ETHNOPHARMACOLOGICAL AND PHYTOCHEMICAL ASSESSMENT OF MEDICINAL PLANTS USED AGAINST LIVESTOCK INFECTIONS BY TRIBAL COMMUNITY UNDER SEMI-ARID CONDITIONS

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Abstract. The ethnobotanical documentation of medicinal plants used against livestock illnesses was carried out in a tribal community of Shishikoh, District Chitral, Pakistan. For data tabulation, semi-structured questionnaires were used. A total of 52 plant species belonging to 28 families and 46 genera were found to be used for ethnoveterinary purposes. The dominant family was Asteraceae with 7 (13.46%) species followed by Apiaceae with 4 (7.69) species, Brassicaceae, Lamiaceae, Fabaceae (Papilionaceae), Poaceae and Salicaceae each had 3 (6%) species. The reported taxa were used for the treatment of 32 different livestock illnesses. The maximum number of plants used for Constipation was12 (23.0%) followed by 10 (19.23%) for Parasitic infection, 9 (17.31) for wound infection, 7 (13.46%) for diarrhea, 6 (11.53) for galactagogues and gastric trouble was treated with 5 (9.62%) species, while the remaining showed less than 5 (9.62%) for each. The ethnoveterinary medicinal plants were administered mainly orally (39;75%) followed by topical (13; 25%), and nasally (1;1.92%) routes. The most harvested plant parts for preparing remedies in the area were leaves (18; 41%), followed by whole plants (6; 23%) and aerial parts (3; 12%). The maximum use value index (UVi) was recorded for *Allium cepa* at (0.08) followed by *Foeniculum vulgare*, *Artemisia maritima*, *Alium sativum*, *Berberis lyceum*, and *Capparis spinosa* each with 0.07 in each; *Anthemis cotula*, *Artemisia perviflora*, *Brassica compestris*, *Mentha arvensis* had 0.05 UVi in each. The dominant RFCi was also calculated for *Capparis spinosa* with (0.73), followed by *Mentha arvensis* (0.69), *Allium cepa* (0.68), *Verbascum thapsus* (0.67), and *Juniperus excelsa* (0.65). The recipes were mostly used in the form of decoction and infusion, followed by balrn and paste. Indigenous knowledge is widely known by the ethnic groups of tribal communities and is passed down from generation to generation. However, it faces a high risk of elimination due to factors such as lack of interest, allopathy, overgrazing, deforestation, and unsustainable utilization. The scientific evaluation of cited plant taxa is recommended to unlock their maximum therapeutic potential and develop possible conservation strategies in the veterinary sector for the welfare of livestock.
Keywords: *animal care, indigenous knowledge, livestock, veterinary practices, Chitral*

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Introduction

Remedial plant taxa have been used for centuries to treat human and animal illnesses (Bartha et al., 2015). Ethnoveterinary remedies are the traditional approach to treating and maintaining animal health. They involve preserving folklore beliefs, practices, and the assistance of society by utilizing indigenous plant taxa (Hassan et al., 2017; Katerere, et al., 2010; Tabuti et al., 2003). Livestock rearing is the most significant source of income amongst the tribal communities in each region, providing vital resources such as meat, milk, and other products for the survival of these communities. It also plays a significant role in the national economy of Pakistan (Jabbar et al., 2005). In numerous mountainous zones, ethnoveterinary knowledge is very important for the breeding of organisms and supporting the livelihoods of farmers, herders, and shepherds in treating livestock illnesses (Akhtar et al., 2000). This knowledge of veterinary uses is as ancient as the practice of livestock keeping in each mountainous zone (Alemu, 1993). Evolution in population, changes in climate, technology, lifestyles, demands, and other factors rapidly affect cattle production. According to MC Gaw and Eloff (2008), ethnoveterinary knowledge of plants is necessary because plants comprise an extensive range of chemicals.

These floras can provide the leading way to discover new drugs and active products that are useful in the treatment of livestock (Viljoen et al., 2019; Light et al., 2005; Hoveka et al., 2005). Developing countries with rapidly rising populations and countries with a loss of plant biodiversity validate the necessity to document ethnoveterinary knowledge, particularly regarding endemic or indigenous flora (Aziz et al., 2018). Many workers contribute their efforts in various parts of the world to explore ethnoveterinary knowledge, for instance (Muhammad, 1996; Pal, 1980; Pullaiah and Goud, 1996; Corkle, 1998; Kohler and Rathore, 1997; Misra and Kumar, 2004; Maine et al., 2009; Shen et al., 2010). Hey reported the ethnoveterinary information of tribal and remote communities of numerous valleys. In Pakistan, little contribution has been made to document ethnoveterinary knowledge, so it is urgently needed to protect it before it becomes extinct (Shah et al., 2012). The rural communities of Pakistan are using plant resources to treat their livestock. These activities are mainly observed in tribal communities due to a lack of access and availability of modern healthcare (Ahmad et al., 2003). About 70% of the population trusts the unani system of ailments (Marwat et al., 2008). Ethnoveterinary plants are found in various habitats including agricultural fields, gardens, forests, valleys, slopes of hills, moist places, stream banks, shaded areas, and mountains. Poor communities prefer and trust this system due to its low price and easy availability. The cited literature on ethnoveterinary includes Hussain (2007), Abbasi et al. (2013), Khan et al. (2015), Hassan et al. (2014), Badar et al. (2017), and Awan et al. (2001).

The human has a close relationship with plants. In the Chitral District Ethnobotanical documentation was carried out by making a collection of 75 medicinal plants, but there was proper ethnoveterinary knowledge (Afzal et al., 2009). Likewise, Hadi et al. (2014) reported 83 medicinal plants in the literature. Only eight species such as *Acer pentapomicum*, *Carex stenophylum* subsp. *stenophylloides*, *Crisium arvensis*, *Crataegus songarica*, *Fraxanus hookeri*, *Juncus thomsonii*, *Malva neglecta*, *Prangos pobularia* showed minor ethnoveterinary information.

After that, Ahmad et al. (2006) collected plant species from the northern area and reported plant species such as *Celtis australis*, *Papalus alba*, *Ferula assa-foetida*, *Faxanus xanthoxyloid*, *Paganum harmala* and *Indegofera heterantha* showed ethnoveterinary information. Furthermore, Khan et al. (2011, 2013), Mukarram et al.

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(2012), Bano et al. (2013), Ullah et al. (2014), Hadi and Ibrar (2014), Ullah et al. (2017), Akbar (2014), Ali (2009) also conducted relevant research. Thus, the current study explored the indigenous knowledge and ethnobotanical skills related to the uses of plant species for treating livestock disease and other husbandry activities disease and other husbandry activities among tribal communities. It also provides a valuable resource for veterinarians, conservationists, and phytochemists, to conduct pharmacological studies in the future, and will be a treasured benefit for the farmers for the treatment of livestock disease.

