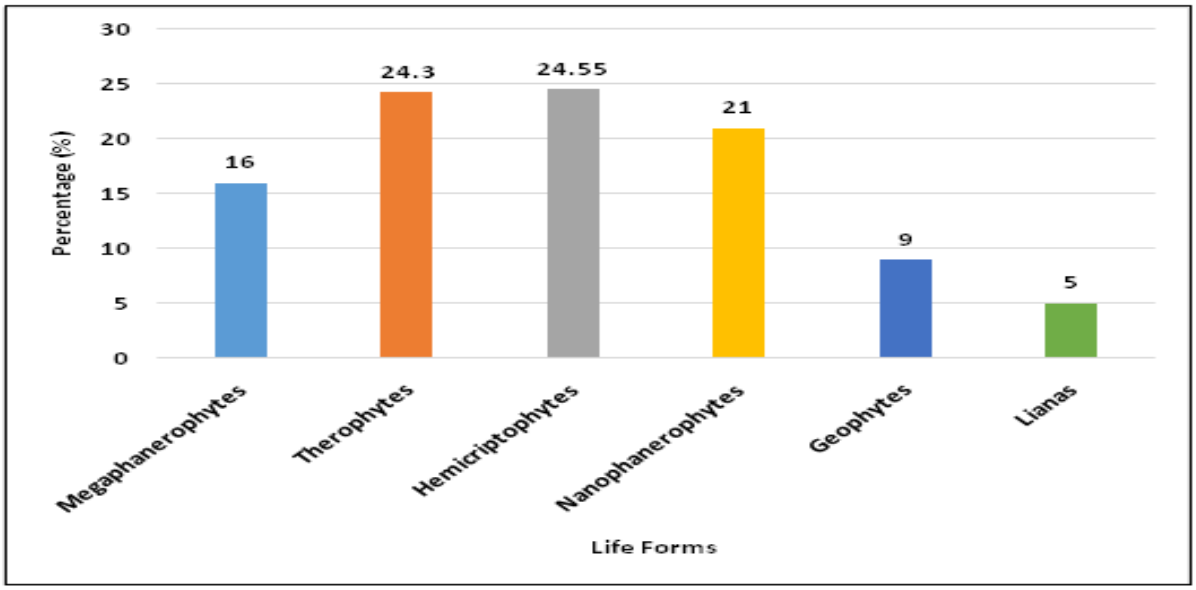

Fig. 2. Life form spectra of Taloq Hills Muzaffarabad.

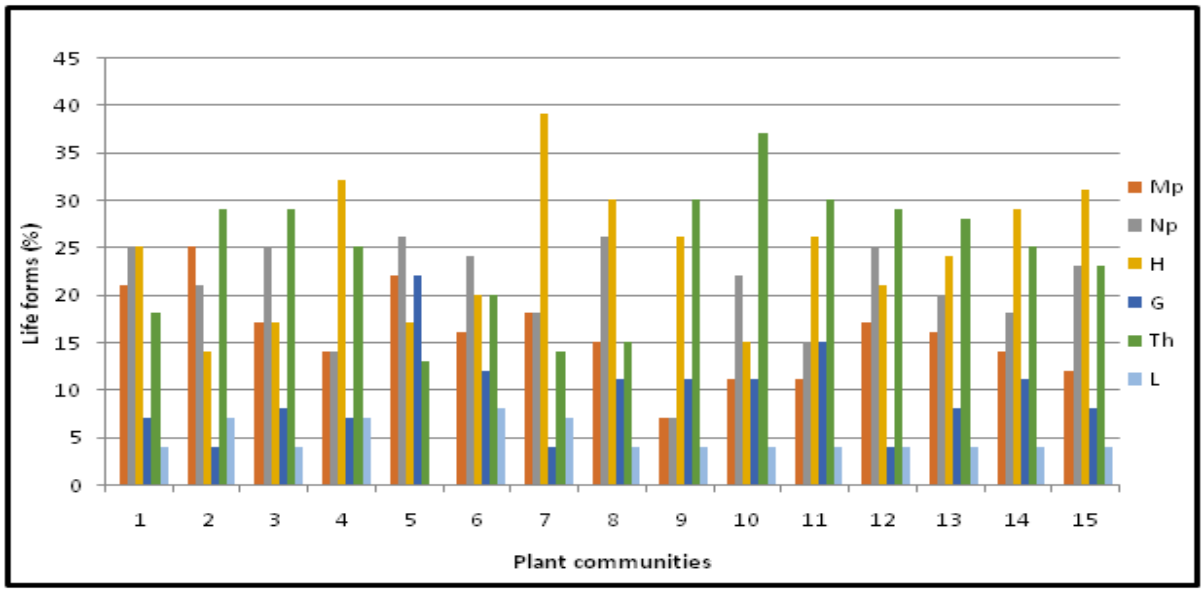

Fig. 3. Percentage of life forms distributed in different communities.

