Ethnoveterinary Therapeutic Practices and Conservation Status of the Medicinal Flora of Chamla Valley, Khyber Pakhtunkhwa, Pakistan

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Domestic animals play a very important role in the human civilization. Besides human being, plants are used as medicines for many domestic animals. The therapeutic practices are very common among the tribes of Chamla, rich in ethnoveterinary medicinal plants. Due to poor availability of modern healthcare facilities and poverty of indigenous people, they depend on local medicinal plants for the healthcare of their domestic animals. This study is the first attempt to document the indigenous knowledge and evaluate the conservation status of medicinal plants and practices of herbal remedies by the local people of Chamla Valley in the treatment of their livestock. Semi-structured questionnaire was used and 120 local inhabitants were interviewed to note the traditional practices regarding plant species uses. Well-known statistical indices, Use Value formula and Relative Frequency Citations were used for quantification of the recorded data. It was observed that 50 medicinal plants belonging to 38 families were reported, where Poaceae was the most cited. The common livestock are goats, sheep, buffalos, cows, bulls, and donkeys. Most of the herbs, which are used in livestock treatment, are wild and few plants are cultivated. The common livestock diseases are red water, 3 days sickness, diarrhea, tympany, and indigestion among others. Most of the plants are used in fresh condition. According to the results, *Brassica nigra* was used for placenta retention, *Butea monosperma* for constipation, *Calotropis procera* for indigestion and 3 days sickness. *Canabis sativa*, *Cedrella serrata*, *Allium sativum*, and *Origanum vulgare* were used for fever. The traditional plant collection techniques have resulted in huge losses of these valuable plant resources. The ethnobotanical conservation assessment revealed that due to increased exploitation and un-sustainable harvesting, 49% of these economically valued medicinal plant species are decreasing in last 30 years. Some of the plants are only present on high altitudes while they had been finished in the foothills like *Paeonia emodi* and *Berberis lycium*. Lack of scientific knowledge, ignorance, poverty, and joblessness, as well as land development, construction and fires, add more pressure on flora and fauna of the area and various species are under the threat of extinction.

Keywords: traditional knowledge, medicinal plants, animal care, ethnomedicinal quantification, statistical indices, conservation, Buner, Pakistan
INTRODUCTION

Livestock keeping is one of the vital economic sources forming integral part of the traditional tribal community. Animals are a source of calories in the form of meat, milk, and its derivatives for the livelihood of local people and also they are a source of earning. Livestock plays an important role in national economy of Pakistan (1), since the majority of the people of the current study area depends on agriculture and livestock production. Livestock is the largest contributor to overall agriculture value. The livestock owners have to rely on the herbal medicinal plant recipes being inherited by their predecessors generation to generation.

Dependency and sustainability of man and animal lives has been revolving around plants through their uses as foods, fibers, and shelter, as well as to control and ease diseases, which is an ancient and reliable practice (2). Ailments and medicinal plants vary in the world, hence their nature, frequency, and methods of administration can change in relation to geography, time and knowledge. Indigenously, different plants have been used to cure a disease or several diseases at a time, but toward the middle of 20th century the contribution of medicinal plants to medicine was reduced by approximately one fourth as research and development favored the use of synthetic chemicals. Now this trend is reversing once again in favor of plants, as they have been discovered to possess natural products that are chemically balanced, effective, less injurious with none or much less side effects (3). Pakistan, China, and India are the supreme users of medicinal plants. Their traditional practices of plant remedies date back at least 7,000 years (1). The influences of traditional medicine upon western medicine have been both indirect and direct (4).

Ethnoveterinary medicine, the scientific term for traditional animal health care, provides low-cost alternatives to allopathic drugs (2, 5). Research in such field is often undertaken as part of a community-based approach that serves to improve animal health and provide basic veterinary services in rural areas (6, 7). In addition, ethnoveterinary medicines cover people's knowledge, skills, methods, practices, and beliefs about the care of their animals (2). In many poor rural areas ethnoveterinary medicine can play an important role in animal production and livelihood development and often becomes the only available means for farmers to treat ill animals (8). These medicines provide valuable alternatives to and complement western-style veterinary medicine. During the late 1930, it was observed that cattle fed on spoiled sweet clover died from hemorrhage. On examination it was finally established that this hemorrhagic effect was due to a chemical, dicoumarin now known under the trademark dicumarol. In 1941, synthesis of this anticoagulant agent was done by Link Stambmann and Huibner and then, it was beneficently employed (4).

Therefore, it is extremely necessary to document and disseminate indigenous knowledge in order to help and share the different uses of plants as animal health care and to promote different conservation measures. Thus, the aim of this study was to evaluate the Ethnoveterinary therapeutic practices and conservation status of the medicinal flora of Chamla Valley, Khyber Pakhtunkhwa, Pakistan. This is the first attempt to document the indigenous knowledge and evaluate the conservation status of medicinal plants and practices of herbal remedies by the local people of Chamla Valley in the treatment of their livestock.