Materials and methods

Study area

The study highlights ethno-veterinary information of the Shishikoh, District Chitral, Pakistan, in the elevated of 1420 m to 4500 m, in Pakistan with coordinates of 35° 54' 51" N and 71° 51' 04" E. Administratively, the valley is a union council of Tehsil Drosh, with four village council and bordered with Golen gol in west, Dir in East, Laspur Chitral North and Drosh attached in south. The total population of the covered area is 17580 (Ullah et al., 2020). Topographically, it is a closed valley and rounds in the northeast route with a warm climate in summer but very cool at higher elevations. Spring is characterized by frequent rainfall while in summer temperature rises to 40°C and in winter it falls below -10°C. Furthermore, little rains in summer originating from Swat. The Valley shows linguistic diversity viz., Khowar, Gujeri, Pushtoo and Farcy. Khowar is the dominant language with Pashto, Gujri and Persian spoken only in Madaklasht. The area lacks educational facilities such as fewer primary schools, negligible middle and high schools, and lacks colleges so the area shows a low literacy rate (Ullah et al., 2020). The vegetation and its diversity improve the uniqueness of Chitral. Due to its location in the Irano-Turanian region, it has unique floristic diversity (Ali, 2008).

Ethnobotanical data collection

General documentation of the ethno-veterinary taxa was carried out from spring 2022 to autumn 2022. All the valuable knowledge was obtained through semi-structured questionnaires (Croom, 1983; Lipp, 1989). The priority was given to aged people because they were well familiar with the local name as well as their traditional uses. The visited localities viz, Kalas, Madaklasht, Birganisar, Kashindel, Istroom, Tar, Pursad, Huzoor begandeh and Shishi (*Fig. 1; Tables 1* and *2*). A total of 75 informants were interviewed. The informants were classified into eight age groups, i.e., 20-35, 35–50, and above 50 (*Table 3*).

Data analysis

After field work the collected data were analyzed by using indices such as use values (UVs) and relative frequency of citation (RFCs) in order to assess the important value of the species.

Use value (UV)

The comparative importance (UV) of each species was calculated according to the formula suggested by (Philips and Gentry, 1993).

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$$\mathbf{UVs} = \sum \mathrm{UVi} / \mathrm{Ni}$$

'*UVi'* represents use value indices for a given species among the informants who participated and '*Ni'* represents the total number of informants.

Relative frequency citation (RFCs)

Relative frequency citation RFCs index reveals the importance of each species and is calculated by using frequency citation 'FC' (number of informants mentioning the use of species), using the formula as described before (Tardio Pardo-de-Santayana, 2008). The FC value is divided by the total number of informants participating in the survey (N), without considering the use-categories

$$\mathbf{RFCs} = \frac{\mathbf{F\,Cs}}{\mathbf{N}}$$

FCs represent the number of informants who mentioned the use of a plant species and N is the total number of informants.

Informant demographics

The old community such as shepherds, farmers, woodcutters, teachers, tourist guides and housewives, show maximum knowledge as compared to younger ones. All these are due to modernization, changing lifestyles, urbanization, allopathic medication and the lack of interest of new generations. The informants were mostly illiterate due to the lack of education facilities, while the new generation such as primary and secondary school level showed little ethno-veterinary information (*Table 3*). All related documentation of ethno-veterinary knowledge such as vernacular name, part used, mode of administration, availability, drug formulation and diseases treated were asked and data were tabulated (*Table 4*).

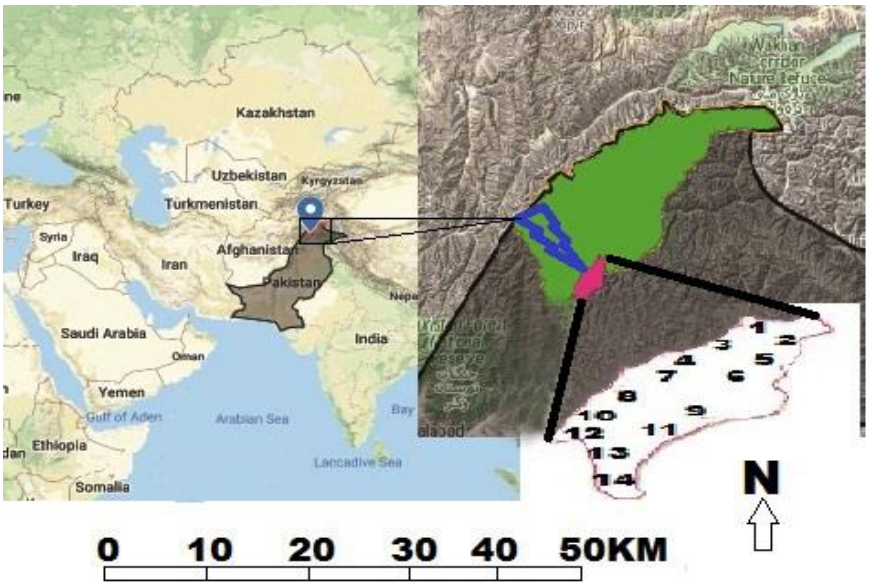

Figure 1. *Study area. Different localities: 1. Madaklasht, 2. Tangalgol, 3. Balpanch, 4. Kawash, 5. Tangel Gol, 6. Goren gol, 7. Kashendel, 8. Birga Balla, 9. law Hill, 10. Istroom, 11. Pursat, 12. Muzdeh, 13. Huzoor Begandeh, 14. Shishi*

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Table 1. *Details of different localities of the study area*

Locality	Longitude	Latitude
Birga	71° 62’ 20.73”E	35° 44’ 12.13”N
Gauch	71° 59’ 16.50”E	35° 40’ 05.17”N
Birga Nisar	71° 60’ 18.55”E	35° 41 ‘5.25”N
Kotek	71° 56’ 17.27”E	35° 47’ 14.61”N
Kalas	71° 67’ 12.42”E	35° 47’ 16.02”N
Madaklasht	71° 57’ 94.71”E	35° 48’ 16.09”N
Lanjari	71° 55’ 11.57”E	35° 44’ 08.08”N
Kyari	71° 58’ 17.58”E	35° 41’ 05.61”N
Muzhdeh	71° 53’ 13.61” E	35° 39’ 02.03”N
Shishi	71° 83’ 3.10” E	35° 59’ 84.01”N

Table 2. *Livestock rearing in different union council of Shishikoh Valley, District Chitral*

Village council	Cows	Goats	Sheep	Donkey	Poultries
Madaklasht	1096	1644	3288	0	1461
Tar	1105	1700	0	99	2040
Pursad	1529	3632	0	0	2549
Kalas	1674	2976	93	47	2558
Total	5404	9952	3381	146	8608

Source: Shishikoh WUMP Database 2014 (Akber, 2014)

Table 3. *Respondents’ demography for quantitative analysis and age group of respondents*

