SPATIAL PATTERNS AND THE TRADITIONAL USES OF THE FLORA OF ZAINI PASS, HINDUKUSH RANGE CHITRAL, PAKISTAN.

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ABSTRACT

The present study was conducted to elaborate the role of altitude and aspect on community structure and species distribution in different seasons during 2018-2019. Field survey was carried out during two seasons' spring and summer. A total of 63 species belonging to 51 families were recorded during spring season, while 74 species belonging to 53 families were reported during summer season. However, PCORD software version 5 was used to classify the vegetation of the area, TWINSPAN classified the vegetation of the entire area into three associations in spring, while 6 associations in summer season. Altitude and aspect were two main factors to describe the distribution of vegetation of research area. Over grazing, soil erosion and over exploitation were found to be main ecological factors, which disturbed local vegetation. This paper enumerates the local uses of 68 plants species belonging to 28 families, which are used by local people for various purposes. Rosaceae was the leading family (11 spp.) followed by Asteraceae (10 spp.) and Silaceae (4 spp.), while the rest have less than 4 species. Out 68 plants 3(26.57%) are used as medicinal, 26(18.18%) as fuel, 25(17.48%) as fodder, 14 (9.79%) as a fruit, 11(7.69%) as timbers, 9 (6.29%) as Thatching and vegetable, 5 (3.49%) ornamental, (2.79%) as food and 1(0.69%) as broom and cosmetic. 38 ethno medicinal species were used to cure 33 different diseases in the studied area. These plants were used to treat various ailments: among 38 ethno medicinal plant species 6 species (8%) were used as analgesic, 5 species of 7% as anthtmentic, 4 species of 5% as antibilous and antidiarrheal, 3 species of 4% as diuretic and jaundice.

Keys: Plant wealth, Hindukush range, Ethno-medicine, Zaini Pass, herbaceous vegetation,TWINSPAN, District Chitral

Introduction

District Chitral is located in the northern part of Khyber Pakhtunkhwa, Pakistan spreading to the country's northern border. It lies within 35^0 $15'06''$ to 36^0 $55'$ $32''$ North and 71^0 $11'$ $32''$ to 73^0 $51'$ $34''$ East. The study area (Zaini Pass) is located in District upper Chitral in between Known Valleys Terich and Mulkhow. It lies between $36^o19'$ $24''$ north latitude and 72^o $09'$ $03''$ east longitude and covers approximately an area of 51 km^2. It is situated at an elevation of 4011m above sea level. The research area is

located to the North of Mulkhow Khass, south of Terich Valley, west of Gaht valley and east of Uthol valley. Phytogeographically, the research area is falling in western Irano-Turanian region, which represents 45.6% of the total floral diversity of Pakistan. Climatically the area falls within the cold arid temperate zone with pleasant summers and alarming winters with snowfall. The vegetation of the area has been categorized into dry temperate open scrub, subalpine scrub, alpine herbaceous vegetation and cultivated plans (Nusser and Dickore, 2002).

Vegetation is one of the most important part of ecosystem that interprets the effect of the whole environment (Shahid and Joshi, 2016). Vegetation varies from season to season, attitude to altitude and aspect to aspect. A biotic factors play key role to change the structure of plant community (Heady 1964). The study of plant community in any phytogepgraphical region is called Phytosociology. Plant species distribution clearly show the gradually change of environmental factors. Over the earth surface, plants species are neither evenly distributed nor randomly, but they are distributed in definite geographic units, governed so by the physical climate and environment (Khan *et al.,* 2020). Biotic and abiotic factors both affect the distribution of species, such as topography, soil, tectonic plate's movement, geology, uplifting of mountains, climate change, species migration and evolution (Mota *et al.,* 2017; Souza *et al.,* 2017).

The term Ethnobotany is defined as the direct or indirect relationship between plants and humankinds, or the branch of Botany, which discuses human interaction with plants and its environment (Hazrat *et al.,* 2011). Local people of the research area almost depend on plants for their basic need of life. Due to backward area and worse transport system the health facilities are insufficient, due to these issues the native people depend on traditional system of cure or aliments for various diseases (Rahim *et al.,* 2017). Plants help the human life momentously having multiuse, millions of traditional population use plants for medicinal, food, fodder, clothing, shelter, and fuel and thatching purposes. Through over the world about 80% population used herb as a medication (Shanwari *et al.,* 2017). A total of 422,000 phanerogams were reported from whole world, over 50,000 are used for therapeutic purposes.

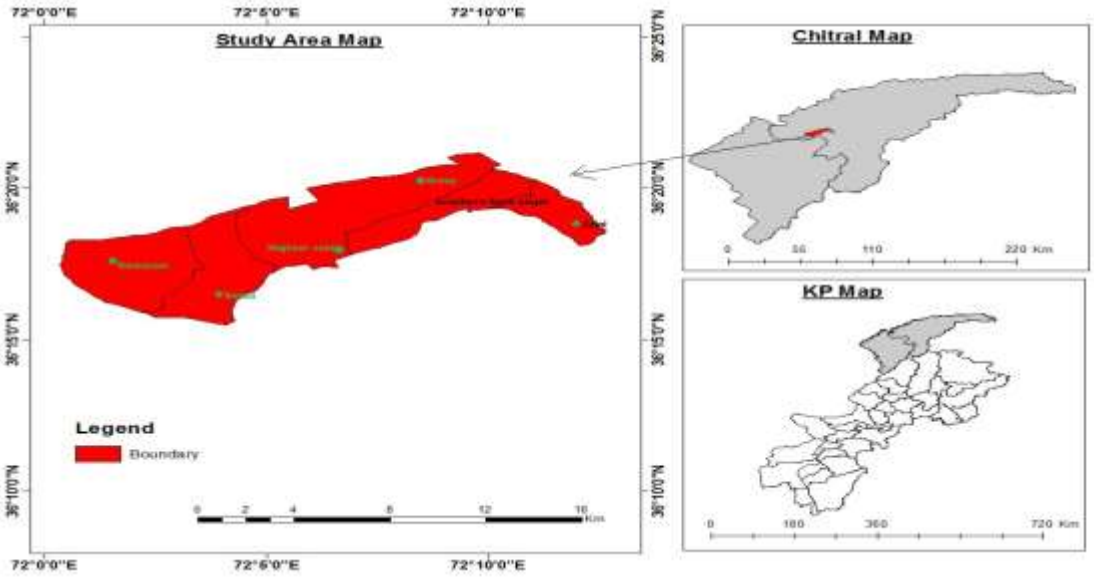

Fig No.1 GIS generated Map of Research area

Materials and Method

Materials and Method for vegetation study

Regular field surveys were conducted throughout the research area (Zaini Pass) during spring and summer of 2019-2020. A total of 6 sites were selected based on altitude, aspect and species diversity that include Zaini Noghoor, Pishalduri, Panjantak, Zaini Ann, Banali and Bamasoor. The collected specimen was identified with the help of Flora of Pakistan (Nasir and Ali 1970-1989, Ali and Nasir 1990-1992 and Ali and Qaiser 1992-2018). The dried specimen was deposited to Herbarium, Botany Department, and University of Peshawar. Pakistan. Data sets were analyzed using multivariate statistical techniques using software PCORD version 5. Data on the presence or absence (1,0) for all species were prepared according to software requirement and treated in PCORD version 5 for classification of plants into communities.