MATERIALS AND METHODS

Study Area

Buner District (34°26′34.83″N, 72°29′57.58″E) is located in Khyber Pakhtunkhwa Province, Pakistan and it was a part of Swat up to 1969. The region presents an area of 1,865 km². Chamla valley has an area of 49 km² and elevation of 670 m. The valley is drained by Chamla River which finally joins Indus River (9). Buner District is administratively divided into six tehsils namely: Daggar, Gadezi, Chagharzai, Gagra, Chamla, and Totalai. Elevation varies from 366 meters in Totalai in the south to 2,911 meters of the Dosara peak in the North. Total population of Buner district is more than 0.9 million.

This region was chosen, because economically the majority of people are poor and agriculture and livestock is the main source of livelihood of the population, where they have their own treatment system for most of the diseases of their domestic animals. Therefore, this region is an excellent study model for the documentation and dissemination of indigenous knowledge in order to help and share the different uses of plants in animal health care. The main livestock include cattle, buffalos, sheep, goats, camels, horses, asses, and mules.

Data Collection

Twelve villages were randomly selected from the upper, middle, and lower areas. In each village, randomly 10 inhabitants were interviewed. Out of these ten, five were common persons involved in farming practices while five were the expert in the use of these plants for the treatment of livestock diseases.

The work was initiated in the result of discussion with experts of knowledge of medicinal plants and experts of study area for identifying and conserving this precious source of natural resources. In detail, the study was conducted in the following steps: (i) Collection of baseline information and Sampling design—Field surveys were carried out and interviews of the local informants were conducted. During field trips, people including local traditional practitioners, veterinary doctors, farmers, and other local respondents were interviewed on random basis for the traditional uses of indigenous plants in curing ethnoveterinary diseases. Semi-structured questionnaire was used to note the traditional knowledge regarding plant species uses [sensu (10)]; (ii) Identification—The samples of the plants were identified in different departments, such as PCSIR (Peshawar), Pakistan Forest Institute (Peshawar), and Department of Botany, University of Peshawar. After filed surveys, different analyzes related to the use of the plants in the animal health care were used (see Statistical analysis below) to observe the relevance of each species in the animal health care.
| S. no | Botanical name | Vernacular name | Family | Habit | Part used | Carrier used for the dosage | Used alone or in combination with other plants | Disease for which it is used | Special care (Parhez) |
|-------|----------------|----------------|--------|-------|-----------|-----------------------------|--------------------------------|--------------------------|----------------------|
| 1     | Acacia modesta  | Polosa         | Mimosaceae | T     | G         | Mixed with flour             | Mixed with other plants       | Three days sickness, indigestion       | Cold water, bitter things |
| 2     | Acorus calamus  | Bekan          | Acoraceae | H     | R         | Mixed with flour             | Alone                          | Abdominal               | Nil                  |
| 3     | Aesculus indica | Jooz           | Hippocastanaceae | T   | F         | Mixed with flour             | Alone                          | Abdominal pain            | Cold water             |
| 4     | Allium cepa     | Piz             | Alliaceae  | H     | B         | Alone                        | Alone                          | Indigestion, tymphany       | Nil                  |
| 5     | Allium sativum  | Ooga            | Alliaceae  | H     | B         | Alone                        | Capsicum annum                 | Fever                    | Cold water             |
| 6     | Aloe vera       | Manzarepanna    | Liliaceae  | H     | L         | Mixed with flour             | Alone                          | Weakness, paralysis         | –                    |
| 7     | Berberis lydium | Zar large       | Berberidaceae | S   | B, W      | Oil                          | Alone                          | Wound, weakness, fever      | –                    |
| 8     | Bombax ceiba    | Badar           | Bombacaceae | T   | B         | Mixed with Milk              | Alone                          | For fracture              | Pregnant animals       |
| 9     | Brassica campestris | Sharsham     | Brassicaceae | H   | S         | Alone                        | Alone                          | For body temperature        | Nil                  |
| 10    | Brassica nigra  | Thor sharsham  | Brassicaceae | H   | P         | Alone                        | Alone                          | Placenta retention          | Nil                  |
| 11    | Butea monosperma | Shanapalai    | Papilionaceae | T   | Fs        | Used in water suspension     | Alone                          | Constipation              | Nil                  |
| 12    | Buxus wallchina | Shamshad       | Buxaceae   | T     | L         | Used in water suspension     | Alone                          | Liver fluke in liver        | Nil                  |
| 13    | Calotropis procera | Spalmai       | Asclepiadaceae | S   | L         | Mixed with flour             | Trachyspermumammii              | Three days sickness, indigestion       | From cold things, from green grass |
| 14    | Cannabis sativa | Bhang          | Moraceae   | H     | L         | Alone                        | Alone                          | Red water                | Nil                  |
| 15    | Capsicum annuum | Marchakay      | Solanaceae  | H     | F         | Alone                        | Oxalis acetosella              | Fever                    | From hotness, from sun  |
| 16    | Cedrela serrate | Meem           | Meliaceae   | T     | L         | Mixed with flour             | Acorus calamus                 | Fever                    | Nil                  |
| 17    | Cissampelos pareira | Tangapanra   | Meniarpasceae | H   | L         | Used in water suspension     | Alone                          | Cough                    | Nil                  |
| 18    | Citrullus colocynthis | ZangaliHindwana | Cucurbitaceae | H   | F         | Mixed with flour             | Alone                          | Abdominal pain, deflection  | From cold water         |
| 19    | Daphne oleoides | Kotilal        | Thymelaceae | S   | Rs        | Mixed with flour             | Alone                          | Weakness, disease in milk production | From cold things, from green grass |
| 20    | Diospyros lotus L. | Tor amlik    | Ebenaceae   | T     | F         | Mixed with flour             | Alone                          | Diarrhea                 | Nil                  |
| 21    | Dodonaea viscosa | Ghaxarasky    | Sapindaceae | S   | L         | Alone                        | Alone                          | Fracture                  | From walking            |
| 22    | Equestum arvensis | Bandakey     | Equisetaceae | H   | St        | Alone                        | Alone                          | Red water                | Nil                  |
| 23    | Ficus carica    | Inzar          | Moraceae   | T     | L         | Mixed with flour             | or alone                       | Placenta retention         | Nil                  |
| 24    | Foeniculum vulgare | Kaga          | Apiaceae   | H     | L         | Alone                        | Alone                          | Weakness, anorexia         | Nil                  |
| 25    | Grewia optiva   | Pastaone       | Tiliaceae   | T     | B         | Mixed with flour             | Alone                          | Round worm, tap worms, liver fluke, placenta retention | Nil                  |
| 26    | Hordeum vulgare | Warbahe        | Poaceae    | H     | S         | Alone                        | Sand                           | If animal eat a local insect | Nil                  |
| 27    | Indigofera heterantha | Keenthai    | Fabaceae   | S     | R         | Alone                        | Alone                          | Abdominal pain             | Nil                  |

