Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2023 20(2):431-442. **OPEN ACCESS**

Traditional knowledge on Livestock poisonous plants of District Bajaur, Khyber Pakhtunkhwa Pakistan.

Amir Hasan Khan*[1], Muhammad Adil[1], Ahmad Hassan khan[1], Ateeur Rahman[1], Salimullah[1], Khaleeq Ahmad[2], Ghani Rehman[1] and Bibi Maryam[1], Ambrin, Ayaz Ali Sher[3], Atifa Quddoos[1], Hamid Ullah[1], Muhammad Naseer[1].

[1]Qurtuba University of Science & Information Technology D.I Khan/Peshawar Khyber Pakhtunkhwa, **Pakistan**
[2]Department of Botany Shaheed Benazir Bhutto University, Sheringal, Dir upper**, Pakistan**
[3]Department of Botany, Islamia College Peshawar, **Pakistan**

***Correspondence: amirhasankust@gmail.com** **Received: 12-03-2023, Revised: 08-05-2023, Accepted: 12-05-2023 e-Published: 14-05-2023**

Poisonous plants comprise the third largest category of poisons known around the world. They are the major cause of economic losses in the livestock industry since the advent of civilization. Aim of the present study was to collect and systematically document the traditional knowledge of poisonous plants of Bajaur District for the benefit of humanity before it is entombed forever. Data was collected through semi-structured interviews from the community members and local herbalists. The reported plants were collected post interviews and later on pressed on herbarium vouchers for reference. Afterwards, the data was analyzed through Use value (UV) and Informant consensus factors (Fic) A total of 66 toxic plants were listed from the study site. Most dominant toxic families were *Fabaceae, Asteraceae, Solanaceae, Apocynaceae and Euphorbiaceae*. Most of the poisonous plants were herbs (53.03%), shrub (28.78%) and tree (18.18%) and the leaves toxicity was reported to be the highest (21.88%). And the whole plant toxicity was the highest (18.75%), followed by seed toxicity (14.58%), According to the factor informant consensus; gastrointestinal category had the greatest agreement closely followed by the death category. The most important species on the basis of fidelity level for the death category are *Nerium oleander* L, *Ricinus communis* L., *Euphorbia helioscopia* L., *Narcissus tazetta* L. In the dermatological category, the most important species were *Calotropis procera* (Aiton) W.T.Aiton, *Datura stramonium* L., *Erigeron canadensis* L., *Datura stramonium* L., and *Solanum incanum* L. The most important species of fever category were *Pteridium aquilinum* (L.) Kuhn, Tulipa clusiana Redouté, Similarly the valuable species for the category Gastrointestinal disorders were *Ricinus communis* L, *Euphorbia helioscopia* L, *Narcissus tazetta* L. *Calotropis procera* (Aiton) W.T. Aiton. The current study has an important contribution towards the preservation of indigenous toxic plants' based knowledge. Hence, this is an opportunity to investigate such plants pharmacologically and toxicologically studies are required to ascertain the toxic components of the poisonous plants, so that they may be utilized for the betterment of future generations.

Keywords: Death; Folk knowledge; Poisonous plants; Dermatological; Fabaceae; Gastrointestinal; Toxicity

INTRODUCTION

District Bajaur has a rich and varied flora that includes a wide variety of plants with the potential to cause poisoning of animals and humans. Heavy stock losses caused by plant poisoning have occurred throughout the history of the region, and have given rise to considerable research. Many of the plant defense compounds when consumed by livestock or humans they may also experience negative effects, ranging from mild discomfort to death. It has been estimated that yearly sheep and cattle death losses due to poisonous plants are 3.5% and 1%, respectively (Nielsen et al. 1988).Although there is a large amount of information in the veterinary field, human poisoning appears to be less well documented. Plant poisoning in animals is usually accidental, and most frequently occurs during unfavorable conditions when pastures are poor due to drought, veld fires and overstocking and trampling of the grazing. Consumption of hay contaminated with poisonous plants also occurs. (Botha and Penrith, 2008) In humans it may be accidental or intentional. Accidental poisoning in humans may be due to confusing poisonous with edible plants, contamination of food with poisonous plants, or by the use of plants as remedies. Poisonous plants can affect the entire spectrum of organ systems, with some plants having several toxic principles that affect different systems. (Botha and Penrith, 2008) The dominant effect may depend on the condition, growth stage or part of the plant, the amount consumed, and the species and susceptibility of the victim. While the active principles and mode of action are known for many

plants, many others are known to induce poisoning, but the mechanism of intoxication has yet to be elucidated. Diagnosis of plant poisoning of livestock depends on the history, clinical syndrome observed, post mortem lesions, evidence that plants have been grazed, and remains of toxic plants in the gastrointestinal tract (Botha and Penrith, 2008). Poisonous plants can be classified on the basis of the chemicals they possess such as alkaloids, glycosides (including saponins), nitrates, bitter principles, oxalates, tannins, phenols, and volatile oils. Alkaloids are the most important group of chemical bases that have an alkali like reaction, with over 4000 distinct compounds that have been discovered to date. Nicotine, colchicine, morphine, ephedrine, and atropine (among others) are common alkaloids that are most familiar to the general public. These have a bitter taste and show pharmaco-logical activity that often effect the gastrointestinal tract and the central nervous system (Frohne and Pfander, 1984).(Islamabad paper) Families like Amaryllidaceae, Apocynaceae, Buxaceae, Asteraceae, Euphorbiaceae, Fabacae, Liliaceae, Papaveraceae, Ranunculaceae and Solanaceae are particularly rich in alkaloids. Some pertinent references on poisonous plants have been published in the USA and Europe (Connor, 1997; Cooper and Johnson, 1984; Frohne and Pfander, 1984; Tampion, 1977; Kingsbury, 1964).There has also been ample discussion of poisonous plants in several books and encyclopaedias dealing exclusively with medicinal plants (Heywood and Chant, 1982; Grieve, 1979; Stuart, 1979; Lewis, and Elvin-Lewis, 1977; Anderson, 1967). Likewise, regionally focused information on Indian poisonous plants have been provided in several Indian literature sources (Chopra *et al*. 1984, 1956; Pandey, 1984; Modi, 1945; Dymock, *et al*. 1890-1893). In contrast, only a few references are available on the specific poisonous plants of Pakistan (Baquar, 1989; Ikram and Hussain, 1978; Baquar and Tasnif, 1967).

With the current emphasis on research and development of phytomedicines in District Bajaur it is imperative to be aware of and have some information a than degrading the more common plant poisonings occurring in man and livestock

MATERIALS AND METHODS

Study area

Bajaur is the smallest district of the (EX FATA) having a total area of 1290 km^2. It shares 52 kilometers border with Afghanistan, which is of great importance to Pakistan and the region. The study area lay at an altitude of 1126 meter above the sea level and geographically exists between 34^0-30^0 and 34^0-58^0 latitudes and 71^0-$11^0$and 71^0-30^0 longitudes. The Bajaur is surrounded to the west by Kunar valley of Afghanistan being separated by the rugged Hindukush hills and other mountain passes known as Nawa Pass, Ghakhi Pass and Letaisar being the notable ones. The agency borders on south with Mohmand agency, on east with lower Dir Districtand the Panj kora River, and on north with the watershed between Bajaur agency and district Dir. Moreover, the agency is situated at the extreme end of the Himalayan Range. The areas dominated by agricultural lands are receiving about 800 mm of average rain fall per annum. The two main tribes of Bajaur Agency known as Tarkani and Utman Khel are mainly populated into seven Tehsils including Barang, Nawagai, Khar, Mamund, Salarzai, Utmankhel and Chamarkand. By profession, mostly the people are farmers, teacher, drivers, and doing small scale businesses and jobs inside/outside the country. Almost every household has a herd of domestic animals for socioeconomic gains. There are only three-degree level colleges and five higher secondary schools. Moreover, there are only two government hospitals in the study area, while most people are deprived of modern health facilities, which justify their reliance on local herbalists (Hakims). The study area consists of one veterinary hospital and 20 small dispensaries to treat the domestic cattle. However, the local people still rely on traditional recipes due to larger distances from the aforementioned health centers.

