AN ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS USED FOR THE TREATMENT OF SNAKEBITE AND SCORPION STING AMONG THE PEOPLE OF NAMAL VALLEY, MIANWALI DISTRICT, PUNJAB, PAKISTAN

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Abstract. Snakebite and scorpion sting are the most neglected public problems especially in the poor rural communities of South Asia including Pakistan. The frequency of snakebites and scorpion stings in Pakistan has increased tremendously due to destruction of habitats of snakes and scorpions as a result of deforestation and the consequent migration of these poisonous animals towards human settlements. The management of the frequency of snake bites and scorpion stings has been unsatisfactory in this region. In order to investigate and collect information from the inhabitants on the curative values of plants for treatment of snakebite and scorpion sting, an ethnobotanical survey of medicinal plants was carried out from September 2015 to July 2016 to document information from 14 villages of Namal Valley of District Mianwali, Punjab, Pakistan. The Martin method was followed for collecting information from informants about the medicinal plants used for these poisonous bites. A total of 68 plant species belonging to 37 families and 61 genera was recorded. Information obtained included the common names and their families while photographs of all plants recorded were obtained using the Olympus digital camera. The plants documented were herbs (54%), shrubs (26%) and trees (20%). The family Solanaceae was found to be the most frequently used. The dominant plant part in the recipes obtained is the leaf (22%). The most frequently used mode of preparation in the recipes was the paste. *Calotropis procera, Arisaema jacquemontii, Albizia lebbeck* and *Portulaca oleracea* were the major medicinal plants recorded. The present study is the first ethnobotanical survey of the area and the first report of the medicinal plants used in the treatment of poisonous snake bites and scorpion stings among the indigenous communities of Namal Valley of District Mianwali, Punjab, Pakistan.
Keywords: *ethnobotany, poisonous bites, Solanaceae, Arisaema jacquemontii, antidotes*

Introduction

Medicinal plants play a pivotal role in the treatment of various health problems due to their therapeutic value. Since ancient times the use medicinal plants has been preferred due to their safety, effectiveness, cultural preferences, inexpensiveness, abundance and availability. Even at present, many indigenous communities depend on

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herbal medicines for the treatment of various diseases including snake and scorpion bites (Singh et al., 2012; Naidu et al., 2013). Thus, studies on herbal antidotes are important in the management of poisonous bites from snakes and scorpions (Mukherjee and Wahile, 2006).

An accurate measure of the global burden of snakebite envenoming remains elusive despite several attempts to estimate it and, apart from a few countries, reliable figures on the incidence, morbidity, and mortality are limited (Chippaux, 1998; Kasturiratne et al., 2008). According to World Health Organization (WHO) the estimated number of cases of snakebites around the world is about 5 million per year and the cases are often fatal resulting to death of 2 million people while 0.4 million victims are disabled for whole life (WHO, 2010; Gutiérrez et al., 2013). On the other hand, approximately two billion people are at risk from scorpion stings, with over one million accidents occurring annually worldwide (Chippaux and Goyffon, 2008).

South Asia is by far the most affected region in this context (Chippaux 1998; Kasturiratne et al., 2008). According to World Health Organization's direct estimates, India has the highest number of deaths from snakebites in the world with 35,000–50,000 people dying per year (Chippaux, 1998; Kasturiratne et al., 2008). Moreover, envenoming by snakebites and scorpion stings impose a high burden on humans worldwide and result in considerable social and economic impact. The countries most affected by snakebites are located in the inter-tropical zone; areas with high rates of field use for agriculture involving adult males who are the most affected (WHO, 2007). In Pakistan, expiries from snake bites and scorpion stings have been reported to increase every year with about 40,000 reported cases annually resulting in up to 8,200 fatalities (Kasturiratne et al., 2008; Ali, 1990). The frequency of scorpion stings and snakebites in Pakistan has been on the increase due to destruction of the habitats of these animals and their consequent migration towards human populations (Nasim et al., 2013). Snakebite cases are reported from most populated parts of the Indus Valley [Punjab] and the Indus Delta [Sindh] where about 95% of country's agricultural activity takes place. It is estimated that snakebite reports from Punjab150, Sindh 500, Khyber Pakhtunkhwa and Balochistan are less than 50 per year (Khan, 1990).

At present, the use of anti-venoms from plants has been reported and documented among many indigenous communities in various regions of the world. In spite of the success of this therapy, there is need to search for more plant based venom inhibitors. Poisonous bites from snakes and scorpions constitute problems for medical researchers because they are neither infectious nor preventable by vaccination thus they are neglected conditions with no associated WHO programmes for control and prevention. In Pakistan, lack of proper facilities in rural areas, treatment by quacks, travelling time to hospital for definitive treatment add considerably to morbidity and mortality of cases involving snakebites in particular. A rich and diverse flora of Pakistan provides valuable storehouse of plants used by the tribal communities in remote areas for medicinal purposes such as cure for snakebite and scorpion sting. Previous reports recorded sixty two (62) medicinal plants for the management of snakebite and scorpion sting in northern Pakistan (Butt et al., 2015).

The main objective of our study was to document how the inhabitants - Awan tribes of Namal Valley, Pakistan, who live as pastoralists, peasants and agriculturists, have employed the plant resources of their area as antidotes for scorpion and snake toxin as with many other health challenges.