(Continued)
| S. no | Botanical name | Vernacular name | Family | Habit | Part used | Carrier used for the dosage | Used alone or in combination with other plants | Disease for which it is used | Special care (Parhez) |
|-------|---------------|----------------|--------|-------|-----------|----------------------------|-----------------------------------------------|-----------------------------|----------------------|
| 28    | Litsea cubeba | Khadang        | Lauraceae | T     | B         | Mixed with Halwa (desert)   | Alone                                         | Wound, fracture             | Ni                   |
| 29    | Malabia philippensis | Kambela       | Euphorbiaceae | T     | S         | Mixed with flour            | Alone                                         | Liver fluke                 | Cold water, green grass |
| 30    | Melia azedarach | Bakyanra      | Meliaceae | T     | F         | Mixed with flour            | Alone                                         | Disease in milk production  | Ni                   |
| 31    | Mentha arvensis | Welani, inale  | Lamiaceae | H     | L         | Mixed with flour            | Trachyspermum ammi                         | Dried muzzle, 3 days sickness | Ni                   |
| 32    | Musa paradisiaca | Kela          | Musaceae | T     | L         | Alone                       | Alone                                         | Red water                  | Ni                   |
| 33    | Opunia dillenii | Zuqam         | Cactaceae | H     | F         | Alone                       | Alone                                         | Wound in eyes               | Ni                   |
| 34    | Orygana vulgaris | Shamke        | Lamiaceae | H     | St, L     | Alone                       | Alone                                         | Fever                       | Ni                   |
| 35    | Oxalis acetosa | Tarocke        | Oxalidaceae | H     | P         | Alone                       | Alone                                         | Red water, itching          | From hot things        |
| 36    | Paeonia emodi | Mamek          | Paeoniaceae | H     | R         | Mixed with flour            | Alone                                         | Wound, weakness            | Ni                   |
| 37    | Pinus roxburghii | Nakhtar       | Pinaceae | T     | Bn        | Mixed with flour            | Berberis lycium                             | From cold water             | Ni                   |
| 38    | Podophyllum emodi | Kakora       | Podophyllaceae | H     | R         | Mixed with flour            | Alone                                         | Constipation, diarrhea      | Ni                   |
| 39    | Prunus perica | Shaltallo      | Rosaceae | H     | Leave     | Used in water suspension    | Alone                                         | Maggots wound               | –                   |
| 40    | Pyrus pashia | Tango          | Rosaceae | H     | S         | Alone                       | Alone                                         | Wound in eyes               | Ni                   |
| 41    | Rumex dentatus | Snahke        | Amaranthaceae | H     | R         | Mixed with Milk             | Alone                                         | Wound, tymphany, diarrhea   | Ni                   |
| 42    | Solarium surattense | Maa ghone  | Solanaceae | H     | L         | Alone                       | Alone                                         | Paralysis                  | Ni                   |
| 43    | Trachyspermum ammi | Speerkey | Apioaceae | H     | S         | Mixed with flour            | Alone                                         | Tymphany, all pain, anorexia | Ni                   |
| 44    | Trigonea tocinograecum | Makhwaeze | Papilionaceae | H     | S         | Mixed with flour            | Alone                                         | Fever, decrease in milk production | From cold water       |
| 45    | Tribus aestivum | Ghanam       | Poaceae | H     | S         | Alone                       | Berberis lycium                             | Wound                       | –                   |
| 46    | Tylaphora hirta | Goganda      | Asclepiadaceae | H     | R         | Mixed with flour            | Alone                                         | Weakness, diarrea, tymphany | From cold water       |
| 47    | Vitis vinerea | Angoor        | Vitaceae | H     | St        | Mixed with flour            | Mixed with other plant                       | Red water                  | Ni                   |
| 48    | Verbascum thapsus | Khardad    | Verbeaceae | H     | R         | Mixed with flour            | Alone                                         | Diarrea, abdominal pain     | Ni                   |
| 49    | Zanthoxylum armatum | Dambara   | Asteraceae | H     | F         | Mixed with flour            | Alone                                         | Three days sickness, fever  | Ni                   |
| 50    | Zea mays | Jawar          | Poaceae | H     | S         | Alone                       | Alone                                         | Diarrea                     | Ni                   |