	Characteristic of category	Participants	Frequency	Distribution (%)
1	Gender	Male	55	73.33
		Female	20	26.67
2	Marital status	Married	30	40
		Unmarried	45	60
3	Age in year	20-35	25	33.33
		35-50	35	46.67
		Above 50	15	20
4	Educational qualification	Illiterate	30	40
		Primary	15	20
		Middle	15	20
		Secondary	10	13.33
		Hr. Sec.	05	6.67
5	Socioeconomics	Teacher	10	13.33
		Shepherd	25	33.33
		Housewife	25	33.33
		Farmer	15	20

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Table 4. *Comprehensive information of medicinal plants taxa used in medication of veterinary diseases in Shishikoh*

Species name/voucher number	Local name	Family	FC	Ui	UV	RFC	Plant parts	Disease ailments	Mode of preparation	Administration route
Allium cepa L. K4948	Theshto	Alliaceae	51	6	0.08	0.68	Bulb/ aerial parts	Mastitis, Constipation, febrifuge, parasite and maggot	Paste	Oral
Artemisia perviflora Buch.-Ham K5911	Kharkhalich	Asteraceae	38	4	5.33	0.51	Aerial parts	Remove placenta in cow, parasite and aphids	Decoction/paste	Oral
Iris songarica Schrenk *in Fisch & Mey. HU 6037*	Krichma	Iridaceae	19	2	0.03	0.25	Leaves	Constipation in cattle	Barn	Oral
Alium sativum L.K4949	Wrezhno	Alliaceae	43	5	0.07	0.57	Bulb	Diarrhea	Decoction	Oral
Anaphalis virgata K5901	godron	*Asteraceae*	13	2	0.03	0.17	Whole plant	Worm repellent, diarrhea, neck injury	Decoction	Oral
Anthemis cotula L. K5920	Shirisht	Asteraceae	33	4	5.33	0.44	Flower	External parasite, Gastric trouble	Decoction/infusion	Oral
Artemisia maritima L. Ex Hook.f. K6055	Dron	Asteraceae	36	5	0.07	0.48	Aerial parts	Intestinal worm	Decoction	Oral
Avena fatua L. K5936	Shashar	Poaceae	14	2	0.03	0.19	Aerial parts	Galactagogue	Barn	Oral
Avena sativa L. K6116	Lajgandum	Poaceae	12	2	0.03	0.16	Seeds	Delivery in cows, recovery of infection		Oral
Berberis lycium Royle. K6109	Chowenjh	Berberidaceae	47	5	0.07	0.63	Root barks	Healing of injury, fractured bone	Infusion	Topical
Bergenia ciliata Hw.Strnb. K5091	Asqarbash	Saxifiragaceae	51	5	0.07	0.68	Rhizome	Recovery of injured organ	Infusion/decoction	Oral
Brassica compestris L. K6007	Charsham	Brassicaceae	42	4	5.33	0.56	Oil	Galactagogue, Placenta retention	Barn	Topical
Bupleurum longicaule Wall.ex DC. K6135	Shonjmook	Apiaceae	35	3	0.04	0.47	Leaves	Diarrhea, reducing allergies, hepatitis, inflammation	Infusion	Oral
Cannabis sativa L.K6021	Bhong	Cannabaceae	38	3	0.04	0.51	Leaves	Used as purgative, appetizer and gastric trouble.	Decoction	Oral
Capparis spinosa L. K7614	Kaveer	Capparaceae	55	5	0.07	0.73	Flower	Relieve worm, typhoid in organism	Infusion	Oral
Carex koelpiriana Rich. K7226	Nol	Cyperaceae	6	1	0.01	0.08	Aerial parts	Constipation	Ground	Topical
Carum capticum L.Benth. & Hook.f. K6131	Zira	Apaiceae	23	3	0.04	0.31	Seeds	Diarrhea, antifungal, antibacterial	Infusion	Oral

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Species name/voucher number	Local name	Family	FC	Ui	UV	RFC	Plant parts	Disease ailments	Mode of preparation	Administration route
Celosia cristata L. K4934	Krui Shakh	Amaranthaceae	21	2	0.03	0.28	Leaves	Diarrhea, constipation, blood thinner	Decoction	Oral
Chenopodium album L. K6013	Shakh	Chenopodiaceae	19	2	0.03	0.25	Leaves	Constipation, wound healing	Decoction	Oral
Cichorium intybus L. K5917	Khasti	Asteraceae	32	3	0.04	0.43	Aerial pats	Typhoid and malarial infection	Decoction	Topcal
Crataegus songarica K. Koch.K6055	Gooni	Rosaceae	11	1	0.01	0.15	Fruits	Fever in cattle.	Infusion	Oral
Cyperus stononiferus Reftz. K6171	Nool	Cyperaceae	7	1	0.01	0.09	Whole plants	Constipation	Ground	Topcal
Datura stramonium L. K6066	Xarjosh	Solanaceae	9	1	0.01	0.12	Leaves	Ringworm (parasite)	Ground	Oral
Foeniculum vulgare Miller. K6138	Bodyong	Apiaceae	44	5	0.07	0.59	Aerial parts/seed	Blood in urine, gastric problem and galactagogue	Infusion	Oral
Glycyrrhiza glabra L. K5972	Moyo	Papilionaceae	30	3	0.04	0.4	Branch/ leaves	Nutritive, burning organ recovery	Barn	Oral
Iris germinica L. K*6036*	Sosan	Iridaceae	22	2	0.03	0.29	Roots	Stomach problem, gastric ailment and intestinal, blockage	Decoction	Oral
Juniperus excelsa M.-Beib. K5924	Sarooz	Cupressaceae	49	3	0.04	0.65	Leaves	Evil eye	Ground	Oral
*Lathrus aphaca L. K*5978	Kharashik	Papilionaceae	19	2	0.03	0.25	Whole plant	Used as fodder	Barn	Oral
Lepedium virginicum L. K6002	Josh	Brassicaceae	12	2	0.03	0.16	Seeds	Delivery and fever, constipation	Decoction	Oral
Melia azedarach L.K6047	Bakayeen	Meliaceae	23	2	0.03	0.31	Leaves	Gastric trouble	Decoction	Oral
Mentha arvensis L. K6140	Pudina	Lamiaceae	52	4	5.33	0.69	Whole plants	External parasite, lice stomach	Decoction	Oral
Mentha longifolia (L.) L. K6084	Bain	Lamiaceae	49	2	0.03	0.65	Whole plants	Typhoid, gastric problem, Pest and external parasite	Decoction	Oral
Morus alba L. K6049	Mrach	Moraceae	22	2	0.03	0.29	Leaves	Constipation, laxative	Barn	Oral
Papalus alba L. K6070	Terk	Salicaceae	16	3	0.04	0.21	Leaves	Gastric trouble	Decoction	Oral
Peganum harmala L. K6141	Ispandur	Zygophyllaceae	45	2	0.03	0.6	Whole plant	Parasites in cattle, lice's from wounds	Barn	Nasal
Plantago major L. K5986	Spaghol	Plantaginaceae	44	2	0.03	0.59	Whole plant	Medication of mouth and foot disease, hooves repossession	Paste	Oral

