

Herbal treatment for snakebites in Uttarakhand state of India

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Plants used in the treatment of snakebites were surveyed in the Uttarakhand state of India, using a questionnaire. The herbal practitioners were interviewed and information on snakebite treatments, using medicinal plants were collected from the traditional healers, locally called as vish vaidyas. The study documents 56 medicinal plant species, of which most of the species (93 %) are used for the treatment of snakebites and some species are used to cure dog and scorpion bite, traditionally. The use of herbs was highest, followed by trees and shrubs for this purpose. Before treatment the vish vaidya makes sure the identity of poisonous or non-poisonous type of snakebites on the basis of claims made by the patient over the taste of plants given. The taste of plant (mainly neem, *Azadirachta indica* A. Juss.) if claimed other than its normal taste by the patient then it is considered the bite of venomous snake. Thorough clinical testing of plants as used by vish vaidyas may help to standardize the efficacy of herbal drugs in curing venomous snake bites, which result into loss of thousands of human life in India.

Keywords: Medicinal plants, Snakebite, Traditional system of medicine, Vish vaidyas, Uttarakhand.

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Introduction

Ophidiophobia, the abnormal fear of snakes and snake-bite is a social and health hazard prevalent in the human societies since antiquity. Snakes are predatory carnivores and are adapted to a wide range of habitats. They tend to be secretive and have evolved many survival strategies as they are preyed upon by other animals¹. About 3000 species of snakes are known to occur worldwide, of these about 15 % are considered risky for humans². In India, the king cobra (*Ophiophagus hannah*), common cobra (*Naja naja*), common krait (*Bungarus caeruleus*), Russell's viper (*Daboia russellii*) and saw-scaled viper (*Echis carinatae*) are the five well-known venomous snake species³. Annually, a large number of people are killed in India by a variety of poisonous snake's bite. In 2005 alone, 45,900 deaths by snakebite were reported in India, which was 30-fold higher than the number declared from official hospitals as many patients are treated and die outside health facilities – especially in rural areas⁴.

Venomous snakebite being a cause of death or chronic disability requires immediate attention and medical emergency. The victims of snakebite are

mainly the people working in the forest and agricultural lands however, the true scale of mortality and chronic disability from snakebite remains uncertain because of inadequacy of reports¹. In view of the severity of problems caused by snakebites, people began to investigate the substances for curing this menace since time immemorial. In Ayurveda, the Vishachikitsa (toxicology) is one of the eight types of treatments which have a high regard in India. Ashtangahridayam is an important book in Indian toxicology apart from the Vishavaidayanarayaniam, Kalavanjhanam and Lakshnaamridham⁵.

The traditional practitioners of curing snakebite are called as visha vaidyas in India^{6,7}. They form the third largest group of folk healers, about 60,000 in number⁸. They are known to cure snakebite, scorpion bite, rat bite, dog bite and spider poison⁷. The importance of medicinal plants for curing snakes bites and stings by poisonous insects has been discussed in the historical as well as present day literature⁹⁻¹⁶. The knowledge on these plant species is still scattered in the society with the folk healers. Documentation of such plant species used in curing snakebites may help to provide the source material for better scientific investigations. In this background, the present study aims to document the plant species used in curing snakebite, scorpion bite and insect bites in the Uttarakhand state of India.

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Methodology

Study area

Uttarakhand state of India comprises 13 districts and is bounded on north west by the Indian state of Himachal Pradesh, on the north by Tibet (China), on the east by Nepal, and on the south by the Indian state of Uttar Pradesh. The state spans over 53,485 km² geographical areas along an altitudinal range from 210 m to 7,817 m¹⁷. The major vegetation types classified along the altitude are tropical, sub-tropical, temperate, sub-alpine and alpine¹⁰. The total human population of the state is 10,086,292 of which 70, 3, 6954, which are about 70 %, live in rural areas, as per the census of 2011. Due to the geographical diversity and inaccessibility, a well-known feature of the mountainous region, Uttarakhand has remained isolated for long period of time hence has preserved some of the old practices, traditions and ethnic norms for various resource use patterns¹⁸. The socio-cultural fabric in this region is characterized by diverse ethnic groups which have developed their own cultures based on available natural resources, giving rise to a cultural diversity. The rich plant diversity, geographical isolation and long period of people's dependency on plants for curing diseases are some of the important factors for selection of Uttarakhand to carry out the present study.

Survey methods

Extensive literature survey was carried out for the compilation of plants used in curing snakebites by various ethnic communities of Uttarakhand^{11,19-21}. Though, the majority of information was collected from secondary sources, field surveys were also undertaken for collection of data on the availability and uses of medicinal plant species across various localities in the study area. The survey focused on collecting information by interviewing practitioners of curing snakebite, apart from the traditional uses of medicinal plants and plant parts used. In order to verify the identity of medicinal plant species field visits were undertaken with the traditional healers.