Abbreviations for plant habit: H, Herb; S, Shrub; T, Tree; R.
Abbreviations for part used: F, Fruit; S, Seed; St, Stem; Wp, Whole plant; L, Leaves; W, Wood; G, Gum; Bn, Branch with needle; W, Wild; C, Cultivated; S.
Abbreviations for cultivation method: Seed; St, Stem; R, Root; P, Plant; Bd, Buds.
| S. no | Botanical name       | Is this plant sold in local market? | Conservation status | Nature of plant | Part used for cultivation | From how long the medicinal properties have been known (years)? |
|-------|----------------------|------------------------------------|---------------------|-----------------|----------------------------|---------------------------------------------------------------|
| 1     | Acacia modesta       | Yes                                | Change              | Wild            | S                          | 40                                                            |
| 2     | Acorus calamus       | Yes                                | No change           | Wild            | R                          | 50                                                            |
| 3     | Aesculus indica      | No                                 | No change           | Wild            | S                          | 50                                                            |
| 4     | Allium cepa          | Yes                                | Increase            | Cultivated      | P                          | 45                                                            |
| 5     | Allium sativum       | Yes                                | Increase            | Cultivated      | P                          | 35                                                            |
| 6     | Aloe vera            | No                                 | No change           | Cultivated      | Bd                         | 40                                                            |
| 7     | Berberis lycium      | Yes                                | Decrease            | Wild            | R                          | 44                                                            |
| 8     | Bombax ceiba         | No                                 | Increase            | Cultivated      | P                          | 50                                                            |
| 9     | Brassica campestris  | Yes                                | Increase            | Cultivated      | S                          | 45                                                            |
| 10    | Brassica nigra       | No                                 | No change           | Wild            | S                          | 50                                                            |
| 11    | Butea monosperma     | Yes                                | No change           | Wild            | S                          | 43                                                            |
| 12    | Buxus wallichiana    | No                                 | Decrease            | Wild            | S                          | 50                                                            |
| 13    | Calotropis procera   | No                                 | No change           | Wild            | S                          | 40                                                            |
| 14    | Cannabis sativa      | No                                 | No change           | Wild            | S                          | 50                                                            |
| 15    | Capsaicum annuum     | Yes                                | Increase            | Cultivated      | S                          | 50                                                            |
| 16    | Cedrela serrata      | No                                 | Decrease            | Wild            | S                          | 55                                                            |
| 17    | Cassampelos pareira  | No                                 | Decrease            | Wild            | R                          | 49                                                            |
| 18    | Citrusus colocynthis | No                                 | Decrease            | Wild            | S                          | 50                                                            |
| 19    | Daphne oleoides      | Yes                                | Decrease            | Cultivated      | S                          | 55                                                            |
| 20    | Dhofophora hirsuta   | No                                 | Decrease            | Wild            | S                          | 44                                                            |
| 21    | Dodonaeus viscosa    | No                                 | Decrease            | Wild            | S                          | 50                                                            |
| 22    | Equisetum arvensis   | No                                 | No change           | Wild            | R                          | 40                                                            |
| 23    | Ficus carica         | No                                 | Decrease            | Wild            | S                          | 50                                                            |
| 24    | Foeniculum vulgare   | No                                 | No change           | Wild            | S                          | 55                                                            |
| 25    | Grewia optiva        | Yes                                | Increase            | Wild            | S                          | 49                                                            |
| 26    | Hordeum vulgare      | No                                 | Decrease            | Cultivated      | S                          | 45                                                            |
| 27    | Indigofera heterantha| Yes                                | Decrease            | Wild            | S                          | 40                                                            |
| 28    | Litsea cubeba        | Yes                                | Decrease            | Wild            | R                          | 15                                                            |
| 29    | Mallotus philippensis| No                                 | Decrease            | Wild            | S                          | 44                                                            |
| 30    | Mela azeirach        | No                                 | Increase            | Wild            | S                          | 55                                                            |
| 31    | Mentha longifolia    | No                                 | Decrease            | Wild            | R                          | 25                                                            |
| 32    | Musa paradisiaca     | No                                 | Increase            | Cultivated      | R                          | 45                                                            |
| 33    | Opuntia dilleni      | No                                 | Increase            | Wild            | St                         | 40                                                            |
| 34    | Orangeum vulgare     | No                                 | No change           | Wild            | R                          | 50                                                            |
| 35    | Oxalis acetosella    | No                                 | No change           | Wild            | S, R                       | 45                                                            |
| 36    | Paeonia emodi        | Yes                                | Decrease            | Wild            | R                          | 55                                                            |
| 37    | Pinus roxburghii     | No                                 | Decrease            | Wild            | S                          | 45                                                            |
| 38    | Podophyllum emodi    | No                                 | Decrease            | Wild            | S                          | 50                                                            |
| 39    | Prunus persica       | No                                 | Increase            | Wild            | R                          | 40                                                            |
| 40    | Pyrus pashia         | No                                 | No change           | Wild            | S                          | 39                                                            |
| 41    | Rumex dentatus       | No                                 | Decrease            | Wild            | S, R                       | 45                                                            |
| 42    | Solanum surattense   | No                                 | No change           | Wild            | S                          | 40                                                            |
| 43    | Trachyspermumannmi    | Yes                                | Increase            | Cultivated      | S                          | 40                                                            |
| 44    | Trigonella foemugrarium| Yes                             | Decrease            | Cultivated      | S                          | 50                                                            |
| 45    | Trilcum aestivum     | Yes                                | Increase            | Cultivated      | S                          | 45                                                            |
| 46    | Tylophora hirsuta    | No                                 | Decrease            | Wild            | S                          | 46                                                            |
| 47    | Vebascum thapsus     | No                                 | No change           | Wild            | St                         | 50                                                            |
| 48    | Vitis vinifera       | No                                 | Increase            | Wild            | S                          | 30                                                            |
| 49    | Zanthoxylum armatum  | Yes                                | Decrease            | Wild            | S                          | 35                                                            |
| 50    | Zea mays             | Yes                                | Increase            | Cultivated      | S                          | 50                                                            |

