Mintage Journal of Pharmaceutical & Medical Sciences

REVIEW ARTICLE

A REVIEW ON MEDICINAL PLANTS USED IN SCORPION BITE TREATMENT IN INDIA

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Received -08-12-2012; Reviewed and accepted -13-12-2012

ABSTRACT

Following snake bite cases, scorpion bite is a common global public health problem including India. Despite various species of scorpions, only few of these can be potentially lethal to humans. In India, the annual number of scorpion stings cases exceeds 1.23 million, of which over 32,250 may be fatal. This can be attributed to various hurdles in the scorpion bite treatment like poor health services, difficult and untimely transportation facilities, wrong traditional beliefs, delay in anti-scorpion venom administration which ultimately leads to substantial amount of mortality and morbidity. Clinical features of the patients stung with scorpion are generally abnormalities indicative of cardiac, respiratory, autonomic and metabolic changes and deaths can be due to multi-system failure. Administration of anti-scorpion venom serum (AScVs) is the only specific treatment available in India but has many limitations like species specificity, difficulty in availability, affordability and ideal storage conditions. The medicinal plants, available locally and used widely by traditional healers, therefore need attention in this aspects. Wide arrays of the plants and their active principles have been evaluated for pharmacological properties useful in the treatment of scorpion bite. However, numerous unexplored plants are claimed to have definite role in this issue need to be further studied. This review is an attempt to present a comprehensive account of numerous Indian herbal plants used in the treatment of scorpion bite in any forms like topical application for local pain relief, oral formulation for pain relief and venom neutralization purpose.

Key words: *Medicinal plants, Scorpion sting, Anti-scorpion venom serum.*

INTRODUCTION

From ancient times poisonous animal bites is a serious issue in world. Millions of people die every year because of poisonous animals' bites, snake bite cases being the most common culprit. Following this, scorpion bite is also a common and global public health problem associated with substantial morbidity and mortality. It constitutes an occupational hazard especially in field of agriculture for farmers, farm labours, villagers, migrating population and hunters**.** The factors mainly responsible for high mortality associated with scorpion bite are poor health services, difficult and untimely transportation facilities, wrong traditional beliefs, delay in anti-scorpion venom administration. It is estimated that in India, the annual number of scorpion stings cases exceeds 1.23 million, of which over 32,250 may be fatal[1]. In Asia, epidemiological data on scorpion stings is scarce. India is the most affected, with a reported incidence of 0.6%[1]. The estimates are arbitrary as the majority of cases go unreported. In rural areas, where most of the scorpion bite cases occurs, the victims are mostly taken to traditional healers, who neither documents the case nor report them to the authorities, hence paucity of reliable epidemiological data. Numerous envenomation cases remain unreported making it difficult for calculating true incidence. Case fatality rates of 3-22% were reported among the children hospitalized for scorpion stings in India, Saudi Arabia and South Africa[2-6].

Globally, 1988 species of scorpions are known to occur of which, 113 valid species of 25 generas under 6 families exist in India[7]. Among the 86 species of scorpion in India, *Mesobuthus tamulus* and *Palamneus swammer-dami* are of medical importance[8].

Chemically, scorpion venom is a cocktail of several neurotoxins, cardipotoxins, nephrotoxins, hemolytic toxins, nucleotides, amino acids, oligopeptides, phospholipase-A, hyaluroinidase, acetylcholine esterase, histamine, serotonin, 5-hydroxyptamine and proteins that inhibit protease, angiotensinase and succinate dehydrogenase[9]. Neurotoxins of scorpion venom content is highly lethal than neurotoxin of snake venom[9]. A clinical effect of the envenomation depends upon the scorpion species, lethality and dose of venom injected at the time of sting and also on the victim's physiological reactions to venom. Clinical features of the patients stung with scorpion are generally abnormalities indicative of major body systems like cardiac, respiratory, autonomic and metabolic changes. Most patients die of multisystem failure[10 - 12]. The autonomic overactivity, pulmonary oedema, acute myocarditis and ischemia-like changes are the most frequent manifestations. There is no standard protocol for the treatment of scorpion venom poisoning. The treatment strategies practiced for these patients include drug regimens like prazosin, angiotensin-converting enzyme (ACE) inhibitors, insulin, anti-scorpion venom serum (AScVs) and others[10-15].

The administration of anti-scorpion venom serum (AScVs) is the only specific treatment available for scorpion bite, but has been a matter of debate and controversy during last five years[9]. Since 2002, nonspecific F(ab)2 SAV has been available for clinical use from Haffkine Biopharma Mumbai[9]. However, there are many drawbacks associated with AScVs. Scorpion antivenins are rather specific[16], hence, absolute specificity is an issue with its use. The geographic and taxonomic diversity in species leads to significant variation in composition and antigenic reactivity of venom restricting the use of particular AScVs in specific geographical area. Conclusively, the treatment is non-specific and symptomatic with limited success. Also, the production of AScVs is associated with logistical, marketing, storage and economical difficulties. The development is costly, time consuming process requiring ideal storage conditions. In this context, the only available option for scorpion bite treatment is herbal treatment as these herbs are common, easily available and cheaper.