Importance value

Importance values of all species were calculated by summing all the relative values RD, RF and RC (Badshah *et al.*, 2016).

IV= RD+RF+RC

Sorensen's similarity index

Sorensen's similarity was calculated by following formula

Similarity index= $\frac{2\sum nc}{\sum n1+\sum n2}$

Simpson's diversity index

Simpson's diversity index was calculated by following equation

Simpson's index= $\frac{N(N-1)}{\sum N(n-1)}$

Maturity index

The community maturity index was obtained by (Pichi-Sermolli 1948).

Maturity index= $\frac{Frequency\ \%\ of\ all\ species\ in\ stand}{Total\ number\ spp\ in\ stand}$

Species richness

SR= $\frac{S}{\sqrt{N}}$

Materials and Methods of Ethnobotany:

Preservation, identification and classification of plants:

The research area is located in the northern part of District Chitral. It lies in $36^{0}19'24''$ north latitude while $72^{0}09'03''$ east longitude with total area of 5,100 ha. It is situated at the height of 4011m above sea level. A total 5,100 ha research area has been divided into 3 sites (Temperate, Sub-alpine and alpine). Plant specimen were collected during two flowering seasons i.e. spring and summer. Plant specimen were pressed, poisoning with nepheline, dried and mounted on slandered size herbarium sheet, according to Jain and Rao, (1977). The preserved plants were identified and confirmed with the help of Flora of Pakistan (Nasir and Ali, 1970; Ali and Nasir, 1989-1991; Ali and Qaiser, 1993-2018). The ethnobotanical data were placid by taking interviews (directly and by Questionnaires) with randomly selected informants. Based on informant's interviews, the plants were classified into various classes; fodder, food, fuel wood, timber wood, medicinal purposes, edible, thatching and fruit. Local language was used to fill Questioners and to get direct information then changed into international language. Ethnobotanical and ethno medicinal data were found from a person above 33-year-old. A total of 103 informants have shared their aboriginal knowledge about the uses of local taxa. The informants comprised of all sort of person such as educated, uneducated and hakims of an area.

Jaccard Formula= Cx100/a+b-c

Where a'' is the number of species of the area A, ''b'' is the number of species of the area B and ''c'' is the number of species common to A and B (Gonza *et al.*, 2008).

Results:

Results for vegetation study;

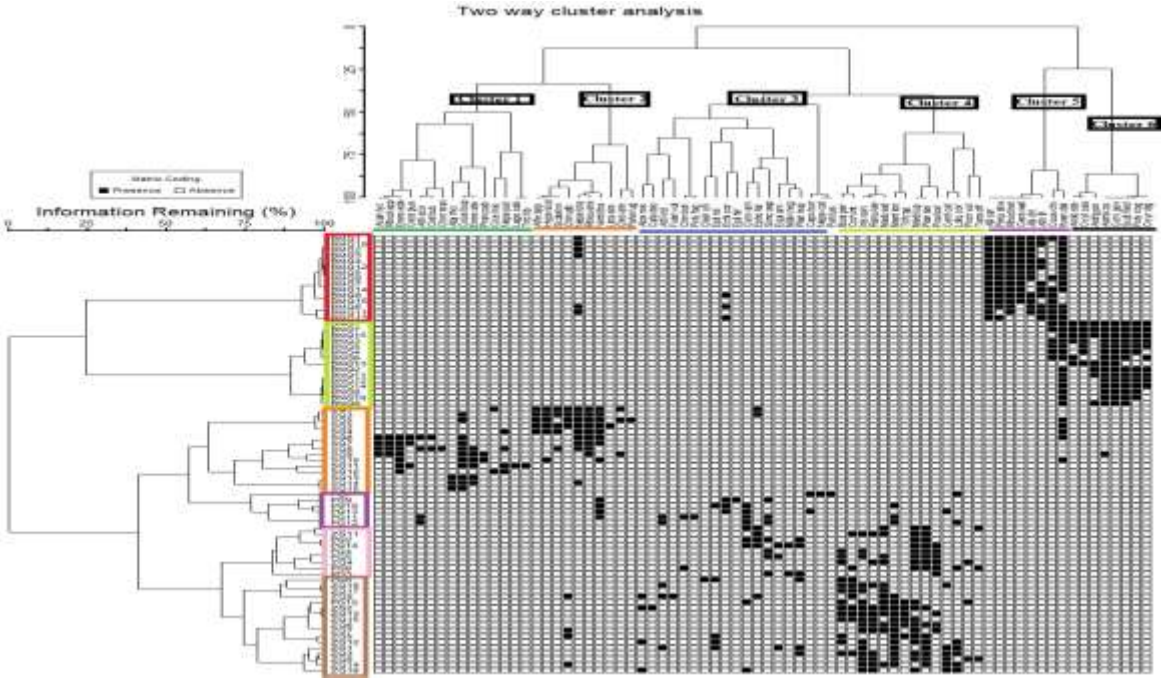

Fig No. 2 Two- way cluster dendogram showing distribution of 74 species in 77 plots of the summer season measured using ward's method

Two-way cluster analysis (TWCA): Result of two-way cluster analysis comprehend the presence or absences of phytosociological element in Zaini Pass. The black dotes represent the presence, while white dotes showed the absence of species in research sites (Fig No.2). Figure No. 2 showed the two-cluster analysis of herbaceous communities of summer season. PCORD software categorized summer data into six group by using ward's method. The details of these six group or communities are as follows:

1. ***Cousinia buphthalmoides- Eremostachys edelbargii -Eremurus stenophyllus* community**

This community/cluster is established in Zaini Ann, which comprised by a total of 14 plant species. *Cousinia buphthalmoides*, *Eremostachys edelbargii* and *Eremurus stenophyllus* were showed the leading species of this community by having 26.22, 22.17 and 17.72 IV respectively. The top indicator species like *Cousinia buphthalmoides* covered 73% quadrates of total area, *Eremostachys edelbergii* 47%, while *Eremurus stenophyllus* covered 40% of total quadrates. Rest of species covered less than 35% of total area (Fig 2).

2. ***Nepeta bractiata- Rheum emodi* community**

This community is also established in Zaini Ann, with comprising of 10 species. *Nepeta bractiata* and *Rheum emodi* were two dominating species of this cluster or community by having 28.20 and 26.44 IV. The top indicator species *Nepeta bractiata* and *Rheum emodi* covered 100% and 60% quadrates of total area. *Atimisia* spp, *Hypericum scabrum* and *Verbascum tapsus* were co-dominant species of this community.

Rest of species showed less than 50% cover of total area (Fig 2).

3. ***Sonchus asper-Epilobium royleanum* community**

This community/cluster was established in Zaini Noghoor, with comprising of 18 species. *Sonchus* asper and Epilobium *royleanum* were two dominating species with high values of IV, 19.89 and 10.06. The top indicator species *Sonchus* asper and Epilobium *royleanum* covered 74% and 62% quadrates of total area. *Alcea rosea, Echinops cornigerus* and *Equisetum arvense* were co-dominant species of this community. Rest of species showed less than 50% cover of total site (Fig 2).

4. ***Medicago sativa- Plantago lanceolate- Poa balbosa community***

This community was established in Pishalduri, with comprising of 14 species. *Medicago sativa, Plantago lanceolate* and *Poa balbosa* were dominating species with high values of IV, 23.65, 21.91 and 18.83 respectively. The top indicator species *Medicago sativa, Plantago lanceolate* and *Poa balboas* covered 87%, 82% and 67% quadrates of total area. Rest of species showed less than 50% cover of total area of the site (Fig 2).