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Materials and methods

Study area

Namal Valley is one of the most important valleys in Pakistan and a priceless place from an ethnomedicinal point of view. Namal Valley is located at 71°48°45° E longitude and 32°40°10° N latitude, on the eastern border of Mianwali District, Punjab, Pakistan and is nestled amidst the mountains of Salt Range along the border area of Districts Mianwali, Chakwal and Khushab. It has a distinct topography with many lakes, of which Namal Lake is the most visible and largest with a surface area of approximately 5.5 km². The valley is speckled with a number of smaller and larger patches of forests and lakes that are stretched up to the Soon Valley (Sakesar) which is the highest point of the Salt Range. Main villages of the valley include Namal, Rikhi, Kalri, Nawan, Ban Hafiz Jee, Chakda, Dhok Ali Khan, Dhurnaka, DhibbaKarsial, Chaki Sheikh Jee, DhokeAyub, DhokStala, DhokMiani and DhokPeerha. The dominant tribal community is the Awan; others include the Malik (with many sub castes), Pathan and Mian (*Figure 1*).

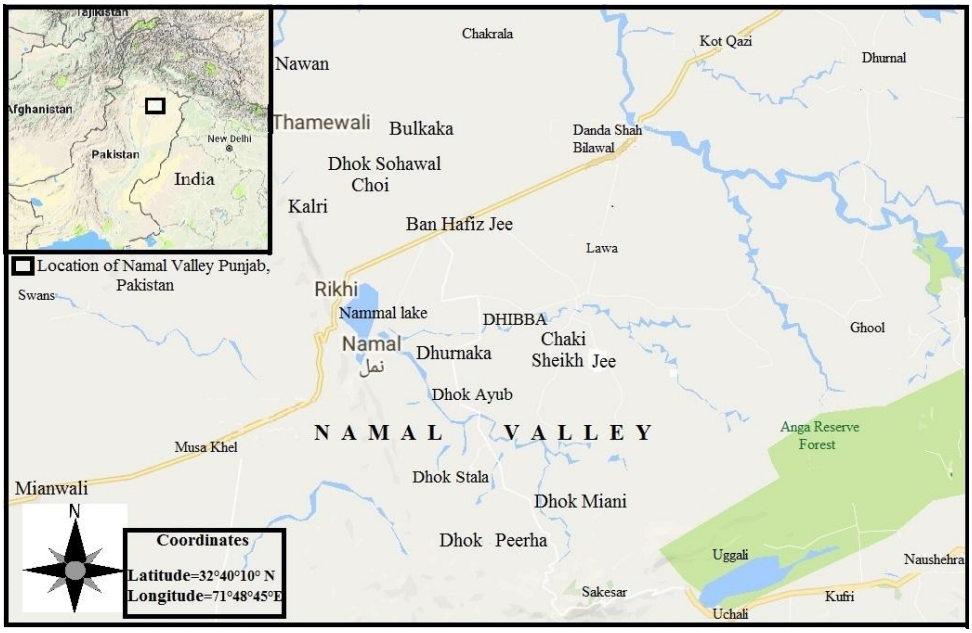

Figure 1. *Map of the study area*

Namal Valley represents one of the ancient civilizations of Pakistan with centuries-old vaults on hills. The dominating economic activity is farming and livestock; people mainly depend on farming for livelihood. Sulphur water spring, shrine of Baba Hafiz Jee, Baba Khaki Shah, Namal College, Namal Lake and Namal Dam are the most fascinating places of the valley. The climate of Namal Valley is extreme; with a minimum temperature of 1°C in winter and a maximum of 45°C in summer and an average annual rainfall of about 250 mm. A unique topography and climatic conditions impart the valley with distinctive characteristics that support biodiversity harboring a wide variety of medicinal plants. The valley is blessed with *Prosopis glandulosa*, *Dodonaea viscosa* and *Tamarix dioica* as the dominant plants in low altitudes while *Olea ferruginea* mixed with *Acacia modesta* represent the evergreen tree population of

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the forests at high altitudes. Other valuable species found in the valley are *Pupalia lappacea*, *Viola cinerea*, *Capparis cartilaginea*, *Capparis spinosa*, *Pluchea arabica*, *Grewia tenax*, *G. villosa*, *Typha angustifolia*, *Phoenix sylvestris*, *Tamarix aphylla*, *Prosopis juliflora*, *Capparis decidua*, *Tephrosia purpurea*, *Peganum harmala* and *Salvadora oleoides*. These plant species are commonly used as a source of food, fodder, forage, fuel and medicinal purposes by the local communities since ages. This study is the first report of the documentation of plants for the management of snakebite and scorpion sting in the Awan tribes of Namal Valley of Mianwali District, Pakistan.

Methods

Ethnobotanical investigation was carried out from September 2015 to July 2016 in 14 different villages of Namal Valley to document plants utilized for the treatment of snakebite and scorpion sting by the aboriginal people. Ethnomedicinal data was collected following Martin methodology. Informal meetings were held in the 14 different villages of the valley. A semi structured questionnaire was prepared to document the collection, dispensation and usage of the local plants. Information of the ethnic use, common name, part utilized, growing season of the plants for the collection of specimen, mode of administration and locally used recipes were obtained and documented (Martin, 1995). Photographs of all plants recorded were obtained using the Olympus digital camera. All plant specimens collected were pressed, dried and mounted on herbarium sheets. The dried specimens were labeled and allotted voucher numbers. Scientific names of collected plant specimens were confirmed with help of "Flora of Pakistan" (Nasir and Ali, 1970-2003). Preserved voucher specimens were deposited in the Herbarium of the University of Sargodha for future reference.

A total of 130 traditional healers (40 women, 80 men and 10 men) of the area were interviewed. The informants were divided into three different age groups, i.e. 20–40, 41–60, 61–80 years old (*Figure 2*).