Ethnomedicinal data collection and ethnographic composition

In the month of April, respondents were targeted based on their strong reputation in the field of ethno medicinal knowledge while field survey was conducted from May to August 2016. Field visits were carried out prior to medicinal data collection in order to acknowledge the cooperation of the indigenous communities. Mr. Amir Hasan Khan, the local occupant of the area visited different sites with his volunteer team including a taxonomist and a pharmacist. He arranged several meetings with the local representatives known as Maliks, to whom objectives of the study were presented.

A semi structured questionnaire was developed to gather knowledge on ethno veterinary plants by following the method adopted by Martin (Martin, 1995). Mostly the folk knowledge was gathered from nomads, farmers and aged community members. The interviews were conducted at various places and in the local language called “Pashto”. Each informant was acknowledged by presenting main theme of the study to them in order to gain their consent and trust, which allowed the informants to talk more freely and openly. The recorded information was once again redisplayed to the informants to avoid errors and falsification.

Data was collected from different sites known as Kharai kamr, Landy, Meena, Daber, Bilot, Malangi, Larkaly , Laghari, Ghkhay, Inayat qill, Khar, Loee sum, Zor bandadr, Nawagai, Mandal, Pashat, Tali, kotkay, Raghagan, Chorak. Arang, Ghar shamozai, Barang, Jar, Ghani Adda, Loee and Wara Mamund. Accordingly, the sites were categorized into foothill villages and mountainous villages. A total of 110 key respondents were selected belonging to different age groups i.e.98male and

12 female (Table 1). The selection of respondent was based on their high reputation with respect to traditional knowledge on ethno veterinary plants. Continuous relationships were maintained with the indigenous communities throughout the course of survey for the strong validation of traditional knowledge.

Table 1: Reflect the number and details of inhabitants

Category	Total	Percentage (%)
Gender		
Male	98	89
Female	12	11
Age group		
30-50	40	36
>50	70	64
Occupation		
House wives	15	14
Herders	50	45
Farmers	25	23
gujjars	20	18

Preservation and taxonomical verifications of plant species

Surveyed Poisonous plants were collected and identified by taxonomist at the Qurtuba University of Science & Information Technology D.I Khan/Peshawar Khyber Pakhtunkhwa, Pakistan. Species botanical names and their family names were corrected and verified through the website www.kew.org/mpns. After collection, plants were pressed and dried under the shade, poisoned (1% $HgCl_2$ solution), and were mounted properly on the herbarium sheets for future reference. Each herbarium sheet was labeled with a voucher number and submitted to the aforementioned department (Ali and Nasir, 1989; Ali SI and Qaiser, 1993).

Data analysis

Use value (UV)

This index was used and applied to demonstrate the relative importance of each taxa used by the local communities. The use value (UV) was calculated as follow: ΣU V = U/N i

where Ui is the number of uses describe by each respondent for a given species and N shows the total number of respondents taking part in the survey (Phillips and Gentry, 1993).

Informant consensus factors (Fic)

Informant Consensus Factor (Fic). Factor informant consensus (Fic) was applied to analyze overall usage of medicinal plants with respect to specific culture applicability. Informants' consensus between cultural groups and in the community specifies which plant is commonly applied, therefore include in selection of plants for photochemical and pharmacological studies (Giday *et al*. 2007; Khan *et al*. 2014). According to such kind of analysis disorders were classified into groups like plant species having high Fic value can be considered to be more pharmacologically effective as compared to plant species with low Fic value (Ragupathy et al., 2008). A maximum Fic values remains maximum if one or few plant species are acknowledged to be applied by huge figure of respondents to treat a particular disease. On the other hand, low Fic values provide an indication that informers were approved over what kind of plant to be used (Heinrich *et al*., 1998; Canales *et al*., 2005; Khan *et al*. 2014). Fic value may be calculated by the formula

Fic=nur–nt/nur-1

Where Fic = Informants consensus factor, nt = number used species while nur = number of use citation in each group.

Fidelity level (FL %):

Fidelity level (FL) is the percentage of informants, who claim the use of a specific species for the same major use, which can be carried out through fidelity level formulated by (Alexiades, 1996).

FL%= IP/Iux100

Where 'Ip' denote the number of use report cited for a given plant species for a specific disease category and 'Iu' is the number of use report cited for a given plant. High FL values are near 100% is obtained for plants for which, all use reports refer to the same disease category, while, low FL value is obtained for species that are used for different disease (Musa *et al*. 2011).

RESULTS

Prospects and challenges to traditional ethno veterinary knowledge

Indigenous communities play significant role in reporting traditional uses of medicinal flora. Indigenous knowledge can be used as a tool to conserve and maintain the green diversity, and could be further utilized for scientific validation (Mishra, 2013). During the 32nd session of UNESCO, traditional knowledge on ethno veterinary medicines was declared an important part of cultural heritage, which is required to be brought under study, sustenance and protection (Suroowan *et al*. 2017). Indigenous communities at Bajaur Agency are dependent on livestock for supporting their livelihood livestock losses caused by plant poisoning have occurred throughout the history of the region, and have given rise to considerable research. Many of the plant defense compounds when consumed by livestock or humans they may also experience negative effects, ranging from mild discomfort to death. It has been estimated that yearly sheep and cattle death losses due to poisonous plants are 3.5% and 1%, respectively (Nielsen et al. 1988). In our study, we have observed that the herders, farmers and older community members are more equipped with traditional knowledge, and familiar with veterinary medications and their toxicity. .

Indigenous people of the study area are rich in traditional knowledge on veterinary medicines, and plant toxic effect which may be due to their close observation on domestic animals being considered as an important part of traditional life style. Most commonly, the male community member grazes herds of animal, while female stake part in households' management. Figure 3 and 4 showed some of the images of the grazed domestic animals; treated with medicinal plant in the area. Other studies have explained this in a different way that men due to close proximity tend to know more about the animal behavior than women (Giovannini et al. 2011).

People of the study area not only use plants for medicinal purposes to treat their domestic animals but also as a fodder. Local community also prevents their animals from such nutrition, which is not healthy in certain conditions and seasons. One may consider this prevention to be a part of ethno veterinary practices. Nutrition is playing an important role in ethnoveterinary practices in both prevention and cure of domestic animals (Viegi *et al*. 2003; Ogle *et al*. 2003). Livestock usually ingests some extra and non-important food substances in the green fodder, which could be termed as food medicines or medicinal food (Ogle *et al*. 2003). Studies have highlighted the importance of "*food as medicines*" in the context of local traditional knowledge, however possible health advantages of food in in ethnoveterinary methods need further attention (Pieroni *et al*. 2006). Testing the nutritional status of each traditional ethnoveterinary remedy is not necessary however, it is essential to evaluate the biological efficacy from the phytochemical, pharmacological, toxicological and clinical perspectives for wider application. A considerable proportion of the documented uses of plant taxa in our study area accordance with the established pharmacological effects (Disler *et al*. 2014).