Results and Discussion

Present study resulted in the documentation of 56 plant species used in curing snake bite, dog bite, scorpion bite and spider bite. Most of the species (93%), as documented, was used for the treatment of snakebite. Two species, viz. *Capsicum annum* L. and *Cissampelos pareira* L. are used to cure dog bite and one species each was used for the treatment of spider bite (*Ixora arborea* Roxb. ex Sm.) and scorpion bite

[*Indoneesiella echioides* (L.) Sreemadhavan]. Apart from treatment of animal bites and stings, these plant species are used for curing other 42 types of ailments, including cut and wounds, cough and cold, asthma, fever, blood purification, bronchitis, dysentery, headache, diabetes, scabies, gastric problem, ulcer, jaundice, epilepsy, etc (Table 1). The cut and wounds are cured by highest number of species (8), followed by fever and asthma (6 species for each ailment), cough and cold (5), and blood purification, dysentery and bronchitis (4 species for each ailment).

The documented plant species are distributed over 33 families and 51 genera. The plant species of family Fabaceae, Euphorbiaceae and Caesalpiniaceae are used in majority of cases for the treatment of snake bites. Of the total 56 documented species, plants under herbaceous life form are highest (29), followed by trees (12), shrubs (10) and under-shrub (5). Different plant parts of these species are used for treatment, of which roots of highest number of species are used, followed by leaf, bark, fruit, whole plant, flower, tuber, stem and latex. A few species, used for the treatment of snakebite such as *Saussurea simpsoniana* and *Nardostachys jatamansi*, are enlisted in the threatened plant categories.

Many species of snakes are known to occur in Uttarakhand state of India, including greater black krait (*Bungarus niger*), king cobra (*Ophiophagus hannah*), common cobra (*Naja naja*), common krait (*Bungarus caeruleus*) and green pit viper (*Cryptelytrops septentrionalis*)²². Traditionally, the victims of snakebite are brought for treatment to the traditional healers or vish vaidyas, who chant some mantras along with prescribing some specific herbal preparations to the patients. Before treatment the vish vaidya make sure the identity of poisonous or non-poisonous category of snake bites. Depending on the availability, either a leaf of neem (*Azadirachta indica* A. Juss.) or a decoction prepared from medicinal plants with mineral substances is rolled on betel leaf (*Piper betle* L.) is given to the patient to chew.

Taste of both neem and the decoction prepared by medicinal plants is extremely bitter. The patient however claims the different taste depending on the nature of snakebite which may be venomous or non-venomous and also the quantity of poison injected in the body. If the patient reports the original taste, which is bitter, then it is assumed that the bite is non-venomous. Reporting pungent taste by the patient is diagnosed as the bite of cobra, the sour taste to the

Table 1- Medicinal plants used in the treatment of snake bite and other important ailments