Key: Community: 1= *Olea-Dichanthium-Cynodon*; 2= *Dalbergia-Vinca-Bauhinia*; 3= *Broussonetia-Zanthoxylum-Seteria*; 4= *Acacia-Ajuga-Taraxacum*; 5= *Dyospyrus-Phragmitis-Capsella*; 6= *Celtis-Andropogon-Malva*; 7= *Quercus-Geranium-Arundo*; 8= *Pinus*; 9= *Pinus*; 10= *Pinus*; 11= *Quercus-Indigofera-Pinus*; 12= *Pinus-Pinus*; 13= *Pinus-Impatiens-Cynodon*; 14= *Pinus*; 15= *Pinus-Pinus*.

Cluster analysis (CA)

In the investigated area plant species were recorded and cluster analysis was used on the vegetation data set with 15 sites and 395 in order to know the life forms and leaf size spectra in associations. It was done by using the percentage values of life forms and leaf size spectra in all communities. It organizes the data into distinct sets on the basis of correlation among life forms as well as leaf size spectra in different stands. A total of five association clusters were formed during this analysis (Fig. 6).

Association I

This association consists of three communities and was reported from a range of elevation of 820-950 meters.

It was dominated by therophytes with an average percentage value of (25.33%) and was followed by Nanophanerophytes with a value of (23.66%). The dominant leaf size spectrum in this association was leptophylls (33.33%) followed by Nanophylls (32.33%). This association contains 80 plant species in total with 17 trees, 19 shrubs and 44 herbs.

Association II

At an altitude range of 1000-1160 meters; this association was recorded which was comprised of three stands.

Here dominant life form was Hemicryptophytes (23%) followed by Nanophanerophytes (21.33%). Total number of plant species in this association was 76 among them there were thirteen tree, sixteen shrubs and forty seven herbaceous species. Leading leaf size spectrum in this association was microphylls (45%) with co-dominant components Nanophylls (20.66%).

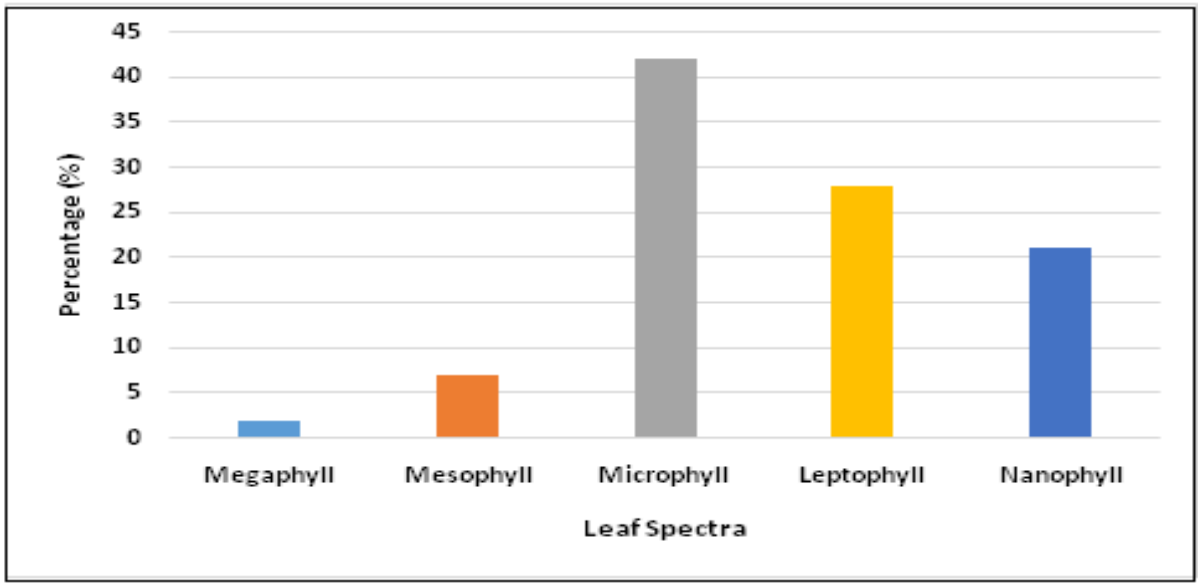

Fig. 4. Leaf size spectra of Taloq Hills Muzaffarabad.