The prevailing indigenous ethnoveterinary and toxic plant knowledge in the study area is facing certain constrains leading it towards extinction. As an example, the nature of traditional knowledge is making it more difficult to learn and then transfer it in an accurate way. Furthermore, practicing traditional therapies are not being respected by the new generation. Other challenges include low literacy rate in the study area, no proper documentation of indigenous knowledge, and introduction of modern allopathic medicines, rapid technological advancement, and environmental degradation. Similar kinds of threats have also been reported in other communities across the world (Pei, 2001; Liu *et al*. 2009; Matekaire and Bwakura, 2004; Mathias and McCorkle, 2004; Shen *et al*. 2007).Informants with little education were foundless familiar to the traditional knowledge while people having no formal education were more responsive in this regard. Some studies have found that education can be correlated with expertise either positively (Reyes-García et al. 2005; Ruiz-Mallén et al. 2009) or negatively (Reyes-García et al. 2010), while others found no relationship (Godoy et al. 2009). Moreover, it is also ambiguous to determine the effect of "modernity" on the loss of ethno medicinal knowledge. Modernity has an established association with greater medicinal competence in Dominica (Quinlan and Quinlan, 2007), but appeared unrelated to variation in expertise among Tsimane horticulturalists in Bolivia (Reyes-García *et al*. 2005). In summary, despite maintaining knowledge on ethno veterinary practices by the locals, the tendency to utilize modern pharmaceuticals is increasing day by day. Hence, the conservation of toxic plant and ethnoveterinary knowledge by the local communities is extremely important for the livestock's health in the remote areas.

(Traditional knowledge on poisonous plants of Udhampur district of Jammu and Kashmir, India for refrences

Floristic characteristics of poisonous plants

A total of 66 species belonging to 34 families were reported in the study site (Table 2).Family Solanaceae 8 species was the most represented family, followed by Asteraceae 7 species, and Fabacea 5 species, Amaranthaceae, Amaryllidaceae3, species and Euphorbiaceae 2species(Figure 1)

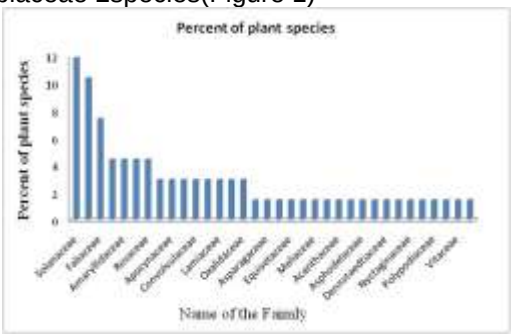

Figure 1: Percent of plant species belonging to different families reflecting poisonous effect

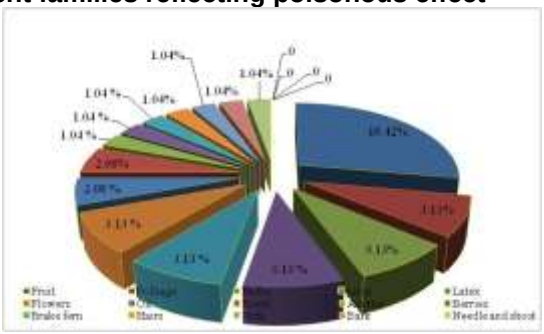

Figure 2: Reflecting the toxic parts among the studied plant species.

Toxicity was observed either in the whole plant or confined to one or more plant parts. Leaves toxicity was reported to be the highest (21.88%). Among the different plant parts, whole plant toxicity was the highest (18.75%), followed by seed toxicity (14.58%), fruit toxicity (10.42%), stem toxicity (7.29%), latex, bulbs, flower, juice, follage toxicity (3.13%), root and oil toxicity (2.8%), Acorns, Berries, Hairs, Pods ,shoot and Bark toxicity

(1.04%).(Figure 2)

Plant toxicity of livestock

Animals observed to be adversely affected by poisonous plants in the study area 27.27% cattle, 25% sheep, 19.32% goats, 4.55% horses of the 66 poisonous species, majority were responsible for causing purgation and dermatitis (7.1% each) followed by deaths (13.77%) , vomiting (11.98%). Diarrhea (10.78 %), Nausea (6.59%), Gastroenteritis (5.39 %), Convulsions, Dermatitis, Weakness, rapid breathing (4.19 %), Colic (3.59 %), Bloating, Vertigo and Dyspnea (2.99 %), Abortion and Anorexia (2.40%) , Fever (2.40 %), Agitation (1.8 %), Anemia (1.20 %), Dizziness , Gait, Drooling, Drowsiness , Aneurysm, Paralysis (1.20 %), staggering, seizures, staggering, loss of consciousness, eye blindness permanent, emaciation, apathy, excessive urination, calm, animal stops cuddling, ataxia , abdominal pain (0.60 %).

Figure 3: Image of died animal

Figure 4: Image of died animal

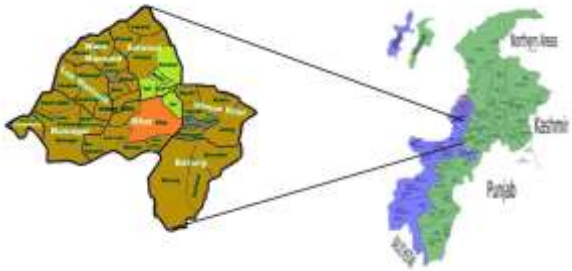

Figure 5 : Map of the study area and area site in Pakistan

Factor informant consensus (Fic)

The results of Fic show that the gastrointestinal disorders had the greatest agreement with a Fic of 0.80, followed by death (0.84), dermatological (0.76) Fever (0.80), gastrointestinal (0.80), Respiratory disorders (0.70), Galactagogue (0.90), Abortion (0.80), Nervous disease (0.90). Death category was122 reports which was the highest number, vomiting reports 112 which is second highest number and diarrhoea had 98 reports within the gastrointestinal category. 79 reports were recorded for the respiratory disorder category. The dermatological reports had 76. In the fever category 24 reports and the abortion category 11 reports, there were 8 reports of Galactagogue (Table 3).

Fidelity level (Fl)

The most important plant in each category of illness was analyzed using fidelity level. For this analysis, the plants mentioned only once were not considered. For death category, *Nerium oleander* L, (Fl;98.61), *Ricinus communis* L. (Fl;97.1), *Euphorbia helioscopia* L. (Fl;97.06), *Narcissus tazetta* L. (Fl;97.06), *Datura stramonium* L. (Fl;96.72), *Sorghum bicolor* (L.) Moench, (Fl;94.74), and *Prunus persica* (L.) (Fl;92.45) (Table 3). In the dermatological category, the most important species were Nerium oleander L. (Fl;98.61), Narcissus tazetta L (Fl;96.97), Calotropis procera (Aiton) W.T.Aiton (Fl;96.88), *Datura stramonium* L. (Fl;96.72), *Erigeron canadensis* L. (Fl;92.45) *Datura stramonium* L.. (Fl;96.72) and *Solanum incanum* L. (Fl;90.91). The most important species of fever category were *Calotropis procera* (Fl;100), *Pteridium aquilinum* (L.) Kuhn (Fl;90), *Tulipa clusiana* Redouté (Fl;89.29), *Celtis australis* L. (Fl;83.33) and *Malus domestica* (Suckow) Borkh (Fl;79.79). Similarly the value able spcies for the category Gastrointestinal were *Ricinus communis* L. (Fl;97.1), *Euphorbia helioscopia* L. (Fl;97.06), *Narcissus tazetta* L. (Fl;96.97) *Calotropis procera* (Aiton) W.T.Aiton (Fl; 60). (Table 3)..The most important species for the category Respiratory disorders *Nerium oleander* L. (Fl; 98.61), *Euphorbia helioscopia* L. (Fl; 97.06), *Lolium arundinaceum* (Schreb.) Darbysh (Fl; 96.08), *Colchicum luteum* Baker (Fl; 95), *Erigeron canadensis* L. (Fl; 92.45). The most important species for the category Galactagogue *Pinus ponderosa* Douglas ex C.Lawson (Fl; 91.49), *Melia azedarach* L. Lawson (Fl; 82.35) The most important species for the category Abortion *Nerium oleander* L. (Fl; 98.61), *Pinus ponderosa* Douglas ex C.Lawson (Fl; 91.49) and *Cuscuta reflexa* Roxb. (Fl; 70.83). The most important species for the category Nervous disease *Nerium oleander* L, (Fl; 98.61), *Ricinus communis* L. (Fl; 97.1), *Euphorbia helioscopia* L. (Fl; 97.06), *Narcissus tazetta* L. (Fl; 97.06), *Datura stramonium* L. (Fl; 96.72), *Sorghum bicolor* (L.) Moench, (Fl; 94.74), and *Prunus persica* (L.) (Fl; 92.45)