5. ***Pimpinella stewartii- Allium carolinianum- Koenigia delictula* community**

This community was established in Bamasoor, with comprising of 10 species. *Pimpinella stewartii, Allium carolinianum* and *Koenigia delictula* were more diverse species with high values of IV, 52.48, 50.64 and 35.22 respectively. The top indicator species *Pimpinella stewartii, Allium* carolinianum and Koenigia *delictula* covered 80%, 80% and 100% quadrates of total area. Rest of species showed less than 60% cover of total area of the site (Fig 2).

6. ***Corydalis govaniana- Astragalus xanthoiphidopsis- Scutellaria heydei* community**

This community was established in Banali, with comprising of 8 species. *Corydalis govaniana, Astragalus* xanthoiphidopsis and Scutellaria *heydei* were more diverse species with high values of IV, 48.75, 47.83 and 41.13 respectively. The top indicator species *Corydalis govaniana, Astragalus xanthoiphidopsis* and *Scutellaria heydei* covered 100%, 82% and 74% quadrates of total area. Rest of species showed less than 70% cover of total area of the site (Fig 2).

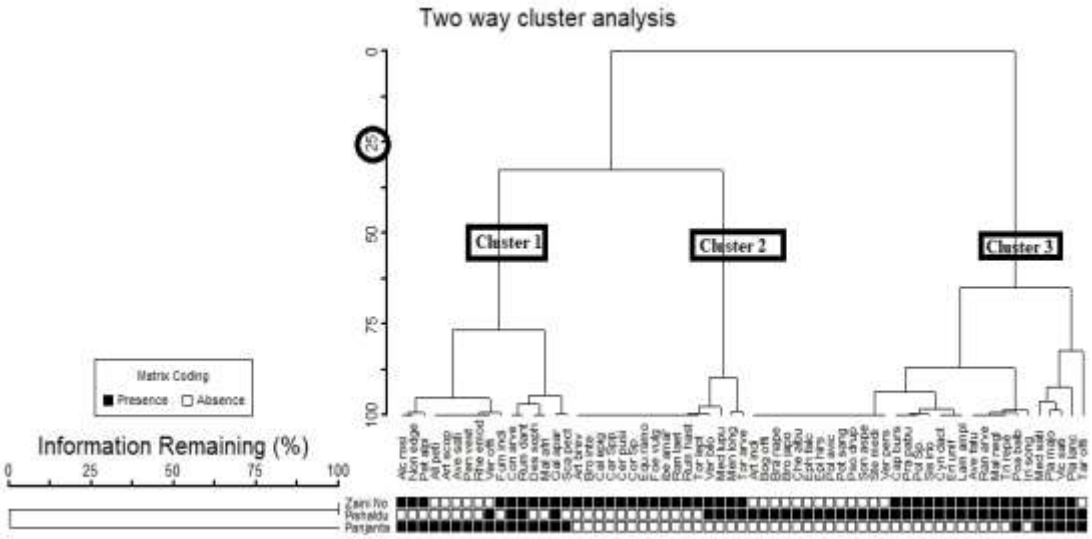

Fig No. 3 Two- way cluster dendogram showing distribution of 63 species in 40 plots of the spring season

Ward's cluster analysis

Cluster analysis was conducted designed by PCORD software by using Wards analysis tool. These cluster are based on IV of the leading species at all sites and combined IV of each species.

1. ***Rumex dantatus- Fumaria indica-Galium aparine* community**

This community was established in Panjantak, with comprising of 16 species. This cluster/community composed of three dominating species like *Rumex dantatus* with IV 64.22 by summation of all 3 sites IV values, *Fumaria indica* had 27.17 IV, while *Galium aparine* came 3rd more diverse species with 22.85 IV values of all three sites IV values. *Rumex dantatus* was found in all 3 sites with IV of 29.3, 10.22 and 24.7 respectively, *Fumaria indica* was found in two sites Panjantak and Zaini Noghoor with IV of 25.55 and 2.17, while *Galium aparine* was also found in all sites with IV of 10.11, 1.54 and 11.2 respectively (Table 1& Fig 3).

2. ***Veronica biloba- Mentha longifolia-Medicago lupulina* community**

This community was established in Zaini Noghoor, with comprising of 16 species. This group/cluster consisted of three more diverse species such as *Veronica biloba* with contribution of 17.74 IV values by summing of all 3 sites IV values, *Mentha longifolia* was 2nd dominating species with sharing of 15.13 IV, while *Medicago lupulina* came 3rd more diverse species with contribution of 13.27 IV values. *Veronica biloba* was found in 2 sites Zaini Noghoor and Pishalduri with IV of 16.2 and 1.54, *Mentha longifolia* was found in two sites Zaini Noghoor and Pishalduri with IV of 9.88 and 5.25, while *Medicago lupulina* was also found these two sites with IV of 10.1 and 2.97 respectively (Table No. 1& Fig No. 3).

3. ***Medicago sativa-Plantago lanceolate- Taraxacum officinale* community**

This community was established in Pishalduri, with comprising of 29 species.

This group/cluster consisted of three more diverse species such as *Medicago sativa* with contribution of 63.77 IV values by summing of all 3 sites IV values, *Plantago lanceolate* was 2nd dominating species with sharing of 46.87 IV, while *Taraxacum officinale* came 3rd more diverse species with contribution of 45.46 IV values. *Medicago sativa* was found in all 3 sites Pishalduri, Zaini Noghoor and Panjantak with IV of 16.2, 21.11 and 26.46, *Plantago lanceolate* was also found in all sites Pishalduri, Zaini Noghoor and Panjatak with IV of 20.7, 13.65 and 12.52, while *Taraxacum officinale* was found in only two sites Zaini Noghoor and Panjatak with IV of 24.23 and 21.23 respectively (Table No. 1& Fig No. 3).

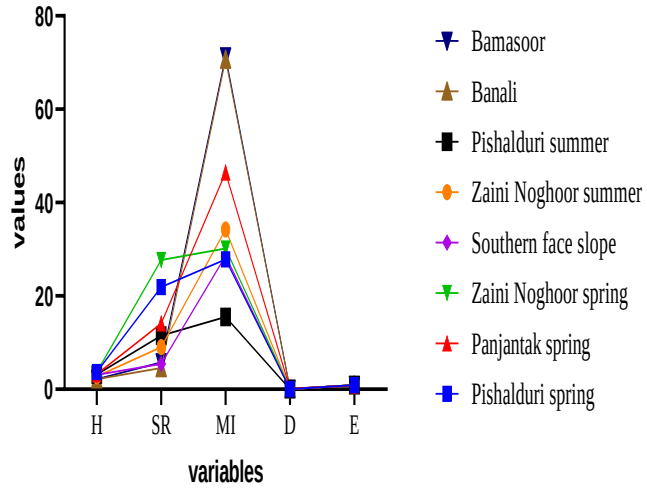

Fig No. 4. Showing Simpson index, Species richness, Maturity index, Simpson index and Evenness

Results of ethnobotany;