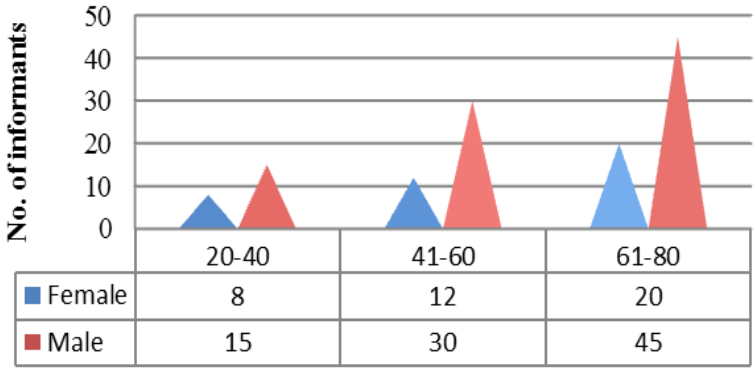

Figure 2. *Gender data of participating informants devided into three age (years) groups*

Results

68 plant species belonging to 61 genera and 37 families were recorded as antidotes used in the Namal Valley. The families, common names, and uses with pictures and reported phytochemical compounds are presented in *Table 1*.

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Table 1. *Plants used for the treatment of snakebite and scorpion sting in Namal Valley, Mianwali, Punjab, Pakistan*

Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
1	*Achyranthes aspera* L./SAN-V-18	Puth Kanda	Amaranthaceae	Seeds and leaves	Alkaloids, steroids, triterpens and saponins possessing oleanolic acid (Barua et al., 2010; Sumeet et al., 2008)	Paste of seeds and leaves is dried in the form of capsule and given to the victim for snakebite. Leaf juice is also effective	
2	*Albizia lebbeck* (L.) Benth./SAN-V-46	Kala Shreen	Fabaceae	Whole plant	Steroids, terpenoids, coumarins,tannins, flavanoids, anthraquinones, and saponins (Babu et al., 2009)	Roots, bark, leaves and fruit all parts are very effective in snakebite	
3	*Albizia procera* L./SAN-V-41	Chhita Sirin	Fabaceae	Whole plant	Acylated Triterpenoid Saponins, proceraosides A–D, (Yoshikawa et al., 1998)	Paste of any part of plant is very effective in snakebite	
4	*Allium cepa* L./SAN-V-16	Pyaaz	Amaryllidaceae	Stem	Albuminoids, Volatile Oil, Quercetin , Sulfur, Ether Organic Sulfur, Moisture,Carbohydrates, Essential Oil, Ash and Sugar (Odhav et al., 2007)	The juice of onion is applied on the effected part of skin for the neutralization of the snake venom as well as scorpion venom	

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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
5	*Allium sativum* L./SAN-V-10	Lehsan	Amaryllidaceae	Roots	Saponins, steroids, tannins, carbohydrates, cardiac glycosides (Mikail, 2010)	Cut the garlic into two pieces and then tie them on the wounded site. Mix the paste in vinegar and apply it on snake or scorpion bitten site	
6	*Aloe vera* (L.) Burm.f./SAN-V-48	KnwarPharra	Xanthorrhoeaceae	Latex	Flavonoids, terpenoids, tannins, Saponin (Arunkumar and Muthuselvam, 2009)	The latex is applied on the wounded site and also prescribed to the patient orally	
7	*Amaranthus viridis* L./SAN-V-02	Chulai	Amaranthaceae	Whole plant	Flavonoids, saponins, glycosides, terpenoids, amino acids, alkaloids, carbohydrates, phenolic compounds and proteins (Kumar et al., 2012)	Decoction of whole plant is used for scorpion bite. Paste is applied externally to the part of skin bitten by snake	
8	*Anagallis arvensis* L./SAN-V-54	NeeliBooti	Asteraceae	Whole plant	Saponins, flavonoids (Napoli et al., 1992; Kawashty et al., 1998)	Decoction of whole plant is used for snakebite	
9	*Arisaema jacquemontii* Blume/SAN-V-14	Zahr Mora	Araceae	Stem tuber	Terpenoids, Coumarins, Quinones, Glycosides, Alkaloids and Anthraquinones (Sudan et al., 2014)	Paste is used for scorpion sting and snakebite	

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10	*Azadirachta indica* A. Juss/SAN-V-18	Neem	Meliaceae	Leaves	Alkaloids, steroids, flavonoids, glycosides, terpenoids, carbohydrates, antiquonons (Raphael, 2012)	The paste of the leaves is tied on the snake bitten site or scorpion sting site with the help of a bandage or leaf extract is given orally to the victim	
11	*Bauhinia variegata* L./SAN-V-13	Kachnaar	Fabaceae	Root	Tannins, alkaloids and saponins (Parekh et al., 2006)	The decoction of the roots is given orally to the victim of snakebite	
12	*Bombax ceiba* L./SAN-V-67	Simbal	Malvaceae	Leaves	Carbohydrates, glycosides, flavones, flavanones, tanins, phenolic compounds, proteins, saponins, sterols, triterpenoids (Anandarajagopal et al., 2013)	Paste of leaves of this plant is tied on the snakebite and scorpion sting part of the body	
13	*Calotropis procera* R.Br./SAN-V-04	Akra	Apocynaceae	Whole plant	Reducing sugars, tannins, steroid glycosides, resins, saponins, flavonoids (Kawo et al., 2009)	The victim is asked to eat the leaves continuously in raw form until it taste turn bitter. This is helpful to neutralize the poison	

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14	*Cannabis sativa* L./SAN-V-36	Bhang	Cannabinaceae	Leaves	Cannabinoids ((Ahmed et al., 2008; ElSohly and Slade, 2005; Radwan et al., 2008)	Paste of the plant is applied to reduce the effect of poisonous bites	
15	*Capsicum annuum* L./SAN-V-24	Laal Mirch	Solanaceae	Fruit	Vitamin C, polyphenols, particularly flavonoids, quercetin and luteolin (Guil-Guerrero et al., 2006; Topuz and Ozdemir, 2007; Chuah et al., 2008; Materska and Perucka, 2005)	Paste is used for snake and scorpion bite	
16	*Carica papaya* L./SAN-V-26	Papeeta	Caricaceae	Fruit	Cardenolides, saponins (Oloyede, 2005)	Sliced piece of fruit is rubbed on the skin for wasp and scorpion sting	
17	*Cassia fistula* L./SAN-V-51	Gardanali/Amaltas	Caesalpinaceae	Fruit	Rhein (Chewchinda et al., 2014)	The pulp of the fruit is applied on snake bitten place on skin. Paste of the fruit is applied on the bitten site and also taken orally	