Biodiversity concerns

It is widespread phenomenon that natural resources

including plants are always prone to threats in their natural habitat due to rapid human intervention and destructions of natural resources. The collection process of medicinal plants for ethnic practices and other anthropogenic practices are not only destructing the indigenous flora but also posing a threat to the traditional knowledge. UNESCO has emphasized on the documentation and preservation of traditional knowledge in South Asia generally, and Pakistan and India particularly. However, efforts are going on but they are not sufficient for the conservation of traditional knowledge persistent since several centuries, and which can lead to valuable discoveries in modern healthcare system. The local perception of indigenous communities regarding the threats being faced to the ecological resources especially the medicinal plants was examined in the current study. Lack of awareness has been observed as a major threat to the conservation of plant resources. It was also observed that different factors including time of collection, processing, storage and herbal preparations are important and necessary steps to be considered both for economic returns and conservation. Mainly, the local healers are involved in the collection of medicinal plants. A study in the Swat region of Pakistan has shown that higher economic outcomes can be obtained from proper harvesting of wild medicinal plants as compared to the standard cash crop (Sher et al. 2015). Other studies are supporting our results by showing an enormous potential in improving the harvesting, storage, use, preparation and marketing of the herbal product as a source of income (Sher and Barkworth, 2017; Aziz et al. 2016). In the remote areas of the study region, local inhabitants obtained significant economic advantages from forest products. Similar advantages have been reported for other mountainous communities in the northern parts of Pakistan (Ahmad et al. 2015).

There are certain other threats to the medicinal plant resources of the study area, which include deforestation, heavy grazing pressure, uncontrolled collection of fodder, and other non-timber forest products by the local people, and traders. Several studies have reported a decrease in the number of medicinal plants due to over exploitation and environmental degradation (Hussain *et al*. 2006; Ahmad *et al*. 2014). It is therefore, a dire need to manage and design the overall grazing system to encourage the sustainable regeneration and protection of medicinal plants. Keeping the observation and findings of the current investigation, proper management steps should be taken with the active participation from the indigenous communities to conserve this precious flora. It is also important to aware the local people about the market value and sustainable harvesting of medicinal plants. Rapid modernization and urbanization is not the only threat for plant species' degradation but also pose a threat for the associated folk knowledge. That is why that the disappearance of folk knowledge has been declared more in danger than the natural resources themselves (Odora Hoppers, 2002; Dweba and Mearns, 2011). Therefore, we present a strong recommendation that ethnobotany as a subject should be included into the curriculum to help students in recognizing the endangered and medicinally important species of their respective regions. In addition, incentives may be given to farmers for the cultivation of medicinal plants on marginal lands and home gardens.

DISCUSSION

In the study the modes of action of the most important toxins have been discussed. In table 1, poisonous plants of district Bajaur are tabulated, with some details of their toxins and toxicology. It is not only important to know these plants in order to avoid intoxication of children, pets or livestock, but these plants or their compounds might be used as natural pesticides against insects, slugs or rodents (Wink 2007). A total of 110 informants from various age groups and professions were interviewed to record the information. The information so collected can be used to perform further physiochemical and pharmacological studies. The two indices used in the present study tell about the main aliments caused as a result of the poisonous plants (using Fic value) and the most important species causing a particular ailment (using Fl value). Plant poisoning in animals is usually accidental, and most frequently occurs during unfavorable conditions when pastures are poor due to drought, wild fires and overstocking and trampling of the grazing land. Accidental poisoning in humans may be due to confusing poisonous with edible plants and contamination of food with poisonous plants (Botha and Penrith, 2008), or by the use of toxic plants as medicine, with many cases, including fatal cases, presumed to occur without diagnosis or documentation (Gaillard and Paquin, 1999). The poisonous plants contain powerful toxic ingredients (phytochemicals) which if introduced in to the body of any animal, may be of relatively smaller quantity, will affect deleteriously and may be fatal at times (Apollo *et al*. 2006). These toxic ingredients act by injuring the protoplasm of the cell and the harmful effects produced may be immediate or accumulative (Apollo et al. 2006) and their concentration varies from plant to plant and season to season. The important poisonous plants causing different ailments have also been recorded in earlier studies (Jones, 1978; Frohne and Pfander, 1984; Smith, 1988; Desai, 1999; Van Wyk *et al*. 2002; Agaie *et al*. 2007; Botha and Penrith, 2008; Ozturk *et al*. 2008) along with discussing the various chemicals present in them resulting in the toxicity. Family is an important taxonomic classification level for determining the usefulness of plant species to local people (Thomas *et al*. 2009). This is also true for the toxicity of plants (Huai *et al*. 2010). Fabaceae, Asteraceae, Euphorbiaceae and Apocynaceae have been reported as the main families containing toxic plants in other studies (Levetin and McMahon, 2008; Ozturk *et al*. 2008; Huai *et al*. 2010). These families are toxic because of the presence of toxins