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Species name/voucher number	Local name	Family	FC	Ui	UV	RFC	Plant parts	Disease ailments	Mode of preparation	Administration route
Platanus orientalis L. K6171	Chinar	Platanaceae	23	3	0.04	0.31	Leaves	Nourishment	Hey	Topical
Prongos pabularia LindI. K4920	Musheen	Apiaceae	22	3	0.04	0.29	Aerial parts	Nutritive, parasite, maggots and aphids	Paste	oral
Quercus baloot Griffith K6143	Banj	Fagaceae	9	1	0.01	0.12	Leaves	Dairy products, nourishment	Barn	Topical
Quercus dilata Royle K6112	Banj	Fagaceae	8	1	0.01	0.11	Leaves	Dairy products and winter hey	Barn	Oral
Ricinus communis L. K6030	Unknown	Euphorbiaceae	9	1	0.01	0.12	Fruits	Cold, skin diseases and wounds healing	Ground	Topical
Rumex hastatus D. Don K6100	Shakhtaal	Polygonaceae	20	2	0.03	0.27	Leaves	Constipation	Infusion	Oral
Salix babylonica L. K6071	Teli	Salicaceae	15	2	0.03	0.2	Leaves and branch	Nourishing the lamb and goats	Barn	Oral
Salvia nubicola Wall. K6141	Ishloinoko	Lamiaceae	26	2	0.03	0.35	Rhizome	Colic, galactagogue, stomach trouble	Decoction	Oral
Seriphidium chitralense (Podlech) Y. R.Ling. K6139	Droon	Asteraceae	6	2	0.03	0.08	Aerial parts	Anthelmintic, Injury, parasitic flies, constipation	Decoction	Topical/oral
Sisymbrium irio L HU6003	Kheli kheli	Brassicaceae	36	2	0.03	0.48	Leaves	Diarrhea abdomen issue of cow (*Trifolium* and *hyocymus)* overuses	Infusion	Oral
Solanum tuberosum K6068	Alo	Solanaceae	20	2	0.03	0.27	Tuber	Wound healing, fire burn wound, rheumatism	Infusion	Topical
Tagetes minuta L. K5919	Gul sambar	Asteraceae	18	2	0.03	0.24	Leaves	Fleas, lice, mosquitoes and ringworm, skin infection	Decoction	Topical
Thuja orientalis L. K6022	Sarfokaan	Cupressaceae	9	1	0.01	0.12	Fruit	Illness and fever of livestock	Decoction	Oral
Trifolium resupinatum L. K6080	Shakhtaal	Papilionaceae	18	2	0.03	0.24	Whole plants	Tonic, laxative, fodder	Barn	Oral
Verbascum thapsus L. K6098	Gordogh karo	Scrophulariaceae	50	3	0.04	0.67	Leaves	Diarrhea	Infusion	Topical
Zea mays L. K6142	Jowari	Poaceae	15	3	0.04	0.2	Seeds	Urinary problem as blood in urine	Infusion	Oral

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About 75 informants have been interviewed on a random basis, such as men were 55 (73.33%) and female were 20 (26.67%). On the basis of education, the interviewer was categorized viz., Illiterate 15 (20%), Primary 5 (6.67%), Middle 10 (13.33%), Secondary 20 (26.67%), Higher secondary 15 (20%) and socioeconomically the informants were farmer 16 (21.33%) species followed by shepherds 20 with (26.67%), teacher 25 (33.33%) and housewives 14 (18.67%) (*Table 3*). After extensive investigation and data tabulation, the herbarium technique was used to process plant material. Available literature supports the collection of data and their correct identification (Stewart, 1972; Ali and Qaiser, 1993-2021; Ali and Y. Nasir, 1990 - 1992; Ali and Nasir, 1989-1993). After data tabulation, the voucher of specimens was cited in the Herbarium, Department of Botany, Hazara University Mansehra as a reference for upcoming efforts.

Results

Demography of informants

Out of the total 75 informants, 73.33% were males and 26.67% were females. Based on age, the informants were divided into three age groups: 20–35 years (33.33%), 35–50 years (46.67%) and above 50 years (20%). Out of the total informants, 30 were married and 45 were unmarried. Concerning education, 40% were illiterate, 20% had attended school up to the primary level, 20% up to middle level, 13.33% up to secondary level and 6.67% showed higher secondary level. Socioeconomically shepherds were represented by (33.33%) followed by housewives (20%), farmers (20%) and teachers (13.33%) (*Table 3*). The duration of time consumed by informants in the research area varies because the tribal community remains mostly in the forest ecosystem for the utilization of the natural resources of plants. The ethno-veterinary medicinal plant preparations were administered mainly through oral (39; 75%) followed by topical (11;21.15%) and nasal (1; 1.92%) routes. The most commonly used plant parts for herbal preparations in the area were leaves (18: 36.62%) followed by whole plants (9: 17.31%), aerial parts (8:15.38%), fruits and seed (4; 7.69%) in each, bulb, rhizome, roots and flower (2; 2.85%) in each, tuber and bark (1, 1.92%) in each (*Fig. 2*).

Medicinal plant diversity

In this recent survey, a total of 52 medicinal plant species belonging to 46 genera and 28 families were reported. The details of botanical names, vernacular names, families, ethno-veterinary uses, parts used, methods of use, UV, FC and RFC are given (*Table 4***).** Familywise Asteraceae was dominated by 7 (13.46%) species followed by Apiaceae with 4 (7.69%) species, Brassicaceae, Lamiaceae, Papilionaceae, Poaceae and Salicaceae with 3 (5.77%) species in each. The remaining 21 families contain less the 3 species per family. The reason of the dominancy of Asteraceae, Apiaceae, Brassicaceae, Lamiaceae and Papilionaceae in the traditional healthcare system is due to the maximum number of plant species in these families as well as, the occurrence of secondary metabolite that is why these families are dominant. Like that, the species of Asteraceae are also known for their pharmacological significance therefore extensively scattered and considered as the leading family of angiosperm in the biosphere (*Table 4*). By following the blooming period in the Shishikoh Valley, plant taxa were found to be used in ethno-veterinary practices. The reported taxa were used for the treatment of 32

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different livestock troubles viz. Constipation, mastitis, febrifuge, parasitic, diarrhea, blood thinner, anti-fungal, anti-bacterial, blood in urine, galactagogue, allergy, inflammation, vermifuge, removal of placenta, typhoid, malaria, injury, anthelmintic, healing of wound, placental infection, delivery, purgative, appetizer, evil eye, fodder, colic, laxative, hooves recovery, urinary bladder, hut formation, foot and mouth disease and rheumatism (*Table 4*). A single species used for more than single purpose and the maximum plant used for Constipation were 12 (23.0%) followed by Parasitic 10 (19.23%) wound infection 9 (17.31), Diarrhea 7 (13.46%), Galactogogue 6 (11.53), Gastric trouble 5 (9.62%), while the remaining show less than (5; 9.62%) in each. The ethno-veterinary medicinal plant is administered mainly through oral (39;75%), topical (13; 25%), and nasal (1, 1.92%) routes (*Table 4*). The most commonly used and dominant plant parts were leaves 18 (41%) followed by whole plants 6 (23%) and Aerial parts 3 (12%) (*Fig. 2*).