Abbreviations part used for cultivation: S, Seed; St, Stem; R, Root; P, Plant; Bd, Buds.
Statistical Analyses

Use Value (UVi). UVi, the Use Value of a plant species was calculated by using the formula [8]:

\[ UV_i = \frac{\sum U_i}{N_i} \]

\[ U_i = \text{Use reports cited for a particular plant species by each respondent} \]
\[ N_i = \text{Total informants interviewed for a particular plant species} \]

Relative frequency of citations (RFCs). RFCs index was used to assess the traditional uses and medicinal value of each species in the area (11).

\[ RFCs = \frac{FCs}{N} \]

FCs = No. of local respondents who use the taxa traditionally and N is the total number of respondents of in the study (in this study, N = 120).

Multivariate ordination analyses, “principal components analysis” (PCA) and species response curve (SRC), were used to evaluate differences in the conservation status and nature of the plant species reported. A species response curve (SRC) was drawn to distinguish significance level of diseases categories based on the use reports of its sub categories treated with medicinal plant species. All analyses were run in CANOCO 5 (11, 12).

RESULTS

Demography

Interviews were conducted from different fields of life viz; local traditional practitioners, veterinary doctors, farmers, and other local respondents. The current study showed that farmers have a preference to collect medicinal plants directly from the field, since they can easily collect and use the plants. Each village of the study area has many expert persons in livestock treatment. The survey showed that most of the people have some information about the use of herbal medicine for the treatment of their livestock, where this information is usually passed down from their parents or elders.

Floristic Contribution in Ethnoveterinary Practices

A total of 50 medicinal plants belonging to 38 families have been reported by the local respondents (Table 1), where Poaceae was the most cited family. In these ethnoveterinary medicinal plant species, 50% were herbaceous growth habit, 28% were trees, and 22% were shrubs. Out of these 50% medicinal plants, 70% were wild in nature and 30% were cultivated (Table 2). All of the understory medicinal plant species were used for curing various veterinary ailments. The common livestock diseases are red water (Kalangari), 3 days sickness (Taqo), diarrhea (Reekh), tympany (parsob), and indigestion (Charmekh) among others (Table 1).

Most of the plants are used in fresh condition. According to the results, in some cases for a single disease many plants were used. Some medicinal plants are used for single disease, such as Cannabis sativa, Cedrella serrate, and Origanum vulgare were used for fever, Brassica nigra was used for placenta retention, Butea monosperma for constipation. On the other hand, species cited for multi disorders were Berberis lyicium for wound, weakness, and fever, Acacia modesta, Calotropis procera for 3 days sickness and indigestion, Daphne oleoides for weakness and disease in milk production, Grewia optiva for round worm, tap worms, liver fluke, and placenta retention, Trigonella foenumgracium for fever, decrease in milk production (Table 1). In addition, we provide some chemical compounds present in some plant species used by local respondents (see Table 3).