like alkaloids, dicoumarin, glycosides, photosensitizing compounds, saponin, selenium (Fabaceae), acrid substances, alcohol, alkaloids, glycosides, nitrogenous compounds, photosensitizing compounds, saponins, selenium, volatile oils (Asteraceae), acrid substances, croton oil, photosensitizing compounds, biterpinoids, triterpenoids, steroids, alkaloids, cyanogenic glucosides and glucosinolates (Euphorbiaceae), resin, glycosides (Apocynaceae) (Abdel-Fattah, 1987; Yamamura et al. 1989; Madureira et al. 2004; Barla et al. 2006; Zhang and Guo, 2006;). Alkaloids are highly poisonous and can effect nervous system and damage liver, and may cause locoism, trembling, abortion, depression, paralysis, vomiting and even death, whereas glycosides may cause excitement, gasping, staggering, paralysis, prostration, convulsions, blindness, coma and death; nitrogenous compounds may result in to abortion, depression, haemorrhages, coma and death; compounds causing photosensitivity may cause liver damage, inflammation of skin, itching, necrosis of skin, restlessness, and death due to kidney failure; resins may cause direct irritation of the nervous and muscular tissues, depression, weakness, staggering, laboured breathing, degeneration of kidney, coma and death (Madureira *et al*. 2004). Most of the poisonous plants are herbs and shrubs as they are more readily available to livestock whereas tree fodder is available to them only when herdsmen climb and cut branches, mainly during scarcity of feeds (Agaie *et al*. 2007). In the present study, the four important categories of ailments caused by poisonous plants were gastrointestinal, dermatological, sexual and death ailments. Factor informant consensus (Fic) is a good analytical tool to select categories of illness (Andrade-Cetto, 2009). Therefore, the gastrointestinal ailments with maximum Fic of 0.85 were the main problem caused by the poisonous plants followed by death (Fic= 0.84). The gastrointestinal disorders were caused by 36 species, death by 20 species, dermatological ailments by 15 species and 13 species caused sexual illness. This further confirms that animals are affected more by consumption of the poisonous plant than coming in contact of that. The gastrointestinal ailments are the first response towards the toxins of the poisonous plants and if not identified and cured at a right time they result into the death of the animal. A number of poisonous plants induce diarrhoea when consumed, although the toxins and their mode of action, where known, differ. Some of the poisonous plants with high fidelity level like *Cannabis sativa, Cassia occidentalis, Euphorbia helioscopia*, *Euphorbia hirta, Jatropha curcas* have been reported to affect the gastrointestinal tract in some other studies also. Cannabis sativa has leaves and flowers as the poisonous parts. Although no fatalities of humans have been reported, the effects on a young child accidentally ingesting these plants are bound to be very disturbing to the parents (Jones, 1978; Smith, 1988). The most common acute adverse effects are anxiety, panic reactions, and psychotic symptoms, all of which are most often reported by naive users (Hall and Pacula, 2003). Ingestion of large amounts of seed pods of Cassia occidentalis by grazing animals has caused serious illness and death (Suliman and Shommein, 1986). Although all parts of the plant are toxic, most poisoning occurs when animals eat the pods and beans, or are fed green-chop containing Cassia plants (Rogers et al. 1979). *Euphorbia helioscopia* contains euphonin, diterpenoid, triterpenoid and steroid (Yamamura *et al*. 1989; Madureira *et al*. 2004; Barla *et al*. 2006; Zhang and Guo, 2006) that causes inflammation and diarrhoea (Baytop, 1984) and irritation to livestock that ingestion it (Cooper and Johnson, 1984a,1984b). Rajeh et al. (2012) reported preliminary oral acute toxicity of *Euphorbia hirta* leaf methanol extract. Jatropha curcas contain a toxalbumin, namely curcin, which can cause severe diarrhoea (Botha and Penrith, 2008). Skin diseases included dermatitis, itching, sores, cracking of skin, inflammation, loss of hairs, etc. The species with high fidelity level for skin disorders were *Euphorbia royleana, Leucaena leucocephala, Parthenium hysterophorus*, etc. The latex of *Euphorbia royleana* has also been reported as an irritant to the skin and eye by Basak *et al*. (2009). The poisonous properties of *Euphorbia royleana* latex are due to the presence of several compounds i.e. epitaraxerol, ellagic acid, euphol, taraxerol, sitosterol, m-hydroxy benzoic acid, 7-hydroxy-3,4-benzcoumarin, 7-methoxy-3,4-benzcoumarin, 2,7-dihydroxy-3,4-benzcoumarin, etc. (Rastogi and Meharotra, 1993; Tiwari *et al*. 2008). Natural poisoning by *Leucaena leucocephala*, a leguminous fodder shrub found in tropical regions, has been described in sheep, cattle, pigs and horses (Tokarnia *et al*. 2000). Some studies on experimental poisoning have shown that in ruminants that ingest Leucaena leucocephala, the clinical signs can be acute, with loss of hair, particularly in the extremity of the tail, and loss of weight. When the plant is ingested for one to ten months, there are alopecia, loss of appetite and weight, excessive salivation, uncoordinated walk, hypertrophied thyroid, and low levels of circulating thyroid hormones (Jones et al. 1978; Jones, 1985). Hair-loss, reduced fodder uptake, salivation, excitation, ataxia of hind limbs, vomit, uncoordinated chewing of fodder, swollen buccal papillae, ulceration and necrosis of the oesophagus, and haemorrhagic lesions in the reticulum and rumen have been observed in experimental poisoning in goats (Martinez and Seifert, 1991). Incorporation of Parthenium hysterophorus into the diet of livestock was found to cause chronic or acute toxicity, due to the presence of parthenin, depending upon the quantum of the weed ingested (Narasimhan *et al*. 1984). The toxicity of the weed to cattle and buffalo was shown to have a significant amount (10–50%) as the weed in the diet had killed animals within 30 days (Narasimhan *et al*. 1997). In addition, the toxicity of Parthenium causes animals to develop dermatitis with pronounced skin lesions. The animals eventually die due to rapture of tissue and haemorrhage in their internal

organs (Ahmed et al. 1988). Carica papaya, *Thevetia peruviana* and *Calotropis procera* were the main poisonous species responsible for sexual problems, especially abortion. Phytochemical analysis revealed that *Carica papaya* seed extract contained mainly papain, a sulfhydryl protease and chymopapain, which have lysosomal action (Brocklehurst and Kierstan, 1973; Leipner and Saller, 2002). Smith et al. (1986) reported that papain broke down the inter-cellular matrix of cartilage while Cherian (2000) documented that *crude Carica papaya* latex contain a uterotonic principle which might be a combination of enzymes, alkaloids and other substances that evoke sustained contraction of uterus. Thevetia peruviana plants are toxic to most of the vertebrates as they contain cardiac glycosides like thevetin A and B (Singh et al. 2012). Singh et al. (2012) reported many cases of intentional and accidental poisoning of humans. In the present study, Thevetia peruviana is misused as abortifacient. Singh et al. (2012) also reported that the seeds of *Thevetia peruviana* are used as abortifacient, and purgative in rheumatism and dropsy. *Calotropis procera* was used as abortifacient by the locals. Jain *et al*. (1996) and El-Badwi and Bakhiet (2010) have also described *Calotropis procera* to be an abortifacient by stimulating a spontaneous contraction on the myometrium. Phytochemically, the plant has been investigated for cardenolide from latex and leaves of plants, triterpenoids, anthocyanins from flowers and hydrocarbons. The leaves and latex of *Calotropis procera* were found to have cardiac glycosides which include calotrogenin, calotropin, uscharin, calotoxin, calactin (Al-Robal *et al*. 1993; Mueen *et al*. 2005). Some other species with low fidelity level in the present study have been reported as highly poisonous or have high fidelity level in other works. Ingestion of the ripe berries of Melia azedarach has been associated with vomiting, diarrhoea, dyspnoea, muscle tremors and convulsions in children (Van Wyk *et al*. 2002). Pigs are most susceptible to poisoning by Melia azedarach, in particular the ripe drupes, which have also been incriminated in poisoning in children, but cases of poisoning have also occurred in sheep and cattle (Kellerman *et al*. 2005). Seeds of *Lathyrus sativus* contain a toxic amino acid which in large quantities can cause a very serious disease of the nervous system known as 0 lathyrism0 (Frohne and Pfander, 1984). All parts of *Ranunculus sceleratus* are poisonous. It contains a toxic irritant that produces protoanemonin upon mastication (Cooper and Johnson, 1984a,1984b). Ricin, derived from the castor oil plant *Ricinus communis*, is one of the most toxic substances known (Botha and Penrith, 2008). Lantana camara (Verbenaceae) is another important cause of poisoning in cattle. Although this exotic weed is generally unpalatable to livestock, its abundant availability at times when pasture is scarce results in ingestion by hungry cattle (Botha and Penrith, 2008). Affected animals develop photosensitivity and jaundice as a result of retention of phylloerythrin and bile stasis, which is ascribed to damage to the bile canaliculi caused by the action of the toxins (Botha and Penrith, 2008).

CONCLUSION

Poisonous plants are those which, when eaten or come in contact with, are harmful to the normal health of man and livestock. They mainly result into gastrointestinal and dermatological disorders. The poisonous nature of these plants is due to production of toxic substances such as alkaloids, glucosides, amines, toxalbumins, picrotoxins, resins, saponins, tannins, essential oils. It is important to be aware of these plants and their toxicity symptoms. it is suggested that further studies are needed to be conducted to confirm the traditional information associated with poisonous plants using appropriate experiments and determine the identity of toxic phytochemicals associated with the poisonous plants, so that compounds of pharmacological interest having potential application in the treatment of human diseases may be discovered.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEDGEMENT

The authors extend their high appreciation and acknowledgment towards the local communities by providing moral support to the authors.