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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
18	*Catharanthus roseus* (L.) G. Don/SAN-V-64	SadaBahaar	Apocynaceae	Flower	Triterpenoids, tannins and alkaloids (Nayak and Pereira, 2006)	The juice of the flower is applied on the sting area to neutralize the wasp sting poison	
19	*Chenopodium album* L./SAN-V-03	Bathu	Chenopodiaceae	Leaves	Quercetin, Isorhmnetin (Jain et al., 1990)	The paste of leaves is applied on the wasp sting part to reduce swelling and neutralize the poison	
20	*Citrullus colocynthis* (L.) Schrad./SAN-V-35	Tuma	Cucurbitaceae	Fruit	Tannins, saponins, proteins, reducing sugars, alkaloids, flavonoids, glycosides (Najafi et al., 2010)	Pulp of the fruit is applied directly on the snake bitten part and also used to treat scorpion stings	

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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
21	*Citrus limon* (L.)Burm. f./SAN-V-59	Nibu	Rutaceae	Fruit	Taninns, glycosides, reducing sugars, flavonoids (Pandey et al., 2011)	*Citrus* neutralize the venom. Just cut a lemon into two halves and apply it on the wasp sting site firmly	
22	*Convolvulus arvensis* L./SAN-V-05	Vehri	Convolvulaceae	Whole plant	Steroids, tannins, flavonoids, coumarins, cardiac glycosides, saponins, phlobatannins (Khan et al., 2015)	Juice extracted from this plant used for the snakebite	
23	*Coriandrum sativum* L./SAN-V-32	Dhania	Apiaceae	Whole plant	Monoterpenes, aldehydes, alcohols, alkanes (Matasyoh et al., 2009)	Extracted juice is applied externally to reduce the effect of scorpion sting	
24	*Cucumis sativus* L./SAN-V-60	Kheera	Cucurbitaceae	Fruit	Glycosides, steroids, flvonoids, carbohydrates, terpenoids, and tannins (Kumar et al., 2010)	Sliced the fruit and place it on the wasp sting site	

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25	*Cucurbita pepo* L./SAN-V-56	Kadu	Cucurbitaceae	Whole plant	Saponins flavonoids alkaloids, steroids Saponins and tannins (Chonoko and Rufai, 2011)	Paste is applied on the scorpion sting site. Juice of this plant is also given orally	
26	*Cupressus sempervirens* L./SAN-V-31	Saru	Cupressaceae	Fruit	Flavonoids, saponons, tannins (Hassanzadeh Khayyat et al., 2005)	Paste of fruit is eaten for curing poisonous bites	
27	*Cynodon dactylon* (L.) Pers./SAN-V-52	Tala	Poaceae	Whole plant	Tannin, quinones and phenols (Kaleeswaran et al., 2010)	Plant is crushed with the black pepper and applied on the sting site to minimize the pain	
28	*Datura alba* Nees./SAN-V-08	Dhatura	Solanaceae	Roots	Flavonoids, phenols, tannins, saponins and sterols (Donatus and Ephraim, 2009)	The roots of this plant are crushed and mixed with garlic juice and applied externally on the snake bitten site	

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29	*Eclipta alba* L./SAN-V-57	Bhangra	Asteraceae	Whole plant	Alkaloids, coumestans, phenolics, saponins, steroids, proteins, amino acids, reducing sugars, flavonoids (Dalal et al., 2010)	Drinking extract of whole plant is used as antidote	
30	*Eruca sativa* Mill./SAN-V-65	Jhamayon	Brassicaceae	Flower	Allyl isothiocyanate, 3-butenyl isothiocyanate, 4-methylsulfinybutyl isothiocyanate, sulforaphane), 2-phenylethyl isothiocyanate and bis(isothiocyanatobutyl)disulphide, fatty acids (Khoobchandani et al., 2010)	Paste of flowers applied on the scorpion sting site	
31	*Euphorbia hirta* L./SAN-V-55	Dodhak	Euphorbiaceae	Root	Ducing sugars, terpenoids, alkaloids, steroids, tannins, flavanoids and phenolic compounds (Basma et al., 2011)	Paste of root is applied on the snake bitten area of skin	
32	*Ficus benghalensis* L./SAN-V-25	Bargad	Moraceae	Leaves	Carbohydrates, flavonoids, proteins, steroids, saponins, tannins, glycosides (Gabhe et al., 2006)	Paste of leaves is effective for scorpion and wasp sting	

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33	*Foeniculum vulgare* Mill./SAN-V-28	Sonf	Apiaceae	Seeds	Alkaloids, flavonoids, tannins, saponins (Kaur and Arora, 2009)	Decoction of seeds is given to the patient of snakebite and scorpion stings	
34	*Fumaria indica* (Hausskn.) Pugsley/SAN-V-37	Paprra	Fumariaceae	Whole plant	Alkaloids, flavonoids, glycosides, tannins, saponins, steroids and triterpenoids (Rao et al., 2007)	Juice of plant is used for snakebite	
35	*Gossypium hirsutum* L./SAN-V-19	Kpa	Malvaceae	Leaves	Alkaloids, saponins, flavonoids, tannins and cardiac glycosides (Ayeni et al., 2015)	Paste of leaves aling with milky juice of *Calotropisprocera*is applied on the bitten part of skin	
36	*Helianthus annuus* L./SAN-V-50	Suraj Mukhi	Asteraceae	Seeds	Tannins, saponins, flavonoids, carbohydrates, steroids, fixed oils and fats (Subashini and Rakshitha, 2012)	Oil extracted from seeds is applied on skin for snakebite and scorpion sting	