Carrier Used for the Dosage

The local community members used different carriers for making the traditional medicine, i.e., flour, water, oil, milk, halwa (a traditional dessert) to treat the diseases. Out of 50 medicinal plants, 24 are used with flour (Table 1). It is important to mention that these ethnoveterinary approaches are practiced from more than five decades (25–55 years) (Table 4).

Special Care (Parhez)

Most of the plants are used in fresh condition and those plants that are used in dry condition are at the top of the mountains and they cannot be obtained immediately. In addition, most of these plants are not available in the market. Plants are mostly given singly and usually there is no special care in the treatment

### Table 3 | Chemical compounds present in some plant species used by local respondents of Chamla Valley, KP, Pakistan.

| Species name | Chemical compound | References |
|--------------|-------------------|------------|
| Aesculus indica (Wall. ex Camb.) Hook | Aescin, decanoic acid, quercitin, saponins | (13, 14) |
| Berberis lyicium Royle | Berberine, berbamine, punjabinine | (15, 16) |
| Cannabis sativa L. | Cannabigerol, cannabidiol | (17, 18) |
| Grewia optiva J.R.Drumm. ex Burret | Grewialin, optivarin | (19, 20) |
| Indigofera heterantha Brandis | Lactone, flavonides, glycosides, saponins | (21) |
| Ficus carica L. | Cyaniding, furanoid, cinnamic alcohol, eugenol, flavonoids, ficusin | (22–25) |
| Pyrus pashia Buch.-Ham. ex D.Don | Flavanoids, saponins, coumarins, terpenes | (26, 27) |
| Origanum vulgare L. | Thymol, linalool, salvianolic, lithospermic, syringic, caffeic acids | (28–30) |
| Verbascum thapsus L. | Auricin, flavonoids, saikogenin, saponins | (31, 32) |
| Zanthoxylum armatum DC. | Linalool, palmitoleic acid | (33, 34) |
TABLE 4 | Quantitative analysis of the medicinal plants of Chamla Valley, KP, Pakistan.

| S. no | Species name       | Basic values | Indices |
|-------|--------------------|--------------|---------|
|       |                    | $U_i$ | N | FC | UVi | RFCs |
| 1.    | Acacia modesta     | 25   | 39 | 25 | 0.64 | 0.21 |
| 2.    | Acorus calamus     | 30   | 42 | 30 | 0.71 | 0.25 |
| 3.    | Aesculus indica    | 17   | 32 | 17 | 0.53 | 0.14 |
| 4.    | Allium cepa        | 15   | 36 | 15 | 0.42 | 0.13 |
| 5.    | Allium sativum     | 32   | 41 | 32 | 0.78 | 0.27 |
| 6.    | Aloe vera          | 12   | 33 | 12 | 0.36 | 0.10 |
| 7.    | Berberis lycium    | 8    | 37 | 8  | 0.22 | 0.07 |
| 8.    | Bombaxceiba        | 25   | 39 | 25 | 0.64 | 0.21 |
| 9.    | Brassica campestris| 28   | 35 | 28 | 0.80 | 0.23 |
| 10.   | Brassica nigra     | 18   | 41 | 18 | 0.44 | 0.15 |
| 11.   | Butearmonosperma   | 40   | 48 | 40 | 0.83 | 0.33 |
| 12.   | Buxus wallichiana  | 16   | 40 | 16 | 0.40 | 0.13 |
| 13.   | Calotropis procera | 31   | 42 | 31 | 0.74 | 0.26 |
| 14.   | Cannabis sativa    | 16   | 38 | 16 | 0.42 | 0.13 |
| 15.   | Capsicum annuum    | 29   | 35 | 29 | 0.83 | 0.24 |
| 16.   | Cedrella serrata   | 11   | 41 | 11 | 0.27 | 0.09 |
| 17.   | Cissampelos pareira| 13 | 38 | 13 | 0.34 | 0.11 |
| 18.   | Citrullus colocynthis | 18 | 36 | 18 | 0.50 | 0.15 |
| 19.   | Daphne oleoides    | 33   | 42 | 33 | 0.79 | 0.28 |
| 20.   | Diospyros lotus L. | 13   | 30 | 13 | 0.43 | 0.11 |
| 21.   | Dodonaea viscosa   | 29   | 37 | 29 | 0.78 | 0.24 |
| 22.   | Equisetum arvense  | 26   | 43 | 26 | 0.60 | 0.22 |
| 23.   | Ficus carica       | 24   | 38 | 24 | 0.63 | 0.20 |
| 24.   | Foeniculum vulgare | 32   | 45 | 32 | 0.71 | 0.27 |
| 25.   | Grewia optiva      | 16   | 36 | 16 | 0.44 | 0.13 |
| 26.   | Hordeum vulgare    | 19   | 40 | 19 | 0.48 | 0.16 |
| 27.   | Indigofera heterantha | 12 | 36 | 12 | 0.33 | 0.10 |
| 28.   | Litsea cubeba      | 7    | 39 | 7  | 0.18 | 0.06 |
| 29.   | Mallotus philippensis | 35 | 42 | 35 | 0.83 | 0.29 |
| 30.   | Melia azedarach    | 23   | 32 | 23 | 0.72 | 0.19 |
| 31.   | Mentha longifolia  | 29   | 41 | 29 | 0.71 | 0.24 |
| 32.   | Musa paradisica    | 22   | 31 | 22 | 0.71 | 0.18 |
| 33.   | Opuntia dilleni    | 13   | 30 | 13 | 0.43 | 0.11 |
| 34.   | Origanum vulgare   | 19   | 38 | 19 | 0.50 | 0.16 |
| 35.   | Oxalis acetosella  | 14   | 35 | 14 | 0.40 | 0.12 |
| 36.   | Paeonia emodi      | 20   | 34 | 20 | 0.59 | 0.17 |
| 37.   | Pinus roxburghii   | 18   | 40 | 18 | 0.45 | 0.15 |
| 38.   | Podophyllum emodi  | 21   | 39 | 21 | 0.54 | 0.18 |
| 39.   | Prunus persica     | 29   | 42 | 29 | 0.69 | 0.24 |
| 40.   | Pyrus pashia       | 17   | 37 | 17 | 0.46 | 0.14 |
| 41.   | Rumex dentatus     | 15   | 33 | 15 | 0.45 | 0.15 |
| 42.   | Solanum surattense | 13   | 38 | 13 | 0.34 | 0.11 |
| 43.   | Trachyspermum amni | 11   | 35 | 11 | 0.31 | 0.09 |
| 44.   | Trigonella foemugracium | 20 | 44 | 20 | 0.45 | 0.17 |
| 45.   | Tritcum aestivum   | 24   | 41 | 24 | 0.59 | 0.20 |
| 46.   | Tylophora hirsuta  | 16   | 33 | 16 | 0.48 | 0.13 |
| 47.   | Vitis vinifera     | 24   | 35 | 24 | 0.69 | 0.20 |
| 48.   | Verbascum thapsus  | 12   | 23 | 12 | 0.52 | 0.10 |
| 49.   | Zanthoxylum armatum| 7    | 29 | 7  | 0.24 | 0.06 |
| 50.   | Zea mays           | 24   | 45 | 24 | 0.53 | 0.20 |