During the survey, 68 plant species belonging to 28 different families were collected with ethnobotanical uses. The major families which contributed in various ethnobotanical purposes were (11 spp.), Asteraceae (10 spp.) and Silaceae (4 spp.), while the rest have less than 4 species. The present results showed that 38 species (26.57%) were used for medicinal purposes, 26 species (18.18%), for fuel, 25 species (17.48%) fodder, 14 (9.79%) for fruit, 11 (7.69%) for timber, 9 (6.29%) for thatching and vegetable each, 5 (3.49%) for ornamental, 4 (2.79%) for food and 1 (0.69%) for broom and cosmetic each (Table No. 1 &Fig No. 1.). Different plant parts were used to cure various disease like fruits 11 species (21.56%) followed by leaf and whole plant 9 species (17.64%) each, flower 8 species (15.68%), seed 6 species (11.76%), stem 4 species (7.84%), root 3 species (5.88%) and bark contributed 1 species (1.96%). Rosacea was the leading family with their highest number of species (11 species, 16.66%), followed by Asteraceae (10 species, 12.12%), Apiaceae and Salicaceae (4 species, 6.06%) each and Brassicaceae, Fabiaceae, Iridaceae, Polygonaceae and Scrophulariaceae (3 species, 4.53%) each, while rest of the families (Salicaceae, Tamaricaceae, Poaceae, Eleagneaceae, Chenopodiaceae, Anacardiaceae, Berberidaceae, Capparadeaece, Convolvolaceae, Geraniaceae, Malvaceae, Moraceae, Plantaceae, Punicaceae, Rubacieae, Simaroubaceae, Umbelifreae, Vitaceae and xanthorhoeaceae) had contributed less than 3 species each. Local medicinal plants of 68 species of herbs (36 spp., 52.94%), shrubs (15 spp., 22.05%) and trees (17 spp., 25%) were used by the local people (Table No 2. & Fig No 2.). The inhabitants of Zaini Pass, District Chitral were using 38 plant species belonging from 17 plant resources for 35 various ailments. The major disease was

based on number of contributed species was Analgesic with 6 species (8.45%) followed by Anthelmintic 5 species (7.04%), Antibiolous and Antidiarrheal 4 species (5.63%) each, Diuretic, Jaundice, Antitussive, Antipyretic, Asthmatic and Blood pressure 3 species (4.22%) each, Ulcer, Balsamic, Hypertensive, Typhoid, Refrigerant, Pectoral, Skin disorder, Laxative and Skin protection 2 species (2.81%) each, Tonic, Vermicide, Alterative, Antiseptic, Aromatic, opthalmacum, Pungent, Memory improvement, Anesthetic, Insomnia, Stabbing pain, Retaining placenta and Ant acidic 1 species (1.40%) each (Table No 2. & Fig No.3.).

Table # 1 Ethnobotanical profile of flora of Zaini Pass, District Chitral

S. NO	Botanical Name/ Family	Local Name	1	2	3	4	5	6	7	8	9	10	11
	Anacardiaceae												
1	*Pistacia integrimma* J. L.	Binjo	-	-	-	+	-	+	+	-	-	-	-
	Apiaceae												
2	*Ammi visnaga* L.	Ishparo zokho	-	-	-	-	-	-	-	-	-	-	-
3	*Bonium persicum (*Boiss.) B. Fedtsch.	Hojoj	+	-	-	-	-	-	-	+	-	+	-
4	*Foenicolum vulgare* Mill.	Bodyong	+	-	-	-	-	+	-	+	-	-	-
5	*Ferula narthex* Royle.	Rau	-	-	-	-	-	-	-	+	-	-	-
	Asteraceae												
6	*Artemisia parvifolia* Roxb.ex. D. Don.	Kharkhalich	-	-	+	-	+	-	-	+	-	-	-
7	*Artemisia scoparia* Waldst. & Kit.	Droon	-	-	+	-	+	-	-	+	+	-	-
8	*Chichorium intybus* L.	Khasti	-	-	-	-	-	-	-	+	-	-	-
9	*Conyza buniriensis* L.	Basabur	-	-	-	-	-	-	-	-	-	-	-
10	*Helianthus annus* L.	Yorotmoknoko rak	-	-	+	-	-	-	-	-	-	-	-
11	*Matricaria chamomila* L.	Shirisht	-	-	-	-	-	-	-	+	-	-	-
12	*Sonchus asper* (L.) Hill.		+	-	-	-	-	-	-	-	-	-	-
13	*Taraxicum officinale* Weber ex F. H. Wigger.	Phowo	+	+	-	-	-	-	-	-	-	-	-
	Berberidaceae												
14	*Berberis lyceum* Royle.	Chovenj	-	-	+	-	-	-	-	+	-	-	-
	Brassicaceae												
15	*Capsella bursa-pectoris* L.		+	-	-	-	-	-	-	-	-	-	-
16	*Lepidium sativum* L.	Wahjosho	-	-	-	-	-	-	-	-	-	-	-
17	*Sisymbrium irio* L.	Kheli kheli	-	-	-	-	-	-	-	+	-	-	-
	Capparadaceae												
18	*Capparis spinose* L.	Kaveer	-	+	-	-	-	-	-	+	-	+	-
	Chenopodiaceae												
19	*Chenopodium album* L.	Darkunak	-	+	-	-	-	-	-	-	-	-	-
20	*Chenopodium murale* L.		-	-	-	-	-	-	-	-	-	-	-
	Convolvulaceae												
21	*Convolvulus arvensis* L.	Meeshk	+	-	-	-	-	-	-	-	-	-	-
	Eleagnaceae												

22	*Eleagnus angustifolia* L.	Shinjoor	-	-	+	-	-	+	-	+	-	-	-
23	*Hippophae ramnoides* L.	Mirganch	-	-	+	-	-	-	-	-	-	-	-
	Fabaceae												
24	*Medicago sativa* L.	Mushich	+	+	-	-	-	-	-	-	-	-	-
25	*Rubinia psedo-acasia* L.	Akasi	-	-	+	+	-	-	+	-	-	-	-
26	*Sophura mollis* L.	Bashoo	-	-	+	-	+	-	-	-	-	-	-
	Geraniaceae												
27	*Geranium wallichianum* D. Don ex Sweet.	Unknow	+	-	-	-	-	-	-	+	-	-	-
	Iridaceae												
28	*Fraxinus xantholoides (*G. DON) Wall. Ex. DC.	Toor	-	-	+	+	-	-	-	-	-	-	-
29	*Iris garmanica* L.	Sawasan	-	-	-	-	-	-	+	-	-	-	-
30	*Iris songarica* Schrenk.	Krisma	+	-	-	-	-	-	-	-	-	-	-
	Malvaceae												
31	*Malva neglecta* Wall.	Yoropagozo	+	+	-	-	-	-	-	+	-	-	-
	Moraceae												
32	*Ficus carica* L.	Koyit	-	-	+	-	-	+	-	+	-	-	-
	Platanaceae												
33	*Platanus orientalis* L.	Chenar	-	-	+	+	-	-	-	-	-	-	-
	Poaceae												
34	*Triticum aestivum* L.	Goom	+	+	-	-	-	-	-	-	-	+	-
35	*Zea mays* L.	Juwari	+	-	+	-	-	-	-	-	-	+	-
	Polygonaceae												
36	*Rheum emodi* Wall ex Meissn	Ishapar	+	-	-	-	-	+	-	-	-	-	-
37	*Rumex dantatus* L.		+	+	-	-	-	-	-	-	-	-	-
38	*Rumex hastatus* D. Don.	Shootshakoo	+	+	-	-	-	-	-	-	-	-	-
	Punicaceae												
39	*Punica granatum* L.	Darum	-	-	+	-	-	+	-	+	-	-	-
	Rosaceae												
40	*Cotoneaster affinis* Lindl.	Ishkoralik	-	-	+	-	-	-	-	-	-	-	-
41	*Cotoneaster microphylla* L.	Mikeen	-	-	+	-	-	+	-	+	-	-	-
42	*Craetagua songarica* K. Koch.	Goni	+	-	+	+	-	-	-	+	-	-	-
43	*Malus domestica* L.	Paloogh	+	+	+	+	-	+	-	+	-	-	-
44	*Prunus armanica* L.	Xolli	+	-	+	+	-	+	-	-	-	-	-
45	*Prunus amugdalus* Dulcis.	Badam	+	-	+	-	-	+	-	+	-	-	-
46	*Prunus domestica* L.	Girvalogh	+	-	+	-	-	+	-	-	-	-	-
47	*Prunus persica* L.	Alocha	+	-	+	-	-	+	-	-	-	-	-
48	*Pyrus communis* L.	Tong	+	+	+	-	-	+	-	-	-	-	-
49	*Rosa indica* Linn.	Gulab	-	-	+	-	-	-	+	-	-	-	-
50	*Rosa webbiana* Wall.ex Royle	Throni	-	-	+	-	-	-	-	+	-	-	-
	Rubiaceae												
51	*Galium aparine* L.	Krachako	+	-	-	-	-	-	-	-	-	-	-
	Salicaceae												
52	*Populus alba* L.	Tarik	-	-	+	+	+	-	-	+	-	-	-