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37	*Jatropha curcas* L./SAN-V-63	Jamal Ghota	Euphorbiaceae	Seed	Alkaloids, saponin tannin, Terpenoid, Steroid, Glycosides, Phenolic Compound, Flavonoid (Sharma et al., 2012a)	The seed powder with water is given orally to the victim to drain the poison out of the body through urine	
38	*Justicia adhatoda* L./SAN-V-22	Bhaikar	Acanthaceae	Leaves	Quinazoline alkaloids (vasicoline, vasicolinone, vasicinone, vasicine, adhatodine and anisotine)- (Jha et al., 2012)	Paste of fresh leaves is applied on the skin for snakebite	
39	*Luffa acutangula* (L.) Roxb./SAN-V-49	Tori	Cucurbitaceae	Leaves	Steroids, tannins, flavonoids, anthroquinone (Anitha and Miruthula, 2014)	The juice of leaves is applied on the scorpion sting site	
40	*Mangifera indica* L./SAN-V-33	Amb/Aam	Anacardiaceae	Flowers	Tannins, Phenols, Pentagalloyl, Glucopyranose (Sahreen et al., 2011; Bhatt et al., 2012; Pithayanukul et al., 2009)	Crushed flowers are externally applied to reduce the effect of scorpion and wasp sting	

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41	*Mentha longifolia* (L.) Huds./SAN-V-42	Podina	Lamiaceae	Whole plant	Essential oils, flavonoids (Ghoulami et al., 2001)	Paste is applied on the body for wasp and scorpion sting. Used in snakebite treatment to avoid the sleepiness	
42	*Momordica charantia* L./SAN-V-53	Karaila	Cucurbitaceae	Fruit	Alkaloids, tannins, saponins, cardiac glycosides and steroids (Bakare et al., 2010)	The juice of fruit causes vomiting in this way removes poison or venom	
43	*Moringa oleifera* Lam./SAN-V-09	Suhanjran	Moringaceae	Roots	Flavonols, carotenoids, quercetin, kaempferol, b-carotene (Lako et al., 2007) tannins, anthraquinones (Kasolo et al., 2010)	Paste of the roots is used for snakebite or scorpion bite	
44	*Morus alba* L./SAN-V-34	Jangli Toot	Moraceae	Leaves	Saponins, phenolics, alkaloids, flavonoids, (Toyinbo et al., 2012)	Leaves are applied as a poultice to snakebite	

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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
45	*Musa paradisiaca* L./SAN-V-44	Kaila	Musaceae	Fruit	Alkaloids, flavonoids, tannins, phenols, saponins, phytates, oxalates (Adeolu and Enesi, 2013)	The peel of fruit is rubbed on the wasp sting site. Fresh juice is given to the victim of snakebite	
46	*Nerium oleander* L./SAN-V-11	Knair	Apocynaceae	Roots	Terpenoids, cardiac glycosides, alkaloids, saponins, tannins, carbohydrates (Bhuvaneshwari et al., 2007)	Paste of roots is used for snakebite and scorpion sting	
47	*Nicotiana tabacum* L./SAN-V-20	Tambaku	Solanaceae	Leaves	Alkaloids, phenols, flavonoids, phytosterols, triterpinoids, tannins and carbohydrates (Kaushik et al., 2010)	Dried leaves are tied on the wounded skin	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
48	*Ocimum basilicum* L./SAN-V-62	Niazbo	Lamiaceae	Whole plant	Saponins, tannins and glycosides (Daniel et al., 2011)	Decoction taken orally to minimize wasp sting poisonous. Juice of the leaves is also applied on the sting area	
49	*Olea ferruginea* Royle./SAN-V-61	Zaitoon	Oleaceae	Fruit	Quercetin,β-amyrin, oleuropein, and ligstroside (Hashmi et al., 2015)	Oil is extracted from fruit is rubbed on the wasp or scorpion sting part	
50	*Opuntia dillenii* (Ker Gawl.) Haw./SAN-V-43	Thor	Cactaceae	Roots	Phenols, Alkaloids, Flavonoids, Saponins, glycosides, Terpeonids Steroids, Tannins (Pooja and Vidyasagar, 2016)	Roots are grinded and given orally victim to vomit out the venom of snake	
51	*Portulaca oleracea* L./SAN-V-66	Loonak	Portulacaceae	Leaves	Fatty acids, organic acids, and phenolic compounds (Oliveira et al., 2009)	Juice of the leaves is applied on the stings of wasp and scorpion and paste of the plant is applied on the snake bitten area	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
52	*Punica granatum* L./SAN-V-39	Anaar	Punicaceae	Leaves	Triterpenoids, steroids, glycosides, saponins, alkaloids, flavonoids, tannins (Bhandary et al., 2012)	Paste of leaves is applied on wasp sting site	
53	*Raphanus sativus* L./SAN-V-21	Mooli	Brassicaceae	Root	Alkaloids, flavonoids, and saponins (Jahan and Rahmatullah, 2014)	Slices of root rubbed on wasp and scorpion sting site. Paste is applied on the wounded skin	
54	*Rhazya stricta* Dcne./SAN-V-06	Sava Winraan	Apocynaceae	Leaves	Phenolics (Iqbal et al., 2006)	Infusion of leaves is used to cure snakebite	
55	*Ricinus communis* L./SAN-V-29	Arind	Euphorbiaceae	Seeds root	Toxalbumin, Ricin, Alkaloid Ricinine, Beans yield Fixed Oil Flavonoids, Tannins (Khafagy et al., 1979; Kang et al., 1985; Nadkarni, 1976)	Seeds are used to cure scorpion bite also the root is taken orally for this purpose in raw form	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1601_111143

Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
56	*Rosa indica* L./SAN-V-40	Gulaab	Rosaceae	Flowers	Triterpenoids, steroids, saponins, alkaloids carbohydrates phenolic compounds, tannins (Bakshi et al., 2015)	Infusion is taken orally to avoid the sleepiness during snakebite	
57	*Saussurea heteromalla* L./SAN-V-47	KaaliZeeri	Asteraceae	Leaves	Arctiin, arctigenin and chlorojanerin (Saklani et al., 2011)	The leaves are boiled in water and then the water is used to wash the wasp, scorpion and snake bitten area	
58	*Silybum marianum* (L.) Gaertn./SAN-V-30	Dhmaan/ Kandiara	Asteraceae	Whole plant	Flavonoids, phenols and tannins (Shah et al., 2011)	Juice is extracted from the green plant is given orally to the snakebite victim	
59	*Solanum nigrum* L./SAN-V-38	Mako	Solanaceae	Whole plant	Saponin, phytosterols, tannins oils, fats, carbohydrates, coumarins, phytosterols, flavonoids (Ravi et al., 2009)	Infusion of plant is used to wash the snake bitten part of body	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
60	*Solanum surattense* Burm. f./SAN-V-23	Mahorri	Solanaceae	Fruit	Alkaloids, flavonoids, tannins, glycosides, triterpenoids and sterols (Muruhan et al., 2013)	The ripened fruit is used for the snakebite	
61	*Solanum tuberosum* L./SAN-V-17	Aalu	Solanaceae	Stem	Flavonoids, ferulic acid, pcoumaric acid, rutin, quercetin, myricetin, kaempferol, naringenin other (Nara et al., 2006; Reyes, 2005).	The sliced tuber of potato with salt is rubbed at the wasp sting site to reduce pain and swelling	
62	*Solanum americanum* Mill./SAN-V-68	Jangli niazbo	Solanaceae	Fruit	Solasonine and solamargine (Fukuhara and Kubo, 1991)	The ripened fruit is used for the snakebite	
63	*Trianthema portulacastrum* L./SAN-V-15	It Sit	Aizoaceae	Leaves	Carbohydrates, protein, volatile oils, glycosides, saponins, flavonoids, alkaloids (Verma, 2011)	Used as a paste on the bitten site to avoid the severely swollen body part. Fresh leaves of this plant are eaten in snakebite and scorpion sting cases	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1601_111143

Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
64	*Withania coagulans* (Stocks) Dunal/SAN-V-12	Khamjeera	Solanaceae	Leaves, fruits	Alkaloids, steroids, phenolic compounds, tannins, saponin, carbohydrates, proteins, amino acids and organic acids (Mathuret al., 2011)	Leaves and fruit are used in scorpion sting cases	
65	*Withania somnifera* (L.) Dunal/SAN-V-01	Asgandh	Solanaceae	Root	Glycoprotein (WSG) (Machiah et al., 2006)	Root of plant is crushed and extract is used for snakebite. Decoction of root is also used for snakebite	
66	*Zea mays* L./SAN-V-58	Makai	Poaceae	Seeds	Sesquiterpene hydrocarbons (Köllner et al., 2004)	Corn flour is mixed with water and applied as a paste on the wasp sting site	
67	*Zingiber officinale* Roscoe/SAN-V-27	Adrak	Zingiberaceae	Rhizome	Diarylheptanoids (Ma et al., 2004)	Sliced rhizome is applied on skin for wasp sting	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Scientific name/voucher number	Common name	Family	Part(s) used	Phytochemical (s)	Recipes (mode of utilization)	Picture of plant
68	*Ziziphus nummularia* (Burm. f.) Whight&Arn./SAN-V-45	Bair	Rhamnaceae	Roots	Flavonoids, tannins, sterols, saponins, pectin, glycosides and triterpenoic acid (Morel et al., 2009; Goyal et al., 2012)	The roots are taken orally to cure scorpion sting	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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The family Solanaceae is the most dominant (9 species) followed by the Cucurbitaceae (5 species), the Asteraceae, Fabaceae and Apocynaceae (4 species) Euphorbiaceae (3 species) and Amaranthaceae, Amaryllidaceae, Apiaceae, Brassicaceae, Malvaceae, Lamiaceae, Moraceae and Poaceae (2 species each) (*Table 2*). The plant species are mainly herbs (54%), shrubs (26%) and trees (20%) (*Figure 3*). The mostly used plant parts are leaves (22%), followed by whole plant (22%), Fruit and roots (17%), stem and seeds (8%) and flowers (7%) (*Figure 4*). The frequent mode of utilization is paste (51%) followed by juice (26%), powder (8%), raw form (7%), decoction (5%) and oil (3%) (*Figure 5*).