REASONS BEHIND THE USE OF MEDICINAL PLANTS IN SCORPION BITE

Nearly 80 % of the global population still depends upon the herbal drugs for their health care. In India, the use of different parts of several medicinal plants to cure specific ailments has been practiced since ancient times. Various cultural traditions are associated with use of wild plants as medicinal herbs. This medico-lore is passed over generations traditionally all over the world. Various medicinal plants are being used as folk medicines in the treatment of scorpion bite also. Reliance on plants is primarily due to their safety, effectiveness, cultural preferences, inexpensiveness and abundant availability all the time. The medicinal virtues of plants are identified by instinct/intuition or by trial and errors. Globally, traditional healers are using various medicinal plants for the treatment of scorpion bite; however, this practice is not really completely recognized by modern medicine.

This review is an attempt to present a comprehensive account of numerous Indian medicinal plants used in the treatment of scorpion bite in any forms like topical application for local pain relief, oral formulation for pain relief and also for venom neutralization purpose. A thorough literature survey highlights that plant kingdom has a tremendous resources which can be exploited for unidentified novel compounds with scorpion antivenin activity or those supplementing the action of anti-scorpion venom.

Important plants which are being used for scorpion bite treatment in any form i.e. oral form for pain relief and venom neutralization and local application form for pain relief or sting wound healing purpose are mentioned in the accompanying table. Various indexed, non indexed Indian journals were studies for the precise information. *Indian journal of traditional knowledge* and various issues of *life sciences leaflets* (2012) provided valuable information in this aspect. Literature review from some pumbed issues also revealed some novel plants in this regard.

PLANTS USED FOR SCORPION BITE TREATMENT:

Table 1: Showing medicinal plants used In the treatment of Scorpion Bite in India.