Association III

Hemicryptophytes were the most prominent life form of this association; which was reported from a range of elevation of 1240-1320 meters. There recorded average percentage value was (34.50%).The dominant leaf size spectrum was Microphylls with a value of (51%) followed by Leptophylls (27.50%). Two communities form this association which have 55 plant species in total including 9 trees, twelve shrubs and 34 herbs.

Association IV

The reported association consisted of 81 plant species among them woody species were 10 (trees) and 14 (shrubs). The herbaceous constituents of this association were fifty seven in numbers and it was formed at a range of height of 1400-1540 meters. Most prominent life form and leaf size spectrum in this association were Therophytes and Hemicryptophytes with average percentage values of (32.33%) and (47%) respectively. In total there were three stands in this association.

Association V

The dominance among life forms in this association was shown by a combination of Therophytes and Hemicryptophytes with an average percentage value of (26.25%) each.

This association contain 103 plant species in four plant communities among which fifteen were tree species, twenty two were shrubby species and herbaceous components were sixty six in numbers. Microphyllous (47.75%) leaf size spectrum was dominated while Nanophylls (27.25%) were ranked second in this association. The average elevation of this association was 1620-1880 meters.

Ethnobotanical Uses

Total recorded species in the investigated area were 395. Out of these 20 species were selected for Ethnobotanical studies because of their frequent use by the local inhabitants. Plants with their scientific and vernacular names, part used and medicinal uses are given in the Table. A total of 20 plant species belonging to 18 families have been reported which are being used for different purposes. The Ethnobotanical uses are described in the format: botanical name followed by common name, and medicinal uses. The detail uses of native species are given in Table 1.

Discussion

The term vegetation is generally used to describe plant life of a particular region which provides cover to the ground. It is a common term which hasn't any specific orientation to particular taxa, life form, structure, spatial extent or any other particular, botanical or geographical characteristics. The concept of vegetation exhibits variety of issues together with conservation, species diversity, interactions and natural dependence of animals and plants, as well as sustainable wood production. The study of life form is an important part of vegetation description, ranking ahead to floristic composition (Cain, 1950). Life form spectra tell us about the climate of an area. It differs in every zone with the change in altitude.

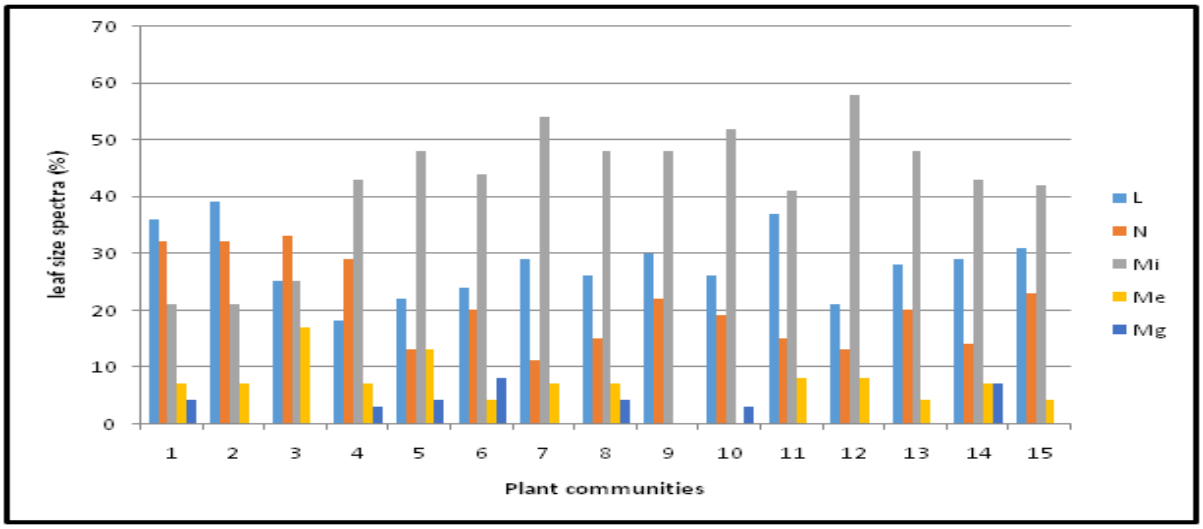

Fig. 5. Percentage of leaf size spectra found in different communities.