AUTHOR CONTRIBUTIONS

AHK and GR conducted the field work. AHK wrote the draft manuscript. AH, AR SU helped in data collection. KA, BM, AM, HU, MN, AA. helped in the compilation of Data. MA technical comments on the draft and indicated the language and grammatical mistakes. MA supervised all the stages. All the authors read and approved the Manuscript.

REFERENCES

Abdel-Fattah, M.R., 1987. The chemical constituents and economic plants of the Euphorbiaceae. Bot. J. Linn. Soc. 94, 293–326.

Agaie, B.M., Salisu, A., Ebbo, A.A.,2007.A surveyof common toxic plants oflivestock in Sokoto State, Nigeria. Sci. Res. Essay 2 (2), 40–42.

Agaie, B.M., Salisu, A., Ebbo, A.A.,2007.A surveyof

common toxic plants oflivestock in Sokoto State, Nigeria. Sci. Res. Essay 2 (2), 40–42.

Ahmad K, Ahmad M, Weckerle C: Ethnoveterinary medicinal plant knowledge and practice among the tribal communities of Thakht-e-Sulaiman Hills, West Pakistan. J Ethnopharmacol. 2015;170:275-283.

Ahmad M, Sultana S, Fazl-i-Hadi S, Hadda TB, Rashid S, Zafar M, Khan MA, Khan MPZ, Yaseen G. An ethnobotanical study of medicinal plants in high mountainous region of Chail valley (District Swat-Pakistan). J EthnobiolEthnomed. 2014;10:36.

Ahmed, M.N., Rao, P.R., Mahendar, M., 1988. Experimental induction of acute toxicity in buffalo calves by feeding Parthenium hyterophorus. Indian J. Anim. Sci. 58, 731–734.

Alexiades, M.N. 1996. Collecting ethnobotanical data: an introduction to basic concepts and techniques. Advances in Economic Botany, 10: 53-96.

Ali S I, Nasir YJ (Eds.). Flora of Pakistan. Nos. 191–193. Department of Botany.University of Karachi and National Herbarium, PARC, Islamabad Pakistan. 1989–1991.

Ali SI, Qaiser M (Eds.). Flora of Pakistan. Nos. 194-218. Department ofBotany, University of Karachi, Pakistan. 1993-2011.

Al-Robal, A.A., Abo-Khatwa, A.N., Danish, E.Y., 1993. Toxocological studies on the latex of the usher plants Calotropis procera (Ait). R. Br. in Saudi Arabia 111. Effects of usher latexon the fine structures, oxygen consumption and Naþ/kþtransporting ATPase activity of albino rat kidneys. Arab-Gulf J. Sci. Res. 11 (3), 441–445.

Anderson, E. 1967. *Plants, Man and Life,* pp. 124-135, University of California Press, Berkley, USA.Baquar, S.R.H. 1989. *Medicinal and Poisonous Plants of Pakistan,* 506 pp., Printas Karachi, Pakistan.

Andrade-Cetto, A., 2009. Ethnobotanical study of the medicinal plants from Tlanchinol, Hidalgo, México. J. Ethnopharmacol. 122, 163–171.

Apollo, M., Dash, S.K., Padhy, S., 2006. Eco-consciousness for poisonous and injurious plants among urban dwellers of Bhubaneswar, Orissa. J. Hum. Ecol. 19 (4), 239–248.

Aziz M A, Adnan M, Khan AH, Rehman AU, Jan R, Khan J. Ethno-medicinal survey of important plants practiced by indigenous community at Ladha subdivision, South Waziristan agency, Pakistan. J EthnobiolEthnomed. 2016;12:53.

Baquar, S.R., Tasnif, M. 1967. *Medicinal Plants of Southern West Pakistan,* pp. 7-119, Pakistan Council of Scientific and Industrial Research, Karachi, Pakistan.

Barla, A., Birman, H., Kültür, S., Öksüz, S., 2006. Secondary metabolites from Euphorbia helioscopia and their vasodepressor activity. Turk. J. Chem. 30, 325–332.

Barla, A., Birman, H., Kültür, S., Öksüz, S., 2006. Secondary metabolites from Euphorbia helioscopia and their vasodepressor activity. Turk. J. Chem. 30, 325–332.

Basak, S.K., Bakshi, P.K., Basu, S., Basak, S., 2009. Keratouveitis caused by Euphorbia plant sap. Indian J. Ophthalmol. 57 (4), 311–313.

Baytop, T., 1984. Therapy with Medicinal Plants in Turkey. University Press, Istanbul, pp. 385–386

Botha, C. J., & Penrith, M. L. (2008). Poisonous plants of veterinary and human importance in southern Africa. *Journal of ethnopharmacology*, *119*(3), 549-558.

Botha, C.J., Penrith, M.-L., 2008. Poisonous plants of veterinary and human importance in southern Africa. J. Ethnopharmacol. 119, 549–558.

Brocklehurst, K., Kierstan, M., 1973. Propapain and its conversion to papain: a new type of zymogen activation mechanism involving intramolecular thiol-disulfide interchange. Nat. N. Biol. 242, 167.

Canales M, Hernández T, Caballero J, Romo de Vivar A, Avila G, Duran A, Lira R. 2005. Informant consensus factor and antibacterial activity of the medicinal plants used by the people of San Rafael Coxcatlán, Puebla, México. Journal of Ethnopharmacology 97, 429–439.

Cherian, T., 2000. Effect of papaya latex extract on grand and non-gravid rat uterine preparations in vitro. J. Ethnopharmacol. 70, 205–212.

Chopra,R.N.,Badhwar,R.L.,Ghosh,S.1984.*Poisonous Plants of India,* vol.1, pp. 13-23, Academic Publishers, Jaipur,India.

Connor, H.E. 1997. *The Poisonous PlantsinNew Zealand.*E.C.Keating(ed),pp.14-27,2nd edition.

Cooper, M.R., Johnson, A.W. 1984.*PoisonousPlants in Britain and their Effects on Animals andMan.*

Cooper, M.R., Johnson, A.W., 1984a. Poisonous Plants in Britain and their Effects on Animals and Man. Her Majesty0s Stationary Office, London, UK p. 237 Cooper, M.R., Johnson, A.W., 1984b. Poisonous plants in Britain and their effects on animals and man. Her Majesty0s Stationery Office, London, England p. 305

Desai, K.N., 1999. Poisonous plants of Goa. Zoo0s Print J. I–XIV 3–12, 175–176.

Disler M, Ivemeyer S, Hamburger M, Vogl CR, Tesic A, Klarer F, Meier B, Walkenhorst M. Ethnoveterinary herbal remedies used by farmers in four north-eastern Swiss cantons (St. Gallen, Thurgau, Appenzell Innerrhoden and Appenzell Ausserrhoden). J EthnobiolEthnomed. 2014;10:32.

Dweba TP, Mearns MA. Conserving indigenous knowledge as the key to the current and future use of traditional vegetables. Int J Inform Manag. 2011; 31:564-571.

Dymock, W., Warden, C.J.H., Hooper, D. 1890-1893. *Pharmacographia Indica.* vol. 1, pp. 59-81, Education Society's Press, Bombay, India.

El-Badwi, S.M.A., Bakhiet, A.O., 2010. Toxicity of Calotropis procera latex in pregnant and non-pregnant goats. Sci. Res. Essays 5 (17), 2404–2408.

Flores KE, Quinlan MB. Ethnomedicine of menstruation in rural Dominica, West Indies. J Ethnopharmacol.2014;14:153(3):624-34.

Frohen, D. Pfander, H.j.1984. A colore Atlas of poisonous plant , pp.113-291, wolfe publishing Ltd, London, Uk.