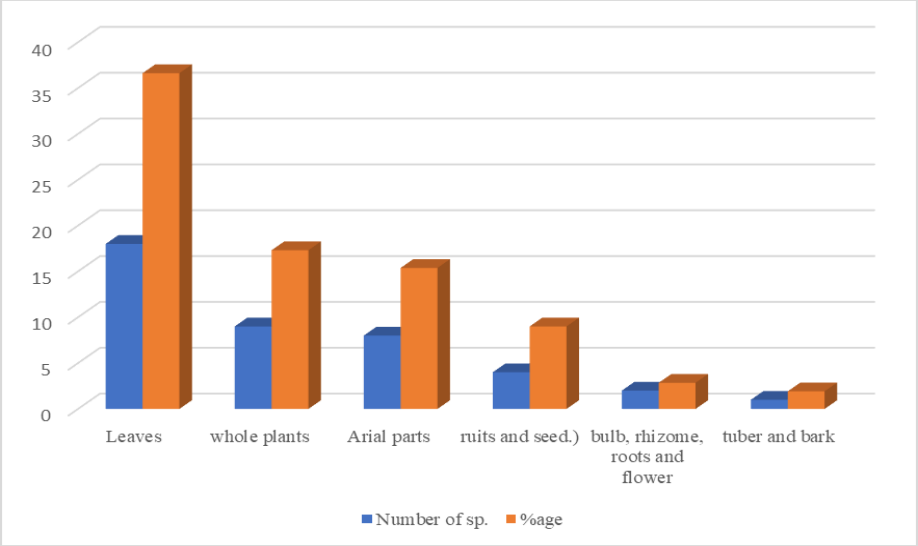

Figure 2. *Common used parts for herbal preparations in the area*

Use values

In present study, the UV (*Table 4*) ranged between highest to lowest (0.08_ 0.01) viz, *Allium cepa* (0.08). followed by *Alium sativum*, *Foeniculum vulgare*, *Berberis lycium* (0.07) in each, *Artemisia maritima*, *Berberis lyceum*, *Capparis spinosa*, *Bergenia ciliata* with (0.07) in each, *Mentha arvensis*, *Brassica compestris*, *Artemisia perviflora*, *Anthemis cotula 5.33* in each, while *Carum capticum*, *Prongos pabularia*, *Bupleurum longicaule*, *Cichorium intybus*, *Cannabis sativa*, *Juniperus excels*, *Glycyrrhiza glabra*, *Platanus orientalis*, *Zea mays*, *Papalus alba* and *Verbascum Thapsus* 0.04 in each, *Solanum tuberosum*, *Peganum harmala*,, *Salix babylonica*, *Rumex hastatus*, *Avena sativa*, *Avena fatua*, *Plantago major*, *Lathrus aphaca*,, *Trifolium resupinatum*, *Morus alba*, *Salvia nubicola*, *Melia azedarach*,, *Mentha longifolia*, *Iris songarica*,, *Iris germinica*,, *Chenopodium album*, *Lepedium virginicum*, *Sisymbrium irio*, *Tagetes minuta*,, *Seriphidium chitralense*, *Anaphalis virgata* and *Celosia cristata* with 0.03 *each. Thuja orientalis*, *Carex koelpiriana*, *Cyperus stononiferus*, *Ricinus communis*, *Quercus baloot*, *Quercus dilate*, *Crataegus songarica* and *Datura stramonium* (0.01) each with lowest UVs (*Table 4; Figs. 3* and *4*).

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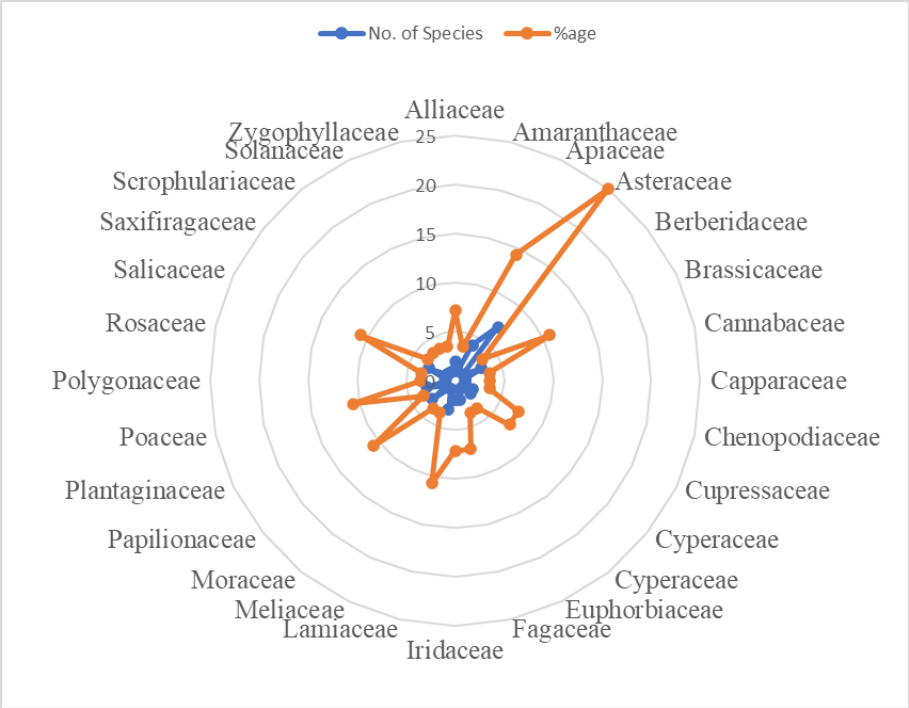

Figure 3. *Frequency of the 28 plant families used in the treatment of cattle diseases in the Shishikoh, tribal community of District Chitral*