The UVi ranged from 0.18 to 0.83 (Table 4). The plants with highest value of UVi were Butea monosperma and Mallotus philippensis (UVi = 0.83), followed by Brassica campestris (0.80), Daphne oleoides (0.79), Allium sativum, and Dodonaea viscosa (both with 0.78), respectively. On the other hand, the plant with the lowest value was Litsea cubeba (0.18). Relative frequency citation ranged from 0.06 to 0.33 (Table 4). Based on the RFC values, the most valuable and cited medicinal plant species by the traditional practitioners and local respondents were Butea monosperma (RFCs = 0.33), Mallotus philippensis (0.29) and Daphne oleoides (0.28). The plants with the lowest RFCs were Litsea cubeba and Zanthoxylum armatum (RFCs = 0.06).

Principle Components Analysis (PCA)

Principle components analysis (PCA) was determined to examine the correlation between plant species and treated ailments (disease categories). The PCA results revealed that Allium cepa, Allium sativum, Bombax ceiba, Brassica campestris, Capsicum annuum, and Melia azedarach were most frequently found with positive and significant correlation with increased population; and Buxus wallichiana, Cedrella serrata, Cissampelos pareira, Citrullus colocynthis, Daphne oleoides, and Tylophora hirsuta was cited as decreased species. Acacia modesta, Acorus calamus, Aesculus indica, and Berberis lycium were positive and significant in correlation with wild nature and all these species were most frequently found in wild habitats. Allium cepa, Allium sativum, and Aloe vera were found cultivated. All the remaining species-diseases correlations are illustrated in Figure 1.
Species Response Curve (SRC)
The analysis clearly indicates highly significant differences ($p < 0.00001$) for increased population variable (conservation status) in comparison with all other variables due to their maximum frequency as shown in Figure 2A. Additionally, this disease category also showed maximum response (72.5%) and computed value ($F = 126.8$) as well. Nevertheless, wild and cultivated frequency of species (Figure 2B) also showed highly significance ($p < 0.00001$) due to its citations frequency with a response percentage (85.8%) and (85.8%) and computed value ($F = 289.9$) and value ($F = 289.9$), respectively. Furthermore, the remaining variables showed non-significant differences as mentioned in the Table 5.

Status of Ethnoveterinary Medicinal Plants
At high altitude, high diversity in medicinal plants population was found. While, as we go toward the plain area, the number of species decreases. The population of most of medicinal plants has been decreased in last 30 years (Table 4). Only few plants, which are cultivated or not grazed by animals, are increased.