Frohne, D., Pfander, J., 1984. A Colour Atlas of Poisonous Plants. Wolfe, ISBN 0723408394.

Frohne, D., Pfander, J., 1984. A Colour Atlas of Poisonous Plants. Wolfe, ISBN 0723408394.

Gaillard, Y., Paquin, G., 1999. Poisoning by plant material: review of human cases and analytical determination of main toxins by high-performance liquid chromatography-(tandem) mass spectrometry. J. Chromatogr. B: Biomed. Sci. Appl. 733, 181–229.

Giday M, Asfaw Z, Woldu Z, Teklehaymanot T. 2009. Medicinal plant knowledge of the Bench ethnic group of Ethiopia: an ethnobotanical investigation. Journal of Ethnobiology and Ethnomedicine 5, 34.

Giovannini P, Reyes-García V, Waldstein A, Heinrich M. Do pharmaceuticals displace local knowledge and use of medicinal plants? Estimates from a cross-sectional study in a rural indigenous community, Mexico Soc Sci Med. 2011;72(6):928-36.

Government Printer, Wellignton,NewZealand.

Grieve, M.1979. *A Modern Herbal.* C.F. Level (ed.), pp. 170-171, Jonathan Cape, London, UK.

Hall, W.D., Pacula, R.L., 2003. Cannabis Use and Dependence: Public Health and Public Policy. Cambridge University Press, Cambridge, UK

Heinrich, M., Ankli, A., Frei, B., Weimann, C., Sticher, O., 1998. Medicinal plants in Mexico: healers0 consensus and cultural importance. Soc. Sci. Med. 47, 1863–1875.

Heywood, V.H. Chant, S.R. 1982. *Popular Encyclopedia ofPlants,* pp. 116-117, Cambridge University Press, UK.

Huai, H., Dong, Q., Liu, A., 2010. Ethnomedicinal analysis of toxic plants from five ethnic groups in China. Ethnobot. Res. Appl. 8, 169–179.

Huai, H., Xu, J., 2000. Indigenous knowledge: an inexhaustible “information bank” for toxin research. Toxicon 38 (6), 745–746.

Hussain F, Islam M, Zaman A. Ethnobotanical profile of plants of Shawar Valley, District Swat, Pakistan Int J BiolBiotechnol.2006;3:301-307.

Ikram, M., Hussain, S.F. 1978. *Compendium of Medicinal Plants.* 167 pp., Pakistan Council for Scientific and Industrial Research, Peshawar, Pakistan.

Jain, S.C., Sharma, R., Kain, R., Sharma, R.A., 1996. Antimicorbcorbial activity of Calotropis procera. Fitoterapia 67 (3), 275–277.

Jones, R.J., 1985. Leucaena toxicity and the ruminal degradation of mimosine. In: Seawright, A.A., Hegarty, M.P., Sames, L.F., Keeler, R.F. (Eds.), Plant Toxicology. Queensland Poisonous Plants Committee, Yeerongpilly, Queensland, Australia, p. 111 Jones, R.J., Blunt, C.G., Nurnberg, B.I., 1978. Toxicity of Leucaena leucocephala. The effect of iodine and mineral supplements on penned steers fed a sole diet of Leucaena. Aust. Vet. J. 54, 387.

Jones, R.J., Blunt, C.G., Nurnberg, B.I., 1978. Toxicity of Leucaena leucocephala. The effect of iodine and mineral supplements on penned steers fed a sole diet of Leucaena. Aust. Vet. J. 54, 387.

Kellerman, T.S., Coetzer, J.A.W., Naudé, T.W., Botha, C.J., 2005. Plant Poisonings and Mycotoxicoses of Livestock in Southern Africa, 2nd ed. Oxford University Press, Cape Town

Khan I, Abdelsalam NM, Fouad H, Tariq A, Ullah R, Adnan M. 2014. Application of Ethnobotanical Indices on the Use of Traditional Medicines against Common Diseases. EvidenceBased Complementary and Alternative Medicine

Kingsbury, J.M. 1964. *Poisonous Plants of the United StatesandCanada.*pp.9-28,PrenticeHall,Englewood Cliffs, New Jersey,USA.

Leipner, J., Saller, R., 2002. Systematic enzyme therapy in oncology: effect and mode of action. Drug 59, 769–780.

Levetin, E., McMahon, K., 2008. Plants & Society, 5th edition McGraw-Hill, New York

Lewis,W.H.,Elvin-Lewis,M.P.F.1977.*MedicalBotany: Plants Affecting Man’s Health.* pp. 11-62, John Wiley & Sons, New York,USA.

Liu YC, Dao ZL, Yang CY, Liu YT, Long CL: Medicinal plants used byTibetans in Shangri-la, Yunnan, China. J EthnobiolEthnomed. 2009;5:15.

Madureira, A.M., Ferreira, M.J.U., Gyémánt, N., Ugocsai, K., Ascenso, J.R., Abreu, P.M., Hohmann, J., Molnár, J., 2004. Rearranged jatrophane-type diterpenes from Euphorbia species evaluation of their effects on the reversal of multi-drug resistance. Planta Med. 70, 45–49.

Madureira, A.M., Ferreira, M.J.U., Gyémánt, N., Ugocsai, K., Ascenso, J.R., Abreu, P.M., Hohmann, J., Molnár, J., 2004. Rearranged jatrophane-type diterpenes from Euphorbia species evaluation of their effects on the reversal of multi-drug resistance. Planta Med. 70, 45–49.

Martin GJ. Ethnobotany: A Methods Manual. London: Chapman and Hall; 1995.

Martinez, M.A., Seifert, H.S., 1991. The virulence of Leucaena leucocephala for goats in northeastern Mexico. Berl. Münch. Tierärztl. Wochenschr. 104, 257–262.

Matekaire T, Bwakura TM. Ethnoveterinary medicine: A potential alternative to orthodox animal health delivery in Zimbabwe. Int J Appl Res Vet. 2004;2(4):269-273.

Mathias E, McCorkle CM. Traditional livestock healers. Rev Sci Tech Off IntEpiz. 2004, 23(1):277-284.

Mishra D. Cattle wounds and ethnoveterinary medicine: a study in Polasara block, Ganjam district, Orissa, India Indian J TraditKnowl. 2013;12:62-65.

Mueen, A.K.K., Rana, A.C., Dixit, V.K., 2005. Calotropis species (Asclepediaceae)–a comprehensive review. Pharm. Mag. 1 (2), 48–52.

Musa, M.S., F.E. Abdelrasool, E.A. Elsheikh, L. Ahmed, A.L.E. Mahmoud and S.M. Yagi. 2011. Ethnobotanical study of medicinal plants in the Blue Nile State, South-eastern Sudan. J. Med. Pl. Res., 5(17): 4287-4297.

Narasimhan, T.R., Ananth, M., Narayana, S.M., Rajendra, B.M., 1997. Toxicity of Parthenium hysterophorus L. Curr. Sci. 46, 15–16.

Narasimhan, T.R., Murthy, K., Harindranath, B.S., Subba Rao, P.V., 1984. Characterization of a toxin from Parthenium hysterophorus and its mode of excretion in animals. J. Biosci. 6 (5), 729–738.

Nielsen DB, Rimbey NR and James LF (1988). Economic Considerations of Poisonous Plants on Livestock. In: (James, L.F., Ralphs, M.H., Nielson, eds.), The Ecology and Economic Impact of Poisonous Plants on Livestock Production, Westview Press, Boulder, CO, pp.5-16.

Odora Hoppers CA. Indigenous Knowledge and the Integration of Knowledge Systems: Towards a Philosophy of Articulation. *Claremont New Africa Books*.2002.