53	*Populus nigra* L.	Romani	-	-	+	+	+	-	-	-	-	-	-
54	*Salix alba* L.	Tali	-	-	+	+	+	-	-	-	-	-	-
55	*Salix iliensis* Regel.	Shatali	-	-	+	+	+	-	-	-	-	-	-
	Scrophulariaceae												
56	*Antirrhinum majus* Linn.	Ranifrokhi	-	-	-	-	-	-	+	-	-	-	-
57	*Verbascum thapsus* Linn.	Gordoghkaro	-	-	-	-	-	-	-	+	-	-	-
58	*Veronica biloba* Linn	Xoogh josho	+	-	-	-	-	-	-	-	-	-	-
	Simaroubaceae												
59	*Alianthus altisima* (Miller). Swingle.	Bakayani	-	-	+	-	-	-	-	+	-	-	-
	Solanaceae												
60	*Solanum nigrum* L.	Pirmilik	-	-	-	-	-	-	-	+	-	-	+
61	*Solanum tuberosum* L.	Aloo	-	+	-	-	-	-	-	-	-	-	-
	Tamaricaceae												
62	*Tamaricaria elegans* (Royle) Qaiser & Ali.	Hinjoo	-	-	+	-	+	-	-	-	+	-	-
63	*Tamarax dioica* Rox.ex Roth	Hinjoo	-	-	+	-	+	-	-	+	-	-	-
	Umbelliferae												
64	*Prongos pabularia* Lindl.	Mushan	+	-	-	-	-	-	-	+	-	-	-
	Vitaceae												
65	*Vitis venifera* L.	Drooch	+	-	+	-	-	+	-	+	-	-	-
	Xanthorhoeaceae												
66	*Peganum harmala* Linn.	Bosit	+	-	-	-	-	-	-	-	-	-	-

KEYS: 1. Fodder, 2. Vegetable, 3. Fuel, 4. Timber, 5. Thatching, 6. Fruit, 7. Ornamental, 8. Medicinal, 9. Broom, 10. Food, 11. Cosmetic

Table No. 4 Comparative analysis of present study with previous District Chitral, papers

S. No	Botanical Name	Local Name	Regional comparison with similar Uses									
			1	2	3	4	5	6	7	8	9	10
1	*Allium cepa* L.	Theshtoo	+	-	+	-	-	-	-	-	-	-
2	*Artimisia maritima* L.	Droon	+	-	-	-	-	-	-	-	-	-
3	*Alcea rosea* L.	Lain	+	-	+	-	+	-	-	-	+	-
4	*Artimisia parviflora* Roxb.	Kharkhalich	+	+	+	-	-	+	+	-	+	+
5	*Berberis lyceum* Royle.	Chowenj	+	-	+	+	-	-	-	-	-	+
6	*Cappris spinosa* L.	Kaveer	+	-	+	+	+	+	+	-	+	+
7	*Carthamus tinctorius* L.	Poam	+	-	+	+	+	-	-	-	+	+
8	*Chenopodium album* L.	Chirkoonzo	+	+	+	+	-	-	-	-	-	-
9	*Cichorium intybus* L.	Khasti	+	+	+	+	+	+	+	-	+	+
10	*Eleaegnus angustifolia* L.	Shinjoor	+	+	+	-	+	-	+	+	+	+
11	*Foeniculum vulgare* L.	Bodiyong	+	-	+	-	+	+	-	-	+	+
12	*Hippopheae rhamnoides* L.	Mirghanz	+	-	+	-	-	-	-	-	+	+
13	*Helianthus annuus* L.	Yorotmokhnok orak	+	-	+	-	-	-	-	-	-	+

14	*Linium usitatissimum* L.	Shentheeki	+	-	+	-	-	-	-	-	-	-
15	*Mentha arvensis* L.	Bain	+	-	+	-	+	-	+	-	+	-
16	*Mentha longifolia* (L.) Huds	Bain	+	-	+	-	+	-	-	-	-	+
17	*Morus alba* L.	Marach	+	-	+	-	+	-	-	-	+	+
18	*Plantago major* L.	Ispagool	+	+	-	-	-	-	+	-	+	-
19	*Pronus amygdalus* Bcill Batsch.	Badaam	+	+	-	-	-	-	-	+	-	-
20	*Prunus armanica* L.	Zhooli	+	+	+	-	-	-	-	-	-	-
21	*Papaver soniferum* L.	Afun	+	-	+	-	-	+	-	-	+	+
22	*Rheum emodi* L.	Ishpar	+	-	+	-	-	-	-	-	-	-
23	*Silene conoidea* L.	Apupar	+	-	-	-	-	-	-	-	+	-
24	*Sophora mollis* (Royle) Baker	Bashoo	+	-	+	-	-	-	-	-	-	+
25	*Solanum nigrum* L.	Pirmilik	+	+	-	-	+	-	+	-	-	+
26	*Verbescum thapsus* L.	Gordogh karoo	+	-	+	-	-	-	-	-	+	-
27	*Vitis vinifera* L.	Droch	+	-	-	-	-	-	-	-	+	-
28	*Sisymbrium irio* L.	Khali khali	+	-	+	-	-	-	+	+	+	-
29	*Matricaria chamomilla* Linn.	Shirisht	+	+	-	-	+	-	-	-	-	+
30	*Iris germanica* L.	Sawsan	+	-	+	-	-	-	-	-	-	-
31	*Ficus carica* L.	Koiat	+	-	-	-	+	-	-	-	-	-
32	*Tamarix dioica* Rox.ex Roth.	Hinjo	-	-	-	-	-	-	+	-	-	-
33	*Bonium persicum (*Boiss.) B. Fedtsch.	Hojoj	-	+	-	-	-	-	-	+	-	-
34	*Prongos pabularia* Lindl.	Mushan	-	+	-	-	-	+	+	+	+	+
35	*Ferrula nortex* Royle.	Raw	-	+	-	-	-	+	+	+	+	+
36	*Cotoneaster microphylla* Wall.ex Lind	Mikeen	+	+	-	-	-	-	-	-	-	-
37	*Geranium wallichianum* D. Don ex Sweet.	Unknown	+	+	-	-	-	-	-	+	-	-
38	*Nepeta cataria* Linn.	Mutrich	+	-	+	-	-	+	-	-	+	+