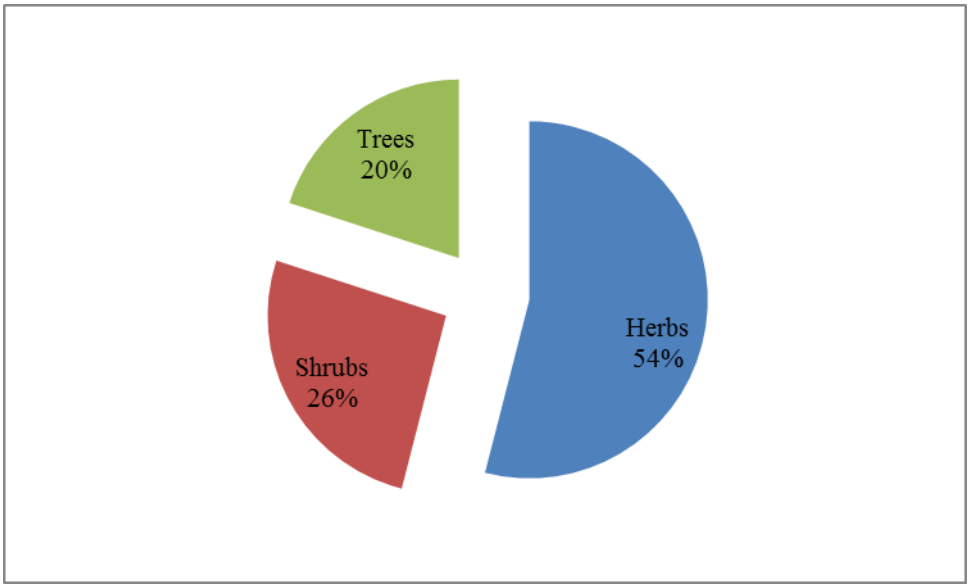

Figure 3. *Habit of medicinal plants used*

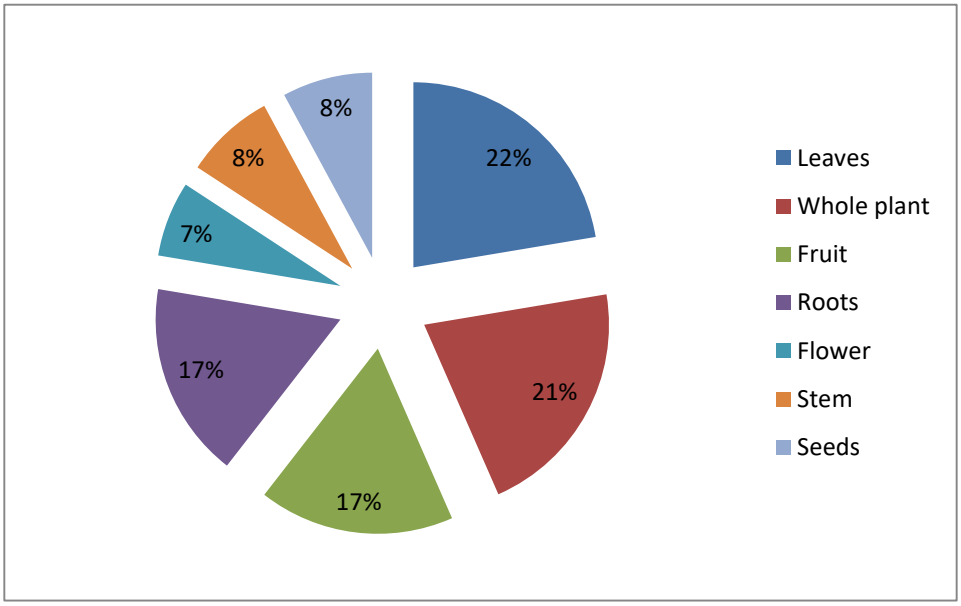

Figure 4. *Part used of medicinal plants*

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1601_111143

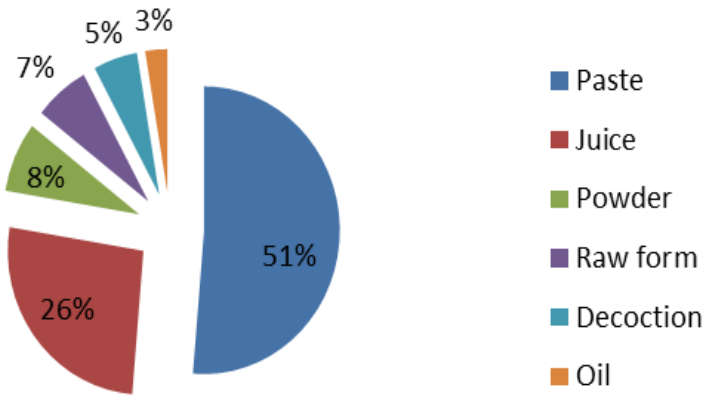

Figure 5. *Mode of utilization of reported medicinal plants*

Table 2. *List of plant families with species name and number of species in each family*

Sr. No.	Family	Scientific name of species	No. of species
1	Amaranthaceae	*Achyranthes aspera* L.	2
		Amaranthus viridis L	
2	Anacardiaceae	*Mangifera indica* L.	1
3	Acanthaceae	*Justicia adhatoda* L.	1
4	Aizoaceae	*Trianthema portulacastrum* L.	1
5	Amaryllidaceae	*Allium cepa* L.	2
		Allium sativum L.	
6	Apiaceae	*Coriandrum sativum* L.	2
		Foeniculum vulgare Mill.	
7	Apocynaceae	*Catharanthus roseus* (L.) G. Don	4
		Calotropis procera (Aiton) W. T. Aiton	
		Rhazya stricta Dcne.	
		Nerium oleander L.	
8	Araceae	*Arisaema jacquemontii* Blume	1
9	Asteraceae	*Eclipta alba* (L.) Hassk.	4
		Helianthus annuus L.	
		Saussurea heteromalla (D. Don) Hand.-Mazz.	
		Silybum marianum (L.) Gaertn.	
10	Brassicaceae	*Eruca sativa* Mill.	2
		Raphanus sativus L.	
11	Cactaceae	*Opuntia dillenii* (Ker Gawl.) Haw.	1
12	Cannabaceae	*Cannabis sativa* L.	1
13	Caricaceae	*Carica papaya* L.	1
14	Chenopodiaceae	*Chenopodium album* L.	1