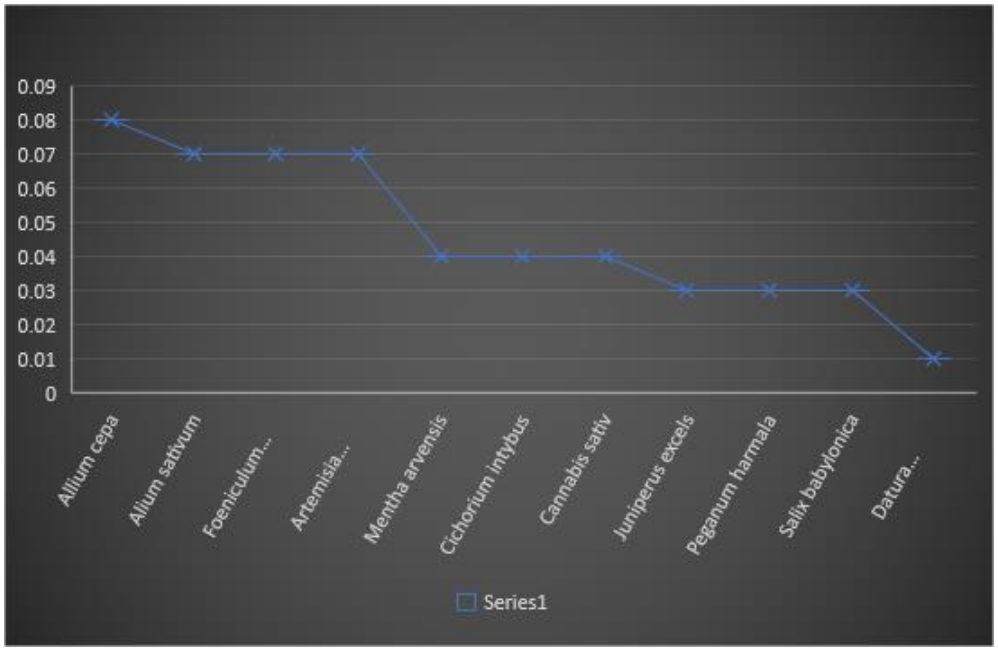

Figure 4. *Frequency of percentage of use value (UV) of 11 dominant species from tribal community*

Relative frequency citation (RFCs)

Data were analyzed based on use reports for each species to treat a given health disorder. Traditional remedies of each taxon along with disease treatment were evaluated

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using the number of citations by the informants. The significance of each plant species was estimated by the relative frequency citation index (RFCi), which indicates the local importance of each species. High frequency citations were ranged between (0.08-0.73). The maximum such as *Capparis spinose* (0.73) followed by *Mentha arvensis* (0.69), *Bergenia ciliate, Allium cepa* (0.68) each *Verbascum Thapsus* (*0.67*), *Juniperus excels*, *Mentha longifolia* (*0.65*) *in each, Berberis lyceum* (*0.63*), *Peganum harmala* (*0.6*), *Foeniculum vulgare, Plantago major* (*0.59*) *in each, Alium sativum,* (*0.57*), *Brassica compestris* (*0.56*), *rtemisia perviflora, Cannabis sativa* each with (*0.51*), *Sisymbrium irio* (*0.48*), *Bupleurum longicaule* (0.47), *Anthemis cotula* (0.44), *Cichorium intybus* (0.43), *Glycyrrhiza glabra* (0.4), *Salvia nubicola* (0.35), *Platanus orientalis* (0.31), *Morus alba* (0.29), *Solanum tuberosum, Rumex hastatus* (0.27) in each, *Chenopodium album, Iris songarica*, *Lathrus aphaca* (0.25) in each, *Trifolium resupinatum*, *Tagetes minuta* with (0.24) in each, *Papalus alba* (0.21), *Salix babylonica*, *Zea mays* (0.2) each, *Avena* fatua, *Anaphalis virgata* (0.17) in each, *Lepedium virginicum* (0.16), *Crataegus songarica* (0.15), *Avena sativa, Datura stramonium, Ricinus communis, Quercus baloot, Thuja orientalis* with (0.12) in each, *Quercus dilata* (0.11), *Cyperus stononiferus* (0.09), *Carex koelpiriana, Seriphidium chitralense* (0.08) in each (*Table 4; Figs. 5* and *6*). In addition, we provide some chemical compounds present in some plant species used by local respondents (*Table 5*). According to field observations, the indigenous knowledge of Ethno-veterinary taxa is greatly known by old people and transfers from generation to generation, with a high risk of elimination. The unsustainable utilization, overgrazing, overpopulation, urbanization, allopathic medication, Poverty, poor harvesting and soil erosion were also considered as potential threats to the plant community as well. Exploration and Conservation strategies of the area need special attention on an urgent basis, as their precious indigenous knowledge as well as therapeutic plants may be extinct in the future. So, the implementation of conservation strategies is better for veterinary plants as well as for the welfare of livestock.

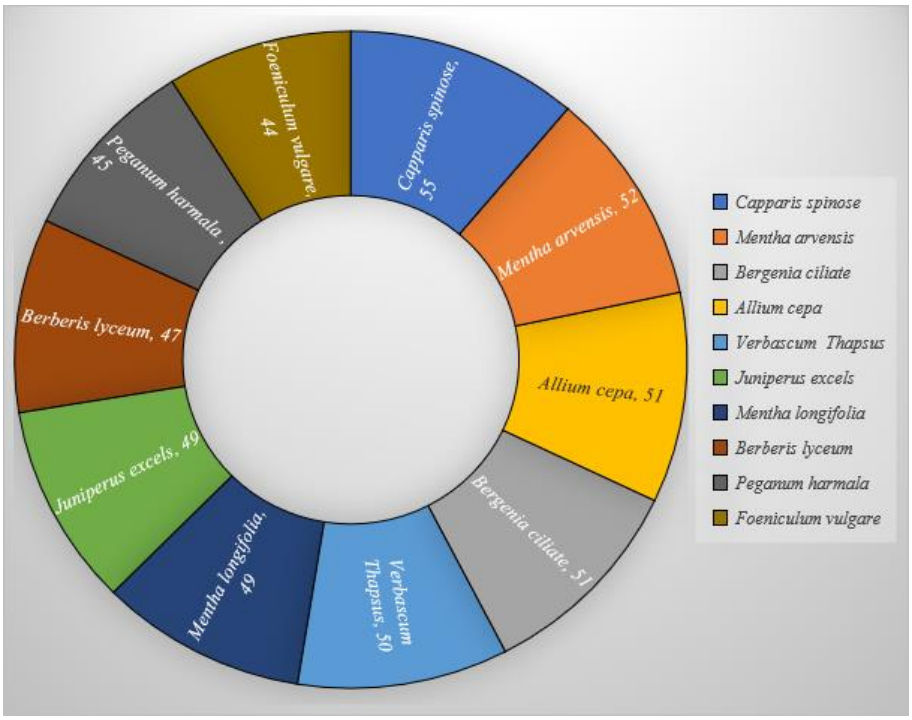

Figure 5. *Graphical representation of ten dominant species with RFC of study area*