1: Kifayatullah *et al.* (2017), 2: Tariq *et al.* (2019), 3: Ullah *et al.* (2020), 4: Rahim *et al. (*2017), 5: Jan *et al.* (2017), 6: Khan *et al.* (2013), 7: Khan *et al.* (2011), 8: Ali and Qaiser (2009), 9: Ahmad *et al.* (2006)

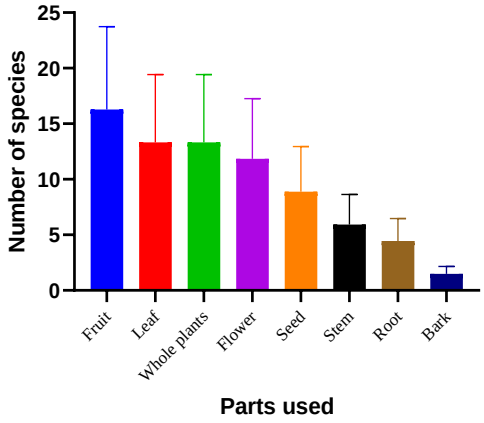

Fig 1. Ethnobotanical uses Classes different Disease

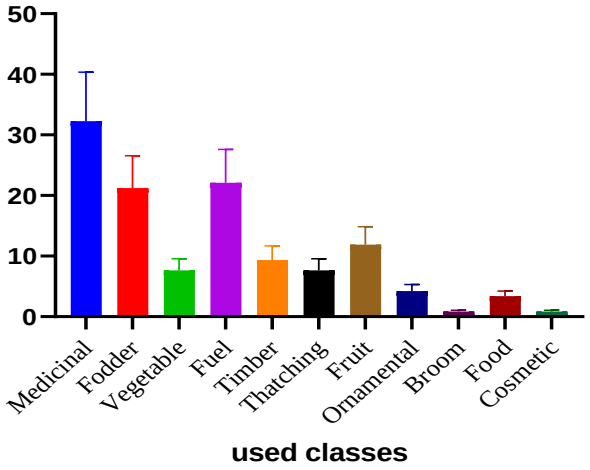

Fig 2. Plant parts used against

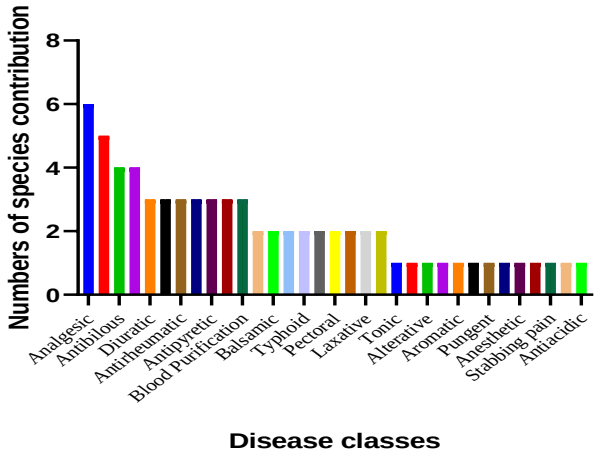

Fig 3. Graphical representation of Some Disease of research area

Table No. 2 Ethno-medicinal profile of Zaini Pass, District Chitral, Pakistan

S/N	Botanical Name	Local Name	Family	Part used	Drugs Form	Used
1	*Allium cepa* L.	Theshtoo	Alliaceae	Whole	Decoction	Cough, cool and ear problem
2	*Artimisia maritima* L.	Droon	Asteraceae	Flower and leaves	Decoction	Stomach pain, intestinal worm, anthelmintic, dysentery and typhoid.
3	*Alcea rosea* L.	Lain	Malvaceae	Flower & leaves	Powder & Paste	Stomach inflammation, pus, ulcer and wound healing.
4	*Artimisia parviflora* Roxb.	Kharkhalich	Asteraceae	Flower & Leaves	Powder&Decoction	Stomach pain, abdominal pain and blood pressure.
5	*Berberis lyceum* Royle.	Chowenj	Berberidaceae	Roots, leaves & fruits	Decoction	Typhoid, remove worm in human, jaundice and diarrhea.
6	*Cappris spinosa* L.	Kaveer	Capparaceae	Flower	Decoction	Diuretic, tonic, rheumatism, typhoid, malaria, blood purification and as worm repellent.
7	*Carthamus tinctorius* L.	Poam	Asteraceae	Flower	Powder	Typhoid and blood purification.
8	*Chenopodium album* L.	Chirkoonzo	Chenopodiaceae	Leaves and seeds	Powder	Abdominal pain, worm repellent and antiseptic.
9	*Cichorium intybus* L.	Khasti	Asteraceae	Whole plant	Decoction	Typhoid, high fever, diarrhea, malaria and digestion.
10	*Eleaegnus angustifolia* L.	Shinjoor	Eleaegnaceae	Fruit	Decoction	Against cough, cool and as worm repellent.
11	*Foeniculum vulgare* L.	Bodiyong	Umbelliferae	Leaves and fruits	Powder	Bronchitis, aromatic, stomach pain, colic and fruit and improve eye sight.
12	*Hippopheae rhamnoides* L.	Mirghanz	Eleaegnaceae	Fruit and stem	Powder	Lungs problem, stomach pain and relieve the problem of split heels.
13	*Helianthus annuus* L.	Yorotmokh nokorak	Asteraceae	Seed	Powder	Hair restorer bronchitis problem, cough and cool.
14	*Linium usitatissimum* L.	Shentheeki	Linacaea	Seed	Extract	Skin disorder
15	*Mentha arvensis* L.	Bain	Lamiaceae	Whole plant	Powder	Blood pressure andjaundice