S. No.	Species	Family	Part(s) used*	Other important uses	Life form
1.	<i>Ageratum conyzoides</i> L.	Asteraceae	Rt, Lf	Headache, cuts, diarrhoea	Herb
2.	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Bk, Latex	Asthma, mouth ulcer, cholera	Tree
3.	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Wp	Blood purification, cold, cough	Herb
4.	<i>Anisomeles indica</i> (L.) Ktze.	Lamiaceae	Wp	Fever, wounds, muscular pain	Herb
5.	<i>Arachne cordifolia</i> (Decne.) Hurusawa	Euphorbiaceae	Lf	Wounds	Shrub
6.	<i>Argyreia speciosa</i> Sw.	Convolvulaceae	Rt, Sd	Anticancer, dysentery, headache	Herb
7.	<i>Arisaema concinnum</i> Schott	Araceae	Fr, Tuber	Vomiting	Herb
8.	<i>Arisaema jacquemontii</i> Blume	Araceae	Tuber	-	Herb
9.	<i>Baliospermum montanum</i> Muell.-Aug.	Euphorbiaceae	Sd, Rt	Cuts, asthma, gastric trouble	Shrub
10.	<i>Barleria cristata</i> L.	Acanthaceae	Rt, Lf, Sd	Pneumonia, wounds	Under Shrub
11.	<i>Bauhinia purpurea</i> L.	Caesalpiniaceae	Bk, Fl, Lf	Wounds, bone fracture, jaundice	Tree
12.	<i>Bauhinia retusa</i> Roxb.	Caesalpiniaceae	Bk, Lf, Fl	Cholera	Tree
13.	<i>Betula alnoides</i> Buch.-Ham. ex D. Don	Betulaceae	Lf, Bk	-	Tree
14.	<i>Capsicum annuum</i> L.	Solanaceae	Fr	Dog bite	Herb
15.	<i>Casearia elliptica</i> Willd.	Flacourtiaceae	Lf, Bk	Blister, wounds, headache	Tree
16.	<i>Cassia fistula</i> L.	Caesalpiniaceae	Fr, Bk	Asthma, bronchitis, antiseptic	Tree
17.	<i>Cassia occidentalis</i> L.	Caesalpiniaceae	Fr, Rt	Dropsy, piles, ringworm	Under Shrub
18.	<i>Cassine glauca</i> (Rottb.) Kuntze	Celastraceae	Lf	Epilepsy	Tree
19.	<i>Celastrus paniculatus</i> Willd.	Celastraceae	Sd, Rt	Ophthalmic and mental disorders	Shrub
20.	<i>Cissampelos pareira</i> L.	Menispermaceae	Lf, Rt	Dog bite, body ache, child birth	Climber Herb
21.	<i>Clerodendrum serratum</i> (L.) Moon	Verbenaceae	Rt, Lf	Bronchitis	Shrub
22.	<i>Clitoria ternatea</i> L.	Fabaceae	Rt	Stomachache	Herb
23.	<i>Costus speciosus</i> (Koenig ex Retz.) Smith	Costaceae	Rt	-	Herb
24.	<i>Cryptolepis buchmanii</i> Roem. & Schult.	Periplocaceae	Rt	Dysentery, bodyache, cuts	Shrub
25.	<i>Cyanodon dactylon</i> (L.) Pers.	Poaceae	Rt, Lf	Fever, blood purification	Herb
26.	<i>Cyathula tomentosa</i> (Roth.) Moq.	Amaranthaceae	Lf	-	Under Shrub
27.	<i>Delphinium denudatum</i> Wall. ex Hook. f. & Th.	Ranunculaceae	Rt	Tonic, stimulant	Herb
28.	<i>Delphinium vestitum</i> Wall. ex Royle	Ranunculaceae	Wp	Cuts, wounds, fever	Herb
29.	<i>Desmodium triquetrum</i> (L.) DC.	Fabaceae	Wp	Cold, cough, fever	Herb
30.	<i>Erythrina variegata</i> L.	Fabaceae	Bk	Anthelmintic	Tree
31.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Wp	Asthma, bronchitis, scabies	Herb
32.	<i>Euphorbia ligularia</i> Roxb.	Euphorbiaceae	Lf, st	Asthma, jaundice	Herb
33.	<i>Gymnema sylvestris</i> (Retz.) R.Br.	Asclepiadaceae	Lf	Diabetes, gastric trouble	Shrub
34.	<i>Hoppea dichotoma</i> Hayne ex Willd.	Gentianaceae	Shoot	-	Herb
35.	<i>Indoneesiella echioides</i> (L.) Sreemadhavan	Acanthaceae	Shoot	Scorpion sting, liver tonic	Herb
36.	<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae	Rt	-	Herb
37.	<i>Ixora arborea</i> Roxb. ex Sm.	Rubiaceae	Rt, Fr	Spider poison, child birth, eczema	Shrub
38.	<i>Leucas cephalotes</i> (Roth.) Spreng.	Lamiaceae	Wp	Antiseptic	Herb
39.	<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	Fr	Fever, scabies	Herb
40.	<i>Madhuca longifolia</i> (Koen.) Mac.	Sapotaceae	Bk, Fl, Lf	Cough, diabetes, ulcer	Tree

(Contd.)

Table 1- Medicinal plants used in the treatment of snake bite and other important ailments—(Contd.)

S. No.	Species	Family	Part(s) used*	Other important uses	Life form
41.	<i>Mimosa pudica</i> L.	Mimosaceae	Rt	Digestive trouble	Under Shrub
42.	<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Fr, sd	Aphrodisiac, ulcer, madness	Shrub
43.	<i>Nardostachys jatamansi</i> (Don) DC.	Valerianaceae	Rt	Blood purification, cough, diuretic	Herb
44.	<i>Naringi crenulata</i> (Roxb.) Nicolson	Rutaceae	Fr	-	Tree
45.	<i>Pandanus odoratissimus</i> L.	Pandanaceae	Rt	Arthritis, skin diseases	Shrub
46.	<i>Parnassia nubicola</i> Wall. ex Royle	Parnassaceae	Tuber	-	Herb
47.	<i>Pergularia daemia</i> (Forsk.) Chiovenda	Asclepiadaceae	Lf	Asthma, bronchitis	Shrub
48.	<i>Pistacia integerrima</i> (Stew.) Rech. f.	Pistaciaceae	Lf	Dysentery	Tree
49.	<i>Polygala crotalarioides</i> Buch.-Ham. ex DC.	Polygalaceae	Rt, Lf	Cough and cold	Herb
50.	<i>Potentilla sundaica</i> (Blume) Kuntze	Rosaceae	Rt, St	Itching	Herb
51.	<i>Rubia manjith</i> Roxb.	Rubiaceae	Rt, St	Tonic, dysentery	Climber Herb
52.	<i>Saussurea simpsoniana</i> (Field & Gard.) Lipsch.	Asteraceae	Fl	Fever	Herb
53.	<i>Tephrosia purpurea</i> Pers.	Fabaceae	Rt	Blood purification, liver ailments	Herb
54.	<i>Tricholepis glaberrima</i> DC.	Asteraceae	Rt	Skin diseases	Herb
55.	<i>Vincetoxicum hirundinaria</i> Medikus	Asclepiadaceae	Rt	-	Under shrub
56.	<i>Wrightia arborea</i> (Denn.) Mabber.	Apocynaceae	Bk	-	Tree