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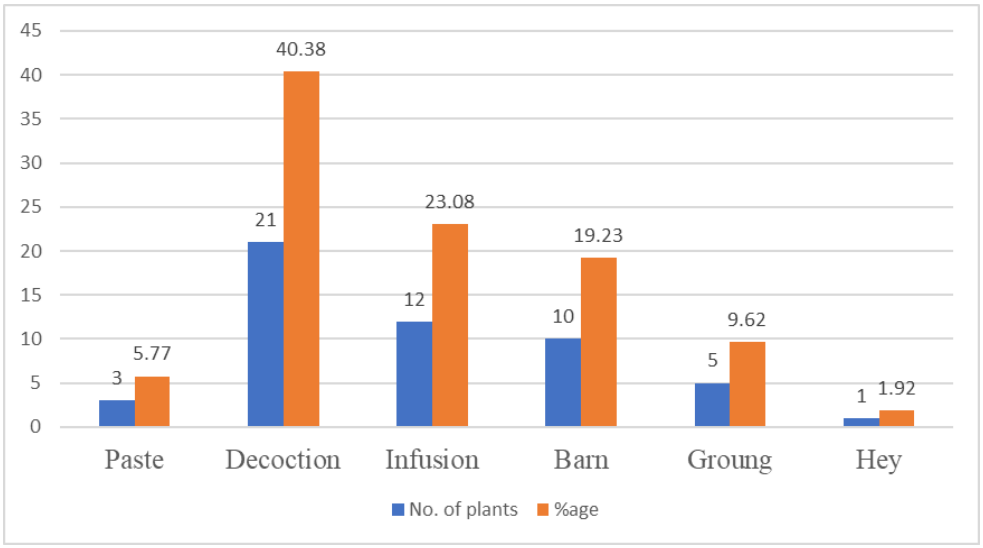

Figure 6. *Distribution (%) pattern for the administration of plants used in the treatment of cattle diseases in the tribal community of Shishikoh*

Table 5. *Chemical compounds existing in some plant taxa used by tribal community of Shishikoh Valley, Chitral, Pakistan*

Species name	Chemical compound	References
Berberis lycium	Berberine, barbemine, ounjabine	(Mustafa et al., 2011; Watanabe et al., 2005)
Canabis sativa	Cannabigerol, cannabidiole	(Dahab et al., 2013; Pardo et al., 1998)
Verbascum thapsus	Aucubin, saponins, flavanois	(Shi et al., 2016)
Celosia cristata	Phenolic compounds, flavonoids, fatty acids, saponins, steroid	(Shi et al., 2016)
Artemisia maritima	Disaccharides, polysaccharides, glycosides, saponins, terpenoids, flavonoids, and carotenoids	(Bisht et al., 2021)
Ricinus communis	Phenole, flavanois, saponin, steroid	(Yadaw and Arawala, 2011)
Artemisia perviflora	Saponins, disaccharides, terpenoids, flavonoids, and carotenoids	(Bisht et al., 2021)
Cichorium intybus	Flavonoids, alkaloids, steroids, terpenoids, oils, volatile compounds, coumarins, vitamins and polyynes	(Snafi, 2016)
Capparis spinosa	Alkaloids, glycosides, tannins, phenolics, flavonoids, triterpenoids steroids, carbohydrates, saponins	(Mustafa et al., 2011; Watanabe et al., 2005)
Brassica compestris	Phenolic acids, flavonoids, alkaloids, saponins, terpenoids, tannins	(Pardo et al., 1998; Bisht et al., 2021)
Mentha arvensis	Isomenthone, neomenthyl acetate, menthone, Menthol, menthone	(Kaur et al., 2005)
Melia azedarach	Benzyl, glucopyranosy, hydroxybenzoate, spathuleno, trihydroxy, naphtaldehyde, quercetin, astragalin, methoxy, phenyl glucoside	(Yuan et al., 2013)
Bergenia ciliata	Gallic acid, Tannic acid, Galloylepicatechin, Galloylcatechin, Catechin, Gallicin.	(Saha et al., 2014)
Peganum harmala	harmaline, harmine, harmalol	(Pardo et al., 1998; Bisht et al., 2021)

Discussion

The indigenous community has been using its own traditional veterinary technique for livestock treatment for centuries. Most of the informants are elderly, and very few

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younger people are knowledgeable about the indigenous method for treating livestock ailments (Yigra et al., 2012). Plants show major components that are beneficial for indigenous livestock treatment (Behailu, 2010). In rural communities of Pakistan livestock rearing is considered the most significant and most important tradition. However, in different localities the community uses different parts of the same taxa for various ethnoveterinary purposes. Nomadic communities, shepherds, old farmers, and the populations of mountainous areas not only depend on natural vegetation to obtain the livestock feed but also rely on it for the treatment of several livestock illnesses (Behailu, 2010). According to the field investigation, the alpine community is well-known for its knowledge of veterinary plants and their preparation technique. However, due to developmental activities the life style of alpine community changes. As a result, the public faces difficulties in treating their livestock due to the degradation of indigenous information about therapeutic species. The decline of communication skills, using allopathic medicine, lack of interest, and traditional uses may affect the existence of plant taxa. So, the nomads, herder's shepherds and aged experienced people lost their approach on livestock treatment, thus the ailing cattle died due to lack of proper medicinal care. Losses may also occur due to flood, deforestation, overgrazing, soil erosion, over collection and unsustainable harvesting. However, indigenous people still benefit from and have some knowledge of ethno-veterinary plants. and know little about ethno-veterinary plants. This study is focused on each and every individual during field investigation and documented, all the information which was in their decline position. After field investigation different livestock diseases were reported viz., constipation, mastitis, febrifuge, parasitic, diarrhea, blood thinner, anti-fungal, anti-bacterial, blood in urine, galactagogue, allergy, inflammation, vermifuge, removal of placenta, typhoid, malaria, injury, anthelmintic, healing of wound, placental infection, delivery, purgative, appetizer, evil eye, fodder, colic, laxative, hooves recovery, urinary bladder, hut formation, foot and mouth disease and rheumatism. Maximum plant taxa were used in the form of decoction, followed by infusion, barn, paste, ground and hey. The plant parts used lonely as well combine with other species. *Berberis lyceum* is used against the healing of injured organs and fractured bone in the study area but in Deosai Plateau, the same species was used as anti-inflammatory, anti-diabetes and delivery problem in livestock (Khan et al., 2011) while in Peshawar, the bark powder of the same species is used for cough and cool (Khan et al., 2015). Like that, bark of the same species is used in Abbottabad in favor of treatment of wound healing, bone fracture and antiseptic in cattle (Shah et al., 2012). *Berberis lyceum* is used as an antispasmodic and intestinal wound recovery (Ullah et al., 2014) and Hassan et al. (2014) also reported the same species from Malakand district which are used for the treatment of internal injury in cattle. Due to cultural diversity, topographical diversity as well as environmental fluctuation, the plant shows different veterinary uses. *Mentha longifolia* in our study area is used against typhoid, gastric problems, pests and external parasites in livestock while Ullah et al. (2014) reported the same plant taxa used against diarrhea and constipation in Isolate Region Bumburate, Kalash Valley. Hassan et al. (2014) reported the same species from Malakand district which are being used against diarrhea and low body temperature. Like that the leaves of the same species were used against livestock feeding problems in Peshawar district (Khan et al., 2015) and the same species is used for the same purpose as well as milk production in Abbottabad (Shah et al., 2012). The life style of the inhabitant, cultural diversity, environment and topography of each zone show different veterinary ailments. *Melia azedarach* in our concern area is important for