Key: Community: 1= *Olea-Dichanthium-Cynodon*; 2= *Dalbergia-Vinca-Bauhinia*; 3= *Broussonetia-Zanthoxylum-Seteria*; 4= *Acacia-Ajuga-Taraxacum*; 5= *Dyospyrus-Phragmitis-Capsella*; 6= *Celtis-Andropogon-Malva*; 7= *Quercus-Geranium-Arundo*; 8= *Pinus*; 9= *Pinus*; 10= *Pinus*; 11= *Quercus-Indigofera-Pinus*; 12= *Pinus-Pinus*; 13= *Pinus-Impatiens-Cynodon*; 14= *Pinus*; 15= *Pinus-Pinus*.

In the investigated area hemicryptophytes followed by Nanophanerophytes and Therophytes were dominant. Hemicryptophytes are the indicator of temperate zone while Therophytes are the indicator of disturbed vegetation and geophytes are of Mediterranean climate (Cain and Castro, 1959; Malik *et al.*, 2007). The climate of the investigated localities differs from subtropical to moist temperate type at various heights. The recorded life form is a reflection of existing environmental conditions. Taloqa hill is climatically cool at the top and warm at the base that is why Hemicryptophytes dominated at the top (1620-1880m) while Therophytes at the base (820-950m).

Malik *et al.* (2001) reported similar situation in Dao khun where Hemicryptophytes were dominant at the top and Therophytes at the base. The present result about the dominance of Hemicryptophytes and therophytes agrees with them. In the investigated area trees and shrubs were 15% and 19% which decreased with the increase in altitude. In open physiognomies Phenarophytes is the best represented class (Batalha and Martins, 2004). In our case the area has a great potential for the increase of Phenarophytes but deforestation has decreased the dominancy of trees and shrubs.

Therophytic species at the base and in *Pinus-Phalaris-Dicliptra* association (1400-1540) was high due to moisture and high rainfall at the high altitude. Normally monsoon supports Therophytic species to increase. Similarly, (Ajaib *et al.*, 2008) reported the same situation in Saney Baney Hills District Kotli Azad Jammu and Kashmir. The local inhabitants of the area are dependent on different trees such as use for construction and fuel purpose. That is why the population of trees and shrub decreased.

Similar trend regarding prevalence of Therophytes and decrease of shrubs and trees was observed by (Hussain *et al.*, 1997a; Hussain *et al.*, 1997b). Leaf size spectrum is an important parameter for the description of vegetation. In the investigated area Microphyllous species were dominant in the top and the base is covered by Leptophylls and Nanophylls. Microphylls are the indicator of temperate climate while Nanophylls and Leptophylls are of hot deserts (Cain and Castro, 1959).