Ogle BM, Tuyet HT, Duyet HN, Xuan Dung NN. Food, feed or medicine: the multiple functions of edible wild plants in Vietnam. Econ Bot. 2003;57:103-17.

Ozturk, M., Uysal, I., Gücel, S., Mert, T., Akcicek, E., Celik, S., 2008. Ethnoecology of poisonous plants of turkey and northern Cyprus. Pak. J. Bot. 40 (4), 1359–1386.

Ozturk, M., Uysal, I., Gücel, S., Mert, T., Akcicek, E., Celik, S., 2008. Ethnoecology of poisonous plants of turkey and northern Cyprus. Pak. J. Bot. 40 (4), 1359–1386.

Pandey, B.P. 1984. *Economic Botany.* 476 pp., S.Chand & Company Ltd., New Delhi, India.

Pei SJ. Ethnobotanical approaches of traditional medicine studies: Some experiences from Asia **Pharm Biol.**2001;39:74-79.

Phillips, O., Gentry, A.H., 1993. The useful plants of Tambopata, Peru: i. Statistical hypotheses tests with a new quantitative technique. Econ. Bot. 47, 15–32.

Pieroni A, Giusti ME, De Pasquale C, Lenzarini C, Censorii E, Gonzáles-Tejero MR, Sánchez-Rojas CP, Ramiro-Gutiérrez JM, Skoula M, Johnson C, Sarpaki A. Circum-Mediterranean cultural heritage and medicinal plant uses in traditional animal healthcare: a field survey in eight selected areas within the RUBIA project. J EthnobiolEthnomed. 2006; 24;2(1):16.

pp. 130-305. Her Majesty's Stationery Office, London, UK.

Quinlan MB, Quinlan RJ. Modernization and medicinal plant knowledge in a Caribbean horticultural village. **.**92-Med Anthropol Q. 2007;21(2):169

Ragupathy S, Steven NG, Maruthakkutti M, Velusamy B, Ul-Huda M.M. 2008.Consensus of the "Malasars" traditional aboriginal knowledge of medicinal plants in the Velliangiri holy hills, India. Journal of Ethnobiology and Ethnomedicine 4, 8.

Rajeh, M.B., Kwan, Y.P., Zakaria, Z., Latha, L.Y., Jothy, S.L., Sasidharan, S., 2012. Acute toxicity impacts of Euphorbia hirta L. extract on behavior, organs body weight index and histopathology of organs of the mice and Artemia salina. Pharmacogn. Res. 4, 170–177.

Rastogi, R.P., Meharotra, B.N.,1993. Compendium of Indian Medicinal Plants, vol. II, CDRI, New Delhi, India.

Reyes-García V, Kightley E, Ruiz-Mallén I, Fuentes-Peláez N, Demps K, Huanca T, *et al*. Schooling and local environmental knowledge: do they complement or substitute each other? Int J Educ Dev.2010;30:305-13.

Reyes-García V, Vadez V, Byron E, Apaza L, Leonard WR, Perez E, *et al*. Market Economy and the Loss of Folk Knowledge of Plant Uses: Estimates from the Tsimane' of the Bolivian Amazon. CurrAnthropol. 2005;46:651-6.

Rogers, R.J., Gibson, J., Reichmann, K.G., 1979. The toxicity of Cassia occidentalis for cattle. Aust. Vet. J. 55, 408–412.

Ruiz-Mallén I, Barraza L, Bodenhorn B, Reyes-García V. School and local environmental knowledge, what are the links? A case study among indigenous adolescents in Oaxaca, Mexico. Int Res Geogr Environ Educ. 2009;18:82-96.

Shen SC, Wilkes A, Huang YL: Discussion on the institutionalization of participatory livestock technological development. Guizhou Agricultural Sciences. 2007;35(2):107-111

Sher H, Barkworth ME, de Boer HJ. Medicinal and aromatic plant cultivation in the Swat valley, north-western Pakistan, for economic development and biodiversity conservation. Genet Res Crop Evol. 2015;1-9.

Sher H, Barkworth ME. Economic development through medicinal and aromatic plants (MAPs) cultivation in Hindu Kush Himalaya mountains of District Swat, Pakistan. J Mt Sci. 2017;12:1292-1301.

Singh, K., Agrawal, K.K., Mishra, V., Uddin, S.M., Shukla, A., 2012. A Review on Thevetia peruviana. Int. Res. J. Pharm. 3 (4), 74–77.

Smith, R.A., 1988. Coma in a ferret after ingestion of cannabis. Vet. Hum. Toxicol. 30, 486.

Stuart, M. 1979. *The Encyclopedia of Herbs and Herbalism.* 283pp., Orbis Publishing Ltd., London, UK.

Suliman, H.B., Shommein, A.M., 1986. Toxic effect of the roasted and unroasted beans of Cassia occidentalis

in goats. Vet. Hum. Toxicol. 28, 6–11.

Suroowan S, Javeed F, Ahmad M, Zafar M, Noor MJ, Kayani S, Javed A, Mahomoodally MF.Ethnoveterinary health management practices using medicinal plants in South Asia – a review. Vet Res Commun.2017;41:147–168.

Tampion,J.1977.*DangerousPlants,*pp.73-81.David and Charles Publication, Newton Abbot, London, UK.

Thomas, E., Vandebroek, I., Sanca, S., Damme, P.V., 2009. Cultural significance of medicinal plant families and species among Quechua framers in Apillampa, Bolivia. J. Ethnophamacol. 122, 60–67.

Tiwari, S., Pandey, R.P., Singh, A., 2008. Effect of cycloart-24-en-3-ol from Euphorbia royleana latex on neuro-enzyme AChE and oxidative metabolism of freshwater fish, Channa punctatus. Afr. J. Tradit. Complement. Altern. Med. 5 (4), 332–339.

Tokarnia, C.H., Döbereiner,J., Peixoto, P.V., 2000. Plantas que afetam a pele e anexos. In: Plantas tóxicas do Brasil. Rio de Janeiro, Helianthus, 251–254

University of California Press, Berkley, USA.Baquar, S.R.H. 1989. *Medicinal and Poisonous Plants of Pakistan,* 506 pp., Printas Karachi, Pakistan.

Van Wyk, B.E., Van Heerden, F.R., Van Oudtshoorn, B., 2002. Poisonous Plants of South Africa. Briza Publications, Arcadia, Pretoria (pp. 8, 108, 194, 196)

Viegi L, Pieroni A, Guarrera PM, Vangelisti R. A review of plants used in folk veterinary medicine in Italy as a basis for a databank. J Ethnopharmacol. 2003;89:221-44.

Wink M (2007). Molecular modes of action of cytotoxic alkaloids- From DNA intercalation, spindle poisoning, topoisomerase inhibition to apoptosis and multiple drug resistance. In: The Alkaloids, G. Cordell, (ed.), Elsevier. 64: 1-48.

Yamamura, S., Shizljri, Y., Kosemura, S., Ohtsuka, J., Tayama, T., Ohba, S., Ito, M., Saito, Y., Terada, Y., 1989. Diterpenes from Euphorbia helioscopia. Phytochemistry 28 (12), 3421–3436.

Yamamura, S., Shizljri, Y., Kosemura, S., Ohtsuka, J., Tayama, T., Ohba, S., Ito, M., Saito, Y., Terada, Y., 1989. Diterpenes from Euphorbia helioscopia. Phytochemistry 28 (12), 3421–3436.

Zhang, W., Guo, Y.W., 2006. Chemical studies on the constituents of the Chinese medicinal herb Euphorbia helioscopia L. Chem. Pharm. Bull. 54 (7), 1037–1039.

Zhang, W., Guo, Y.W., 2006. Chemical studies on the constituents of the Chinese medicinal herb Euphorbia helioscopia L. Chem. Pharm. Bull. 54 (7), 1037–1039.