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Family	Scientific name of species	No. of species
15	Convolvulaceae	*Convolvulus arvensis* L.	1
16	Cucurbitaceae	*Luffa acutangula* (L.) Roxb.	5
		Momordica charantia L.	
		Citrullus colocynthis (L.) Schrad.	
		Cucumis sativus L.	
		Cucurbita pepo L.	
17	Cupressaceae	*Cupressus sempervirens* L.	1
18	Euphorbiaceae	*Ricinus communis* L.	3
		Euphorbia hirta L.	
		Jatropha curcas L.	
19	Fabaceae	*Bauhinia variegata* L.	4
		Cassia fistula L.	
		Albizia lebbeck (L.) Willd.	
		Albizia procera L.	
20	Fumariaceae	*Fumaria indica* (Hausskn.) Pugsley	1
21	Lamiaceae	*Mentha longifolia* (L.) Huds.	2
		Ocimum basilicum L.	
22	Liliaceae	*Aloe vera* (L.) Burm. f.	1
23	Malvaceae	*Gossypium hirsutum* L.	2
		Bombax ceiba L.	
24	Meliaceae	*Azadirachta indica* A. Juss.	1
25	Moraceae	*Ficus benghalensis* L.	2
		Morus alba L.	
26	Moringaceae	*Moringa oleifera* Lam.	1
27	Musaceae	*Musa paradisiaca* L.	1
28	Oleaceae	*Olea ferruginea* Royle.	1
29	Poaceae	*Zea mays* L.	2
		Cynodon dactylon (L.) Pers	
30	Portulacaceae	*Portulaca oleracea* L.	1
31	Lythraceae	*Punica granatum* L.	1
32	Primulaceae	*Anagallis arvensis* L	1
33	Rhamnaceae	*Ziziphus nummularia* (Burm. f.)Whight&Arn.	1
34	Rosaceae	*Rosa indica* L.	1
35	Rutaceae	*Citrus limon* (L.) Burm. f.	1
36	Solanaceae	*Datura alba* Nees.	9
		Nicotiana tabacum L.	
		Solanum nigrum L.	
		Withania coagulans (Stocks) Dunal	

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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Sr. No.	Family	Scientific name of species	No. of species
		Withania somnifera (L.) Dunal	
		Capsicum annuum L.	
		Solanum surattense Burm. f.	
		Solanum tuberosum L.	
		Solanum americanum Mill.	
37	Zingiberaceae	*Zingiber officinale* Roscoe	1
Total			**68**

Discussion

Ethnomedicinal survey is a veritable strategy which provides insight into the potentials of plants. Such knowledge can then be explored for pharmaceutical and medical uses. Ethnopharmacological information is imperative for knowledge about human- plant relationship. This can be helpful when applied in the selection of plants for phytochemical as well as pharmacological studies. The present study brought to the fore the immense hidden knowledge of the Awan tribes of Namal Valley in Pakistan on plant remedies for poisonous bites and stings from Snakes and Scorpions. Members of the Solanaceae which are ubiquitous in the valley are the frequently used plants for these bites. This might not be unconnected with their chemical constituents such as alkaloids, quassininoids, sesquiterpene, lactones, coumarins, triterpenoids, limonoids, and quinolone alkaloids (Saxena, 2003). Herbs dominated the major plant forms in the recipes and are the most abundance in the area (Shah and Rahim, 2017). The easy accessibility of leaves by plant harvesters in the region may be responsible for their high frequency of use in the recipes. Leaves are a major source of bioactive compounds (Bhattarai et al., 2006) and less dangerous to plant survival (Giday et al., 2003). Some of the plants have been screened and found to have anti-venom properties (Murti et al., 2010). *Calotropis procera* ranked highest among the documented plants in the treatment of poisonous animal bites and stings as documented in other parts of the world. Its leaf extract are known to have good antidote properties (Sharma et al., 2012b). In vitro studies showed that *Calotropis procera* contains sugars, phenols, flavonoids, saponins, steroids, terpenoids, tannins and glycosides (Sharma et al., 2012a). Several bio-chemicals have been identified for anti-snake scorpion and wasp venom from *Withania somnifera* (Lizano et al., 2003; Machiah et al., 2006), Azadirachta *indica* (Mukherjee et al., 2008) and *Mangifera indica* (Pithayanukul et al., 2009). *Achyranthes aspera* is a widely used herb in the sub-continent for poisonous animal bites and it is one of the major plants utilized in a variety of ways to treat snake and scorpion bites. Some of the chemicals derived from *Achyranthes aspera* include saponin, achyranthine, alkaloids, alkaline ash containing potash, tannins, flavonoids, oil and fats, steroids, carbohydrates, and terpenoids (Kadel and Jain, 2008; Rahmatullah et al., 2010).

Furthermore, *Arisaema jacquemontii* locally known as “zahr mora” that is widely used as treatment here is considered to be one of the unique plant species being used to cure poisonous bites and stings in the subcontinent and in North America. It is collected by only by professionals and old farmers (Turner and Szczawinski, 1991). *Albizia lebbeck* and *Albizia procera* are also abundantly cited species for the same purpose in Pakistan and other countries of the world. The chemical constituents known from these

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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trees are leanolic acid, lupeol, acyclic ester, alkaloid, heneicos, tannins, carbohydrate, proteins, flavanoids (Baquar, 1989; Saha and Ahmed, 2009). Similarly *Allium cepa* and *A. sativum* are two other worth mentioning plant species in the treatment of poisonous bites and stings. Their chemical constituents includes volatile oil, albuminoids, quercetin, sulfur, carbohydrates, ether organic sulfur, moisture, essential oil (Odhav et al., 2007).

Conclusion

The present study has highlighted the potential of the plants document in the search for essential drugs in the treatment of poisonous bites by animals and by the snake and scorpion in particular. The Namal Valley in the Mianwali District, Pakistan is under-explored for its exceptionally rich medicinal plants that can serve as important source of crude drugs of plant origins for antidote medicine. This study has therefore, provided a baseline report for new plant based anti-venomous compounds. The leaves extract of documented plant species could be tested for effective anti-venomous compounds.

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