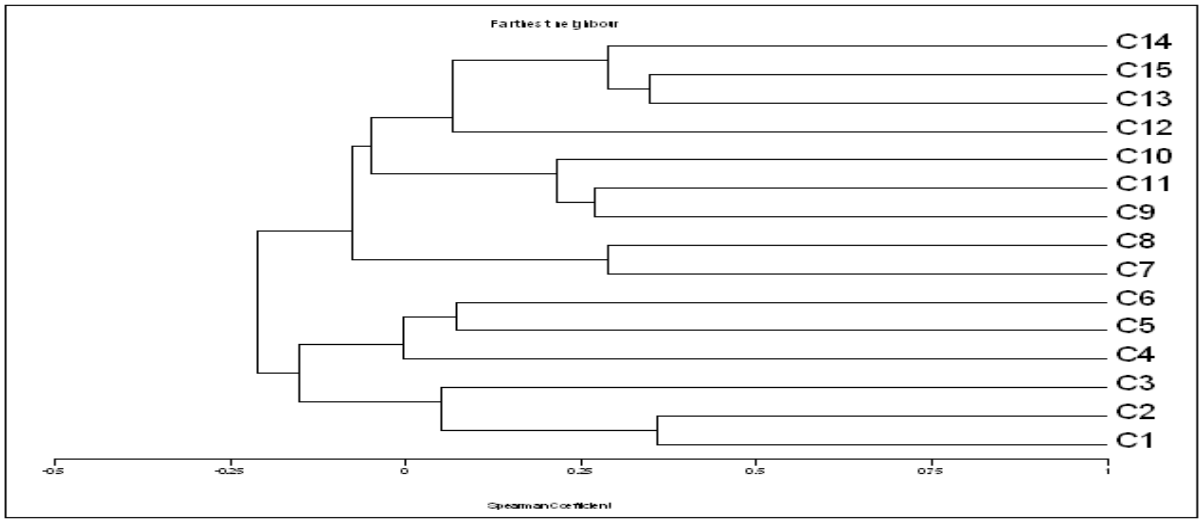

Fig. 6. Cluster analyses dendrogram based on species correlation matrix.

The present findings also agree with those of (Tareen and Qadir, 1993) who reported high percentage of Microphylls in the dry temperate climate of Quetta district. The data indicates the percentage of various leaf form classes varies with increasing altitude. In the base (820-950m) Leptophylls and Nanophylls were dominant while at the top Microphylls were dominant. (Malik *et al.*, 1990) reported Leptophylls and Nanophylls in dry subtropical semi evergreen forest from Kotli which are the characteristic of dry and adverse conditions. Similarly (Saxina *et al.*, 1987) also observed that the percentage of Microphylls was positively linked with the increasing altitude and this also similar to our findings.

The present study provides information about some remedial uses of 20 plant species. Sixty eight ailments/diseases were investigated from the study areas which are being treated using 20 plant species (Table 2).

Most of the species were used for treating stomach problems (10 spp.), followed by cough, fever, cold and flu (8 spp.) tooth decay, bleeding gums and toothache (7 spp.), Diarrhea and dysentery (4 spp.) three species each were used as blood purifier, skin diseases and healing of wounds whereas, two species were used for constipation reliever. Our results are well supported by previous studies (Mehmood *et al.* 2011). This shows that most of the active ingredients are lying in highly utilized parts. Most of the plants were used singly but some are used in combination as well by local hakims. Some plant species are claimed to be highly effective remedies for diarrhea, dysentery and fevers, cough and cold, and stomach troubles. The study shows that there is great potential for ethnobotanical exploitation of the existent flora so there is need for its protection and conservation that can only be achieved through the awareness and involvement of local inhabitants.

Many of the important species of great economic use are at the verge of extinction in the area. Rapid increase in population, urbanization and unplanned use has resulted in extinction of such medicinally important species. It is therefore, obligatory to find ways to increase practices for promoting conservation. By doing so, we can alter the economic and communal conditions of the locals positively.

Conclusion

The present study indicates the high percentage of Hemicryptophytes and the dominant leaf spectra is Microphylls which might be due to cool climate, low temperature, and high wind velocity in the area. Hemicryptophytes are the indicators of grassland semi-arid climate. The investigated area was under heavy biotic pressure due to deforestation and overgrazing. Most of the plants are uprooted to use them as fuel and grazed by the livestock. This leads to decrease in the number of species in the area. So it is the need of the time that this precious wealth should properly be protected and conserved. Further studies are also needed to validate the data and suggest the procedures for biodiversity and conservation of the area.

References

Abbas H, Qaiser M, Alam J. 2010. Conservation status of *Cadaba heterotricha* stocks (Capparaceae): an endangered species in Pakistan. Pakistan Journal of Botany **42,** 35-46.

Ajaib M, Khan Z, Muhammad S, Mahmood R. 2008. Biological Spectra of Saney Baney Hills District Kotli Azad Jammu and Kashmir. Pakistan Journal of Science **60**, 53-58.

Ali S, Qaiser M. 1993-2009. Flora of Pakistan (Fascicle series), Karachi.

Batalha MA, Martins FR. 2004. Floristic, frequency, and vegetation life-form spectra of a cerrado site. Brazilian Journal of Biology **64**, 201-09. http://dx.doi.org/10.1590/S151969842004000200004

Cain SA, Castro GD. 1959. Manual of vegetation analysis. Hafner Pub. Co., the University of Michigan.

Cain SA. 1950. Life-forms and phytoclimate. Botany Review **16,** 1-32.

Gottfried M, Pauli H, Grabherr G. 1998. Prediction of vegetation patterns at the limits of plant life: a new view of the alpine-nival ecotone. Arctic Alpine Research, 207-21.