16	*Mentha longifolia* (L.) Huds	Bain	Lamiaceae	Whole plant	Powder	Jaundice.
17	*Morus alba* L.	Marach	Moraceae	Stem & fruits	Extract	Asthma and worm repellent.
18	*Plantago major* L.	Ispagool	Plantaginacea e	Seed and leaves	Oil	against intestinal blockage and abdominal pain.
19	*Pronus amygdalus* Bcill Batsch.	Badaam	Rosaceae	Seed	Oil	Memory improvement.
20	*Prunus armanica* L.	Zhooli	Rosaceae	Flower and fruits	P/Fresh	Skin protection andLaxative.
21	*Papaver soniferum* L.	Afun	Papavaraceae	Fruit	Exudate	Mind freshness and joints problem.
22	*Rheum emodi* L.	Ishpar	Polygonaceae	Stem	Stream	Asthma and fever.
23	*Silene conoidea* L.	Apupar	Caryophyllace ae	Whole plant	Powder	Skin protection
24	*Sophora mollis* (Royle) Baker	Bashoo	Papilionaceae	Leaves and Stem	Extract	Skin spots.
25	*Solanum nigrum* L.	Pirmilik	Solanaceae	Fruits and leaves	Topically	Skin protection and temperature reduction.
26	*Verbescum thapsus* L.	Gordogh karoo	Scrophulariac eae	Whole plants	Powder	Coughing and fever.
27	*Vitis vinifera* L.	Droch	Vitaceae	Fruits	Agitated	Warm repellent, excitement and insomnia.
28	*Sisymbrium irio* L.	Khali khali	Brassicaceae	Seeds	Powder	Stabbing pain.
29	*Matricaria chamomilla* Linn.	Shirisht	Brassicaceae	Flower	Powder	Abdominal pain and backache.
30	*Iris germanica* L.	Sawsan	Iridaceae	Root	Extract	Used as diuretic.
31	*Ficus carica* L.	Koiat	Moraceae	Bark	Extract	Used for retain placenta.
32	*Tamarix dioica* Rox.ex Roth.	Hinjo	Tamaricaceae	Leaf	Extract	Used for treatment of diarrhea and fever.
33	*Bonium persicum (*Boiss.) B. Fedtsch.	Hojoj	Apiaceae	Fruit/Seed	Powder	Used for treatment of gastric and abdominal pain.
34	*Prongos pabularia* Lindl.	Mushan	Apiaceae	Whole plant	Powder	Used for constipation.
35	*Ferrula nortex* Royle.	Raw	Apiaceae	Whole plant	Paste & Powder	Used for coughing and toothache
36	*Cotoneaster microphylla* Wall.ex Lind	Mikeen	Rosaceae	Fruit	Orally	Used for asthma, blood purification and hypertension.

37	*Geranium wallichianum* D. Don ex Sweet.	Unknown	Geraniaceae	Root	Decoction	Used for blood purification.
38	*Nepeta cataria* Linn.	Mutrich	Lamiaceae	Inflorescence	Orally&Paste	Used to treatment all wounds (Both internal and external) especially used for ulcer.

Table No 3. Comparison of present study with previous studies at District Chitral

S/N	**Study area**	**Year**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Citation**
1	Mulkhow Valley, Chitral	2017	34	34	0	34	100	0	4	11.76	100	0	89.47	Kifayatullah *et al.* (2017)
2	Lone Valley, Chitral	2019	35	14	21	14	40	21	24	68.57	40	60	23.72	Tariq *et al.* (2019)
3	Shishokoh Valley, Chitral	2020	50	24	14	24	48	26	14	28	48	28	37.5	Ullah *et al.* (2020)
4	Jinjerate Valley, Chitral	2017	50	5	33	5	10	45	33	66	10	66	6.02	Rahim *et al. (*2017)
5	Goleen Valley, Chitral	2017	36	12	26	12	33.33	24	26	72.22	33.33	72.22	19.35	Jan *et al.* (2017)
6	Garum Chashma Valley, Chitral	2013	28	8	20	8	28.57	20	30	107.14	28.57	71.42	13.79	Khan *et al.* (2013),
7	Chitral Gol, Chitral	2011	31	10	28	10	32.25	21	28	90.32	32.25	90.32	16.94	Khan *et al.* (2011),
8	Chitral	2009	83	6	32	6	7.22	77	32	38.55	7.22	38.55	5.21	Ali and Qaiser (2009)
9	Booni Valley, Chitral	2006	75	19	19	19	25.33	56	19	25.33	25.33	25.33	20.21	Ahmad *et al.* (2006)
10	Terich Valley, Chitral	2019	64	18	20	18	28.12	46	20	31.25	28.12	31.25	21.42	Zaman and Badshah (2019)

1. *No. Spp 2. Plants with similar uses, 3. Plants with dissimilar uses, 4. Total spp common in both area, 5. %age spp. common in both area, 6. Spp enlisted only in aligned areas, 7. Species enlisted only in study area, 8. % of spp. enlisted only in study area, 9. % of spp. with similar uses, 10. % spp. with dissimilar uses, 11. Jaccard I*

Discussion

Discussion of vegetation

The origin and evolution of biodiversity is directly or indirectly effected by historical and ecological factors like geological and climatic processes, such as continental drift, uplift of mountains and fluctuation in climatic factors. The interactions between these processes, result to establishment of new ecological succession, which causes chances for speciation. Over-grazing, over exploitation of vegetation and development of industries causes climate change, which are badly effects ecosystem. Due to this climate change up today new adaptation occurs in plant species (Rieseberg and Burke, 2001). The herbaceous vegetation of Zaini Pass is classified into 8 community based on IV values. 5 sites were selected based on elevation, aspect and composition. The work of Jin *et al.* (2008), Zhao *et al.* (2018) and Boscutti *et al.* (2018) are also similar, they also selected their site basis on altitude and aspect. Abiotic factors play key role for distribution and classification of vegetation. Climate is major driver for categorization of vegetation. Regular surveys were conducted in two seasons' spring and summer of 2018 and 2019. Three communities were established in spring season in three selected sites (Zaini Noghoor, Pishalduri and Panjantak). The 3 site comes in temperate region so, spring season start from April and May, while no plant species were recorded during spring season in other 3 selected sites like Zaini Ann, Banili and Bamasoor, because of snow cover. Based on elevation Zaini Ann falls in sun-alpine region while Bamasoor and Banili comes in alpine region. *Plantago- Rumix- Veronica, Medicago-Taraxicum- Veronica* and *Veronica-Rumex-Madicago* three communities established in temperate region in spring season. *Veronica biloba* was common species among these three community. It clearly showed that three selected site located in almost same altitude, but their distribution based on species diversity. Almost similar communities were established by Ali *et al.* (2018) and Khan *et al.* (2012) in their research areas. Five communities were established during summer season in 5 selected site falling in temperate, sub-alpine and alpine zone. *Pimpinella-Rhodiola-Allium, Corydalis-Astragalus-Koenigia, Medicago-Plantago-Sonchus, Iris -Mentha-Ranunculus* and *Nepeta-Rheum-Cousinia* communities established in both lower and high altitude. *Pimpinella-Rhodiola-Allium* and *Corydalis-Astragalus-Koenigia* communities established in alpine region. The results of Vanselo *et al.* (2016), Shaheen *et al.* (2015 & 2019), Kaul and Sapru (1973) and Ali *et al.* (2018) also agree to our finding they also found same communities in high altitude of their research areas. Research area has rich flora and which need to documentation and conservation. The vegetation of research area is threatened due to anthropogenic activities like Over exploitation, over grazing, cutting and fragmentation.

In summer season Two-way cluster analysis (TWCA), using PCORD software, classified a total of 74 species into six major herbaceous communities or associations under the influence of area altitude and aspect. The naming of these communities based on HIV (High importance value) (Fig No. 2). Based on absence and presence analysis, using ward,s method PCORD software classified 74 species into six main

communities such as *Cousinia buphthalmoides- Eremostachys edelbargii - Eremurus stenophyllus, Nepeta bractiata- Rheum emodi, Sonchus asper-Epilobium royleanum, Medicago sativa- Plantago lanceolate- Poa balboas, Pimpinella stewartii- Allium carolinianum- Koenigia delictula* and *Corydalis govaniana- Astragalus xanthoiphidopsis- Scutellaria heydei* communities. The results of Ali *et al.* (2017) close harmony to our finding they also reported 5 communities, by using PCORD. Our findings are similar to Hussain *et al.* (2019), they found 3 associations by using ward's method. Fig No. 3 shows Two- way cluster analysis of spring vegetation, measured using by ward's method. Based on High IV PCORD software classified 63 species into 3 clear communities/associations. Based on species dominancy, by using wards method PCORD software distributed spring vegetation into these communities such as *Rumex dantatus- Fumaria indica- Galium aparine, Veronica biloba- Mentha longifolia- Medicago lupulina* and *Medicago sativa-Plantago lanceolate- Taraxacum officinale*. Same trends of works are carried out by Anwar *et al.* (2019), Khan *et al.* (2020) and Kamran *et al.* (2020), they also used PCORD software to classify vegetation of concern areas.