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relieving gastric trouble and constipation, like that Ali and Qaiser (2009) reported the same plant species from lower Chitral, where the community used the plants constituent against constipation problem in livestock. The similar uses show the same climatic condition, similar cultural interaction and same topography, that's why the uses of plant taxa show similarity. Hassan et al. (1914) reported the same species which are used for snake bites and flatulence like that Khan et al. (2015) reported the same plants from Peshawar, where the plant taxa are used against constipation in livestock. In Abbottabad district the leaves of the same species are used as fodder and galactogogue (Shah et al., 2012). Each zone shows different type of interaction with plants so, they use each part of plants for more than single purposes. *Plantago major* used for mouth and foot disease as well as hooves repossession in the study area while Ullah et al. (2014) collected the same plants from Bumburate, Kalash Valley, where it is used against boiling and stabling pain. *Rumex hastatus* is boiled in water and used against constipation is Shishikoh, while (Ullah et al., 2014) reported the same plant which is used as an appetizer, diuretic and astringent in isolated Region of Bumburate, Kalash Valley, District Chitral. Rhizome of *Bergenia ciliate* is used against injured organs as wound healing of livestock as well as antibacterial activities. But the other species *Bergenia stacheyi* used against headache, blood pressure, arthritis, backbone, delivery, diarrhea and dysentery in Peshawar District (Khan et al., 2015). Likewise, the seeds of the same species in District Jhang are used for septicemia and hemorrhage in livestock (Badar et al., 2017] but rhizome of the same plant species is used against internal injury and antiseptic in District Abbottabad (Shah et al., 2012). The seeds and leaves of *Foeniculum vulgare* were reported to improve blood in urine, galactagogue and gastric trouble in livestock while in India the same species used for milk production (Raikwar and Muarva, 2015). In Jhang district the seed of the said plant species is used against digestion trouble (Badar et al., 2017). All the contrast uses verified different topography, climate as well as different life style and habits of the community. *Peganum harmala* used against parasites in livestock, removing lice's from wounds of organisms in Shishikoh, while (Shah et al., 2012) collected the same species with the same use report from Abbottabad, the reason for similarity is that, in some rare cases the species show well similarity except different topography, life style as well as climatic diversity. Further *Verbascum thapsus* is used to improve milk production and relieve diarrhea in cattle from Shishikoh, while (Sha et al., 2012; Ullah et al., 2014) reported the same species to treat chronic abdominal pain in cattle. *Cannabis sativa* is used as an appetizer, purgative and gastric problem in livestock, while (Shah et al., 2012) reported the same species used as appetizer or off-feeding in animals. *Glycyrrhiza glabra*, is medicinally important and given to cows as nutritive and galactagogic in the study zone, while in Peshawar the rhizome of the same species is collected and used for cough and cool. The whole plant of *Peganum harmala* is used against parasites as well as the removal of lice's from wounds of organisms while the seed of the same species in Peshawar District is used against temperature maintenance in cattle (Khan et al., 2015). Each zone and every district show similarity in rare cases while in maximum cases show diversity in veterinary uses, traditional, history, life style, culture topography, climatic condition, range of elevation and income practice. Due to all these dissimilarities, the ethno-veterinary uses of plant taxa also show differences in some extent. After observation and investigation, it is stated that in the study area, the community do not know conservation strategies and preservation methods. Thus the maintenance strategy is urgently required in the study area to protect plant life. The

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custom of herbaceous medications in Shishikoh, Chitral can be most inspired and re-enforced by offering a corresponding practice of inspection. It is necessary to evaluate progress and analyze the useful plant through proper procedure, husbandry and preservation. The unsustainable utility, deforestation, overgrazing and over-exploitation may affect the existing plants. To increase the preferred constituent, suitable assessment would be undertaken for refining husbandry.

Novelty of the study

The current work is the first addition of its nature in the study area and is based on fieldwork to the ethno-veterinary medicinal plants of Shishikoh valley. The comparative assessment with available literature revealed about 52 registered plant taxa, out of the total 26 veterinary medicinal taxa were first time reported from Shishikoh such as *Melia azedarach, Bupleurum longicaule, Berginia ciliata, Lepedium virginicum, Thuja orientalis, Bupleurum longicaule, Cichorium intybus, Artemisia perviflora, Chenopodium album, Thuja orientalis, Tagetes minuta, Celosia cristata, Cyperus stononiferus, Ricinus communis, Quercus dilata, Mentha arvensis, Salvia nubicola, glycyrrhiza glabra, Trifolium resupinatum, Lathrus aphaca, Avena sativa, Zea mays, Papalus alba,, Datura stramonium and Prongos pabularia* from said valley. Endemic taxa *Seriphidium chitralense* is also first time reported as being used for ethno-veterinary purposes. The chemical constituent of some medicinal plant species from the study area are barbemine, Ounjabine, saponins, Flavanois, phenolic, Phenole, flavonoids, oils, volatile, glycosides, tannin, saponins, terpenoids, menthone, methoxy, harmaline. The result show that (i) the most common cattle diseases are constipation, recovery of injured organ, febrifuge, parasite and maggot, Remove placenta, diarrhea, delivery, wound healing, ringworm, gastric trouble and urinary problems. (ii) Some newly reported species of ethno-veterinary are *Prongos pabularia, Cichorium intybus*, *Artemisia perviflora*, *Bupleurum longicaule, Mentha arvensis* and (iii) *Berginia ciliata, Artimesia maririma*, *Berberis lyceum*, and *Pinus roxburghii* that are facing very strong pressure due to their un-selective harvesting method by the inhabitants.

Recommendation

For proper conservation of natural resources, the following recommendations must be carried out:

- Shishi valley needs to generate awareness among the community because the veterinary taxa face difficulties in existing due to anthropogenic activities.
- With the passage of time the unique and precious knowledge is disappearing in the valley so its preservation is necessary up to national and international levels.
- Prompt upgradation and conservation projects are recommended for further documentation of ethno-veterinary knowledge.
- There is a direct need to protect forests and conserve the habitats for flora. For this purpose, the government and NGOs need to implement a strong campaign of awareness among the community about the importance of veterinary medication.
- The alpine veterinary nursery is strongly recommended in Madaklasht (Alpine nursery) for the protection of threatened plants as well as to secure the treasure of the country.

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Conflict of interests. All authors state that the research was conducted in the lack of any commercial or financial conflicts.

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