S. No	Botanical Name	Vernacular Name	Family	Parts used In Scorpion Bite
1	*Andrographis paniculata*[17]	Kalmegh	*Acanthaceae*	Aerial parts -Ethanolic extract for venom neutralization
2	*Aristolochia indica* L.[18,30,36,51]	Eswaramooligai	*Aristolochiaceae*	The leaf juice is taken orally to treat scorpion sting. Roots paste is applied externally on scorpion sting part.
3	*Cleome viscose* L.[18,28]	Nayivelai	*Capparidaceae*	Leaves paste is applied externally on scorpion stung part.
4	*Achyranthus aspera* L.[19,20,23,24,27,28,34,45,46,56,65]	Gathiya,Aghada, Apamarg	*Amaranthaceae*	Shoot, leaves, roots and seeds are useful.
5	*Madhuca indica* Gmel[19,20,28]	Mahuwa	*Sapotaceae*	Seeds oil
6	*Calotropis procera* (Ait.) R. Br.[21,65]	Safed Rui, Mhatari Rui	*Asclepiadaceae*	Latex is used for local application.
7	*Ficus benghalensis* L.[21]	Wad, Wat	*Moraceae*	Paste of tender leaves for local application
8	*Mangifera indica* L.[21,31,32,58,60,61]	Amba,Mamarum	*Anacardiaceae*	Powder of flowers for local application
9	*Nerium indicum* Mill[21].	Kanher	*Apocynaceae*	Root paste for local application.
10	*Aglaia roxburghiana Hiern*. Var. Courtallensis L.[22]	Chokkalai	*Meliaceae*	Decoction of leaves and seeds taken orally.
11	*Albizia amara* Boir[22]	Usilai	*Mimosaceae*	Paste of leaf and root bark for local application
12	*Neanotis monosperma* (Wt. & Arn.)[22]	Kodi urinchi	*Rubiaceae*	Powder of leaf, root and stem - External application
13	*Biophytum candolleanum* W.[22]	Perumani vaatti	*Oxalidaceae*	Leaf powder is taken orally.
14	*Cipadessa baccifera* (Roth.) Miq.[22]	Maramalli	*Meliaceae*	Leaf decoction is taken orally.
15	*Grewia gamblei* Drumm.[22]	Karadi kasavu	*Tiliaceae*	Leaf juice and root bark is taken orally.
16	*Listea ligustrina* Hook.f.[22]	Kaatu senbagam	*Lauraceae*	Powder of leaf, stem bark and flowers is taken orally.
17	*Pouzolzia indica* Gaud[22]	Visha karappan	*Urticaceae*	Powder of leaf, stem bark and flowers for local application.
18	*Amaranthus viridis* L.[23-25]	Kuppacheera	*Amaranthaceae*	Leaves used as emollient in scorpion sting.
19	*Andrographis lineata* Wallich ex. Nees.[26]	Siriyanangai	*Acanthaceae*	Paste of leaves for local application
20	*Andrographis paniculata* (Burm.f.) Wall. ex Nees.[26]	Periyanangai or Nilavembu	*Acanthaceae*	Paste of leaves for local application
21	Cieba pentandra (Linn.) Gratean (Kapok)[28]	Java cotton	*Malvaceae*	Paste of roots for external application
22	*Barringtonia acutangula*[29]	Hijol	*Lecythidaceae*	Plant extract is taken orally.
23	*Argemone mexicana* Linn.[30,36,38,48]	Perammathandu, Bilayat	*Papaveraceae*	Latex and yellow juice of plant orally. Root paste for local application.
24	*Aristolochia bracteolata* Lam.[30]	Aduthinnapalai	*Aristolochiaceae*	Paste of leaves for local application
25	*Muraya paniculata* (Linn) Jack.[30]	Angarapputhalai	*Rutaceae*	The leaf powder mixed with hot water is taken orally.
26	*Rhinacanthus nasutus* Kurz.[30]	Nagamalli	*Acanthaceae*	Leaf paste of the plant is used for local application.
27	*Albizia lebbeck* (L.) Benth[31]	Shireesh,Chichola	*Fabaceae*	Tonic is taken orally.
28	*Centratherum anthelminticum* (L.)Kuntze[31]	kali-zeeri	*Asteraceae*	Seeds of the plants
29	*Azadirachta indica* A. Juss.[31,41]	Neem	*Meliaceae*	Whole plant except root.
30	*Ocimum sanctum* L.[31,37]	Tulsi	*Lamiaceae*	Panchang and root is used for scorpion sting.
31	*Aloe vera* L.[32]	Kathalai	*Liliaceae*	Whole plant juice- orally and externally.
32	*Anisomeies malabarica* R.Br.[32,36]	Peimiratti	*Lamiaceae*	Whole plant paste is taken orally.
33	*Blepharis maderaspatensis* L.[32]	Naikalli	*Acanthaceae*	Leaf juice is taken orally.
34	*Cassia alata* L.[32]	Semaiagatti	*Caesalpiniaceae*	Leaf juice is taken orally.
35	*Cissus quadrangularis* L.[32]	Pirandai	*Vitaceae*	Seed and leaves juice- orally and externally.
37	*Curcuma longa* L.[32]	Manchal	*Zingiberaceae*	Rhizome paste for external application
38	*Eclipta alba* L.[32,56]	Karisilanganni	*Asteraceae*	Leaf juice is taken orally. Leaf extract for local application.
39	*Eclipta prastrata* L.[32]	Karisilanganni	*Asteraceae*	Leaf paste for external application
40	*Gloriosa superba* L.[32,46,49,50,56,66]	Kalapaih, Kilangu	*Liliaceae*	Tuber and root paste for external application
41	*Helianhus annus* L.[32]	Suriyakanthi	*Asteraceae*	Seed oil for external application
42	*Hybanthus inneaspermis* L.F.[32]	Orilaithamatai	*Violaceae*	Whole plant paste is taken orally.
43	*Kalanchoe pinnata*(Forsk) Pers.[32]	Katakataka	*Crasulaceae*	Leaf paste for external application