Hadi F, Naseem M, Shah S. 2009. Prevalence and ecological characteristics of summer weeds in crop and vegetable fields of Botanical Garden Azakhel, University of Peshawar, Pakistan. Pakistan Journal of Plant Sciences **15**, 101-05.

Hussain F, Ilyas M, Takatsuki S. 1997a. Plant communities of Girbanr hills, Swat district, Northwestern Pakistan. Economy Review **23**, 247-260.

Hussain F, Khaliq A, Ilahi I. 1997b. Effect of Altltude, Aspect and Blotlc Factors on the Plant Dlverslty of Dabargai Hllls, Swat, Paklstan In: Mufti, S.A., C.A. Wood and S. Hassan (Eds), Biodiversity of Pakistan: Pakistan Museum of Natural History Islamabad.

Kala CP. 2000. Status and conservation of rare and endangered medicinal plants in the Indian trans-Himalaya. Biological Conservation **93**, 371-79. http://dx.doi.org/10.1016/S0006-3207(99)00128-7

Kala CP. 2005. Indigenous uses, population density, and conservation of threatened medicinal plants in protected areas of the Indian Himalayas. Conservation Biology **19**, 368-78. http://dx.doi.org/10.1111/j.1523-1739.2005.00602.x

Mahmood A, Malik Rn, Shinwari ZK, Mahmood A. 2011. Ethnobotanical survey of plants from Neelum, Azad Jammu & Kashmir, Pakistan. Pakistan Journal of Botany **43,** 105-110.

Malik N, Hussain F, Malik Z. 2007. Life form and leaf size spectra of plant communities harbouring at Ganga Chotti and Bedorii hills. International Journal of Agriculture and Biology **15**, 833-38.

Malik Z, Malik N, Bashir S, Gorsi M. 2001. Phytosociological studies on the vegetation of Dao Khun Hills. Journal of Science and Technology **25**, 35-41.

Malik Z. 2005. Comparative study of the vegetation of ganga choti and bedori hills, District Bagh, Azad Jammu and Kashmir with special reference to range conditions. Pakistan: University of Peshawar.

Malik ZH, Awan AA, Murtaza G. 1990. Phytosociology of Sudhangalli near Muzaffarabad. Journal of Science and Technology **14**, 111-16.

Mian-Ying W, Brett J, Jensen C, Nowicki D, Palu A, Anderson G. 2002. *Morinda citrifolia* (Noni) A literature review and recent advances in Noni research. Acta Pharmacologica Sinica **23,** 1127-41.

Nasir E, Ali S. 1970-1989. Flora of Pakistan (Fascicle series). Department of Botany, University of Karachi Pakistan.

Oosting H. 1956. The Study of Plant Communities. 2 ed. W. H. Freeman and Co, Sanfransisco.

Perveen A, Sarwar GR, Hussain I. 2008. Plant biodiversity and phytosociological attributes of Dureji (Khirthar Range). Pakistan Journal of Botany **40**, 17.

Qureshi R, Ahmad M. 2010. Some notes on the vegetation of Achhro thar (white desert) of Nara region, Sindh, Pakistan. Pakistan Journal of Botany **42**, 2985-94.

Qureshi R. 2004. Floristic and Ethnobotanical Study of Desert Nara Region, Sindh, Shah Abdul Latif University, Khairpur, Sindh, Pakistan.

Raunkir C. 1934. The life forms of plants and statistical plant geography. Clarendon Press.

Samant S, Dhar U, Palni L. 1998. Medicinal plants of Indian Himalaya: Diversity distribution potential value. Gyanodaya Prakashan, Nainital, Uttaranchal, India.

Saxina A, Pandey T, Singh J. 1987. Altitudinal variation in the vegetation of Kaumaun Himalaya. Perspective Environmental Botany 44-66.

Shimwell DW. 1971. The description and classification of vegetation. Sidgwick and Jackson, Cornell University.

Singh D, Hajra P. 1996. Biodiversity Status in the Himalaya. New Delhi, British Council.

Tareen RB, Qadir S. 1993. Life form and Leaf size spectra of the plant communities of diverse areas ranging from Harnai, Sinjawi to Duki regions of Pakistan. Pakistan Journal of Botany **25**, 83-92.

Vergeer P, Rengelink R, Copal A, Ouborg N. 2003. The interacting effects of genetic variation, habitat quality and population size on performance of Succisa pratensis. Journal of Ecology **91**, 18-26.