DISCUSSION

Floristic Medicinal Contribution
Pakistan has a wide variety of flora and fauna, where flora contains about 6,000 species of phanerogams (1). In Pakistan the local populations of different regions have century’s old knowledge and traditional practices of most of the plants occurring in those regions. This local knowledge of plants has been transferred from generation to generation through verbal communication and personal experience. The local people utilized locally available herbal recipes due to many reasons e.g., the people are poor and cannot afford modern veterinary medicine and there is a long distance between their residence and the area where some modern veterinary facilities are available. Due to this reason the traditional herbal medicine is the first option for the people of Chamla Valley (Study area). Harun-or-Rashid et al. (35) reported from Bangladesh that lack of access to modern veterinary facilities and because of the high prices of medicines, most farmers rely on traditional healers for cure of livestock diseases. Due to this reason the traditional herbal medicine is the first option of the people of Chamla Valley and they depend on medicinal plants to cure various diseases of human and animals.

In the present study, herbal healers and local respondents reported a total of 50 medicinal plants used in the treatment of livestock diseases. These medicinal plants are used for various ailments. Some medicinal plants are used for single disease, while some are used for many diseases. Also species cited for multi disorders were Acacia modesta, Calotropis procera for 3 days sickness and indigestion, Daphne oleoides for weakness and disease in milk production, Grewia optiva for roundworm, tap worms, liver fluke, and placenta retention. Similarly, Jabbar et al. (36) and Tabassam et al. (37) have reported different plant species used in animal treatment from different parts of Pakistan.
Dilshad et al. (38) has reported 66 plant species from Sargodha district of Pakistan and Farooq et al. (39) reported 18 plant species representing 14 families to cure parasitic diseases of livestock from Cholistan desert of Pakistan. In another similar study in Mansehra district, a selected hilly area of Pakistan, Sindh et al. (40) reported 35 plant species belonging to 25 families [also see Ole-Midron (41)].

**Use Value and Relative Frequency Citations**

The medicinally used plants with highest use values were *Butea monosperma*, *Mallotus philippensis*, *Brassica campestris* and *Daphne oleoides*. Greater use values of these mentioned medicinal plants might be due to their widespread distribution and also due to local practitioners’ awareness, which makes those plants as the first choice for ailments (11). Based on the RFC values, the most valuable and cited medicinal plant species by the traditional practitioners and local respondents were *Butea monosperma*, *Mallotus philippensis*, and *Daphne oleoides*. Maximum relative frequency citations clarify the facts that the cited plants species are well familiar to the number of traditional drivers (42) and they should be further evaluated in pharmacognostic studies (43).

**Conservation of Medicinal Plants**

The number of ethnoveterinary medicinal plant species is decreasing, as showed by this study. One reason for this is the excessive and unwise utilization, over grazing, climate change, increase in population, poor method of collection like digging out the whole plant, market pressure and deforestation. The local people cut down the forests for the cultivation of orange fruits and other plants because it is the high source of income for local people. Some plants are collected from the mountains, brought to local market by the local people and then transferred to the major cities. The wild plants are seriously endangered. Some plants are only present only at high altitude such as Maban area while in lower mountains they had been vanished and extinct. Local people want to increase their area of cultivation and for this purpose they burn the whole forest, affecting the whole plant population. For instance, besides being cut off indiscriminately, the seedlings of the *Pinus* were also destroyed during burning of the forest.

The existence of forest is essential for the life of these medicinal plant species, an awareness program in the region about the status of indigenous flora, sustainable plants collection and conservation of important medicinal plants will yield better outcomes (9). The indigenous community should be involved in conservation practices and the local staff, local stakeholders, and plant collectors should be aware about the conservation of plant resources of the area. Sher et al. (44) indicated that the investigated area of district Buner is under heavy deforestation, biotic interference, and overgrazing pressure. Resultantly, valuable economic and medicinal plants of the area are reducing. Sustainable utilization, suitable management and conservation of the flora of the area are highly suggested.

**CONCLUSIONS**

This is the first study to collect and organize data about the medicinal plants that are used in the treatment of livestock diseases and identify those species of plants that are endangered due to indiscriminate usage in Buner district, Pakistan. The results showed that (i) the most common livestock diseases are red water, tympany, constipation, diarrhea, fever, and indigestion, (ii) *Butea monosperma*, *Mallotus philippensis*, *Brassica campestris*, and *Daphne oleoides* are the most representative medicinally plant species, and (iii) *Pacencia emodi*, *Berberis lyceum*, and *Pinus roxburghii* are facing very strong pressure due to their indiscriminate harvesting by the local people.

Therefore, we suggest that there is dire need to protect forest and conserve the habitats for flora and fauna. For this, government and NGOs need to implement strong programs with the participation of local people, which need to be made aware of the importance of conserving the precious forest resources and taking part in the plantation for future generations.

**AUTHOR CONTRIBUTIONS**

KK and NA conceived designed the experiment. KK performed the experiment. IUR analyzed the data. KK, IUR, and NA wrote the manuscript. EC and FI commented and made the final suggestions in the manuscript.

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