*Rt – Root; Fl – Flower; St – Stem; Lf- Leaf; Fr – Fruit; Sd – Seed; Bk – Bark; Wp – Whole plant

viper and sweet taste is presumed as bite of a krait by the vish vaidya. These findings of the present study are in conformity of the observations made by Yamashita *et al*¹² to the Indian state of Kerala where a leaf paste of *Luffa acutangula* (L.) Roxb. is given to the patient for similar diagnosis.

Antiserum is a well-known drug which is unfortunately consistently unavailable in the rural and far flung areas. In such situation where antiserum is not available, the support of vish vaidyas in saving the life of people is crucial. Interestingly, as per the traditional norms, the vish vaidya takes nothing in return of curing snake bitten patients. Although, the healers disclose uses of most of the plant species used as medicine, it was noticed that for some specific treatments including snakebite the healers hesitate to disclose the medicinal plants and the procedures applied for curing such ailments. They are asked to take oath before his guru to pass on such knowledge to the right pupil and it is not for all and sundry.

Studies conducted elsewhere have documented plants for curing poisons and venomous bites, including snake bite. For curing poisonous snakebites a total 39 plant species is reported from Uttar Pradesh

- the adjacent state of Uttarakhand¹³, and 57 plant species from the Haryana state of India²³. In southern part of India, 72 plant species, as used against venomous bites by local people of Tamil Nadu, are documented by Samy *et al*²⁴. In Chittoor district of Andhra Pradesh, 32 species of plants as used by tribal people as antidotes for poisonous bites are documented by Penchalapratap *et al*²⁵. A total 483 plants have so far been documented for curing snakebites in India⁵. Though, a sizable number of plant species have been documented for curing snakebite, there is a fair possibility of species used in rural areas remained undocumented.

In vivo and *in vitro* experiments have been conducted by scientists in order to investigate the reputation of plant species traditionally used for curing snake bites. Atropine, which is derived from *Atropa belladonna* L., is established to prolong the effect of black mamba venom. The extract of *Andrographis paniculata* Wall. ex Nees has similar prolonged survival effects²⁶. Study conducted by Samy *et al*²⁴ on mice claims that *A. paniculata*, *Gloriosa superba* L., *Aristolochia indica* L., *Hemidesmus indicus* R. Br., *Strychnos nux-vomica* L.

and *Eclipta prostrata* (L.) L. have shown potential neutralizing effect against the venom of rattlesnake. The plant extracts of *A. paniculata* and *G. superba* possess potent neutralizing capacity against *Naja nigricollis* venom²⁷.

Not only in India but in other parts of the world, where venomous snakes occur, numerous plant species are used as folk medicine to treat snake bites^{26,28}. Clinical studies carried out elsewhere, including Columbia²⁹ and Nigeria³⁰ on the efficacy of some of these plant species have proven the importance of plants in curing snakebites. Leaf extract of *Guiera senegalensis* J. F. Gmel. and stem bark of *Parkia biglobosa* (Jacq.) G. Don. when tested clinically revealed similar effects against the venom of *Naja nigricollis*^{30,31}. The presence of various phytochemicals in these plant species probably plays an important role against venom.

Taking precautionary measures is of utmost significance to be unharmed from the poisonous snakes. In rural areas of developing countries like India, many people stay in the houses having thatched roofs and straw or mud walls having cracks and cavities. They need to take extra care and avoid sleeping on floors. Snakes may enter the houses in search of food, especially rats and chickens and attempts should be made to keep such food away from the houses. As far as possible, avoid snakes and not to provide them hiding places. While working out in the field and jungle, try to hear animals, especially birds, as they make alarm call on snake's presence. Many snakes are nocturnal, hence, use light when walking in night and wear shoes¹. Besides precautionary measures, if any untoward incidence of venomous snakebite has taken place, the vish vaidyas may be useful in the areas deprived from antiserum.

Conclusion

Thorough clinical testing of plants used by vish vaidyas will help to standardize the efficacy of herbal drugs in curing venomous snakebites.

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