Discussion of Ethnobotany.

The humankind all over the world, always depend on plants to cure various diseases. The accumulation of knowledge of plants uses however co-evolved with human civilization through the experiential use of plants, generation after generation. People would have remained exposed to endemic, epidemic and chronic diseases, besides acute ailments (Hamayaun, 2003). The people of Zaini Pass, District Chitral, Pakistan have always used medicinal plants for various diseases and have been dependent on surrounding plants. The high ratio of medicinal plants used to maintain a local health system which is similar to the outcomes described by different ethnobotanist from other areas of District Chitral such as Mulkhow Valley (Kifayatullah *et al.,* 2017), Lone Valley (Tariq *et al.*, 2019), Shishikoh Valley (Ullah *et al.,* 2020), Jinjerate Valley (Rahim *et al.,* 2017), Goleen Gol (Jan *et al.*, 2017), Garum Chashma (Khan *et al.*, 2013), Chitral Gol (Ali and Qaiser, 2009), Booni Valley (Ahmad *et al.*, 2006) and Terich Valley (Zaman and Badshah, 2019). The research area has rich flora, which were used as ethnobotanical purposes and ethno-medicinal as well. Due to the increase of population in Zaini and Tarich Valleys the production of pharmaceutical flora has been gradually exploited from Zaini Pass. Anthropogenic activities also play key role to vanish flora of research area. Both Valleys totally dependent on this area, for grazing, fuel and overexploitation. Current study showed a total of 68 plant species belonging to 28 different families were used as ethnobotanical purposes. Rosaceae was more diverse family with contribution of 11 species, followed by Asteraceae (10 spp.) and Silaceae (4 spp.), while the rest have less than 4 species. The finding of Ahmad *et al.*, 2006., Khan *et al.*, 2011., Jan *et al.*, 2017 and Alamgir *et al.*, 2018 have also same leading families (Rosacea and Asteraceae), our finding agrees with their results. Asteraceae comes next leading family after Rosacea in our result. The finding of Zaman and

Badshah. 2019., Kifayatullah *et al.,* 2017 and Khan *et al.,* 2013 also support our result. The most frequently used plant parts of our research area were fruits 11 (21.56%) followed by leaves and whole plants 9 (17.64%) species each, flowers 8 (15.68%), Seeds 6 (11.76%), Stem 4 (7.84%), Roots 3 (5.88%) and Bark 1 (1.96%) (Fig..). The result of present work, the three classes, fruits, leaves and whole plants are similar to the findings of Shah *et al.,* 2019., Ullah and Bibi. 2018., Ajaib *et al.,* 2014., Ikram *et al.,* 2015., Tariq *et al.,* 2019 and Khan *et al.,* 2013. The present results showed that 38 species (26.57%) were used for medicinal purposes, followed by fuel 26 species (18.18%), fodder 25 species (17.48%), fruit 14 (9.79%), timber 11 (7.69%), thatching 9 (6.29%) and vegetable each, ornamental 5 (3.49%), food and broom and cosmetics 4 (2.79%) each (Table No. 1 &Fig No. 1.). The finding of Kifayatullah *et al.* (2017) and Tariq *et al.* (2019) strongly support our result, their result also showed same sequence of leading classes like medicinal, fuel and fodder. In the present study 38 plant species have been reported which were used for 35 various diseases of research area. The major disease was based on number of contributed species was Analgesic with 6 species (8.45%) followed by Anthimentic 5 species (7.04%), Antibiolous and Antidarrheal 4 species (5.63%) each, Diuratic, Jaundice, Antirheumatic, Antitussive, Antipyretic, Asthematic and Blood pressure 3 species (4.22%) each, Ulcer, Balsamic, Hypertensive, Typhoid, Refrigerant, Pectoral, Skin disorder, Laxative and Skin protection 2 species (2.81%) each, Tonic, Vermicite, Alterative, Antiheptic, Aromatic, Opthalmacum, Pungent, Memory improvement, Anesthetic, Insomnia, Stabbing pain, Retaning placenta and Antiacidic 1 species (1.40%) each. Similar works were carried out by Shah *et al.* 2013, Ahmad *et al.* 2019, Qamar *et al.* (2010 and Ahmad *et al.* (2009) from various areas of Pakistan.

Comparative analysis of our finding with previous work of District Chitral

The finding of current study was compared with previous ethno-medicinal work in neighboring valleys of chitral. This finding showed that large number of medicinal plant belonged with herbaceous, followed by trees and shrubs. Table No. 4 showed the similar and dissimilar uses of a single species in different areas, either all species were found in adjacent valleys or not. Kifayatullah *et al.* (2017), (Tariq *et al.,* 2019), (Ullah *et al.,* 2020), (Rahim *et al.,* 2017), (Jan *et al.,* 2017), (Khan *et al.,* 2013), (Ali and Qaiser, 2009), (Ahmad *et al.,* 2006) and (Zaman and Badshah, 2019) were carried out similar work in neighboring valleys, they reported different plant species with respect to their uses against various diseases. To know about the resemblance and variance of current study, it has to compare with some papers. The uses of different plant for treatment of various diseases, our results are compared with 10 local published papers (District Chitral). The current result showed that in 38 reported plant species (Table No. 3 and 4) the similarity of uses range from 7.22% to 100 % while dissimilar uses vary 90.32% (Khan *et al.*,2011) to 0% (Kifayatullah *et al.,* 2017). In our study highest JI is observed in paper of

Kifayatullah *et al.* (2017) 89.47 and Ullah *et al.* (2020) 37.5, while lowest JI values found in Rahim *et al. (*2017), Khan *et al.* (2013) and Ali and Qaiser (2009).

Conclusion

The research area varies greatly by altitude, aspects and floristic composition clearly affected on species composition and their distribution. Based on elevation and slope research area is divided into 6 sites. Research area falls in unique zone of northern area, which composed of temperate, sub-alpine and alpine zones. Due these zones the vegetation showed great variations. Over grazing, soil erosion and over exploitation were found to be main ecological factors, which disturbed local vegetation.

It is concluded that the distance between two neighboring study areas is responsible for any change in JI values. It is due to environmental factors and methodologies of two communities or study areas (Moerman, 1998). It is clear from this statement that distance between two areas is responsible for changing of JI, because the result of Kifayatullah *et al.* (2017) showed 89.47 JI value. Which adjacent area to our research area. This may be occurring due to sharing of same flora and informants. Similar works were carried out Kyani *et al.* (2015), Zaman *et al.* (2020) and Ijaz *et al.* (2016).

Originality of paper;

It is the original part of my research work. My research title was Floristic composition, Phytosociological and ethnobotanical studies Of Zaini Pass, Hindukush range, District Chitral, Pakistan.

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