44	*Leucas aspera (*Wild*)* Link[32,33]	Thumbai	*Lamiaceae*	Leaf decoction is taken orally.
45	*Michelia champaga* L.[32]	Champagam	*Magnliaceae*	Leaf juice is taken orally.
46	*Mimosa pudica* L.[32,58,62,63]	Thottal, Surungi	*Mimosaceae*	Whole plant paste is taken orally.
47	*Mucuna pruriens* (L.) DC.[31,32,47]	Poonaikkali, Vaseekaramoolam	*Fabaceae*	Whole plant and seeds decoction and powder - orally and externally.
48	*Murraya koeinegii* L.[32]	Karuveppilai	*Rutaceae*	Leaves bark, root bark- juice for orally and externally.
49	*Musa paradisiacal* L. [32]	Valaimaram	*Musaceae*	Bark juice is taken orally.
49	*Pergularia daemia* Forsk. [32]	Veliparuthi	*Asclepiadeaceae*	Leaf juice is taken orally.
50	*Riccinus communis* L.[32,58,60]	Amanakku	*Euphorbiaceae*	Seeds infusion for external application
51	*Solanum virginianum* L. [32]	Kandangkattiri	*Solanaceae*	Flower paste - orally and externally.
52	*Tephrosia perpeura* L. Pers. [32]	Kolunchi	*Fabaceae*	Root decoction is taken orally.
53	*Terminalia arjuna* Wight & Arn. [32]	Marutham	*Combretaceae*	Wood ash is taken orally.
54	*Tribulas terresris* L. [32]	Nerinjii	*Zygophyllaceae*	Flower juice is taken orally.
55	*Veronia cinera* Less. [32]	Mukkuttipunta	*Asteraceae*	Whole plant juice is taken orally.
56	*Wrightia tindoria (*Robx*.)* R.Br. [32]	Veppalai	*Apocynaceae*	Leaves infusion for external application.
57	*Rubia cordifolia* L.[33]	Chevvali kodi	*Rubiaceae*	Leaf paste for external application.
58	*Amaranthus spinosus* L.[34]	Azgho Chalwere	*Amaranthaceae*	Roots are taken orally.
59	*Euphorbia ligularia* Roxb.[34]	Siju	*Euphorbiaceae*	Latex of the plant is employed as antidote for scorpion sting.
60	*Enivulia Buch.*-Ham.[34]	Akujemuda.	*Euphorbiaceae*	Latex of the plant is employed as antidote for scorpion sting.
61	*Helitropium indicum* L.[34,36]	Telukondi	*Boraginaceae*	Leaves are employed as antidote for scorpion sting.
62	*Martynia annua* Linn.[34,45,46]	Bichhu	*Pedaliaceae*	The fruits and seed paste are used for scorpion stings.
63	*Anisomeles indica* O.Kze.[36]	Paeyemarati	*Paeyemarati*	The leaf paste for external application
64	*Emblica officinalis* Gaerth.[36]	Nellikkai	*Euphorbiaceae*	The leaf juice mixed with black pepper and drink to treat scorpion sting.
65	*Tabernaemontana divaricata* (L.)R.Br.[38]	Gulchandini	*Apocynaceae*	Root paste for external application.
66	*Annona squamosa* L.[39]	Hitaphar	*Annonaceae*	Root paste for external application. Root bark decoction orally.
67	*Boswellia serrata* Roxb. ex Cocls.[39]	Salar	*Burseraceae*	Fresh or dried fruits taken orally with hens eggs.
68	*Cyperus rotundus* L.[40,46]	Korai, Muthakkasu	*Cyperaceae*	Paste of dried tuber is applied topically on bitten site of scorpion.
69	*Embelica ribes* Burm. f. [41,42]	False Balack Pepper	*Myrsinaceae*	Dried fruit
70	*Piper longum* L.[41,43]	long pepper	*Piperaceae*	Fruit
71	*Syzygium cumini* (L.)[41,44]	Java plum, Jambeiro, Jambolan, Jamun	*Myrtaceae*	Seed paste and bark mixed with common salt orally.
72	*Madhuca latifolia* Roxb.[45,46]	Mahua	*Sapotaceae*	Dried fruits with leaves of *Ipomea stramonium* (beshram) made into paste and applied on sting part.
73	*Tamarindus indica* L.[45]	Imali	*Combertaceae*	External application of cotyledon over scorpion sting site
74	*Abrus precatorius* L.[46] Wall.	Gulaganji	*Fabaceae*	Root powder is taken orally along with cow's milk to treat scorpion sting.
75	*Bauhinia racemosa* Lamk.[46,54]	Apta	*Caesalpiniaceae*	Paste of fruit and leaf juice is applied on strung part.
76	*Brassica juncea* (L.) Czern. & Coss.[46,54]	Mohari	*Brassicaceae*	Little hot juice of leaf, stem and branches is applied on the stung part.
77	*Carissa congesta* Wight.[46,54]	Karvand	*Apocynaceae*	A piece of root is kept on molar tooth, chewed and its remnant is applied on stung part.
78	*Luffa acutangula* (L.) Roxb.[46]	Kadu-dodka	*Cucurbitaceae*	Juice of the leaf is applied on the stung part.
79	*Hemidesmus indicus* (L.) R.Br.[47]	Nannaari	*Asclepiadaceae*	Whole plant is used.
80	*Bauhinia purpurea* L.[48]	Motha apta	*Caesalpinaceae*	Leaves paste.
81	*Sida spinosa* L.[48]	Prickly sida	*Malvaceae*	Root paste for external application.
82	*Tiiacora acuminata* (Lam)[51]	Kappa theega	*Menispermaceae*	Roots
83	*Tragea plukenetii* R. Sm.[51]	Duradagendaku	*Euphorbiaceae*	Roots
84	*Maerua oblongifolia* Forssk. (A.Rich.)[52]	Sengal *Serer* gul	*Capparaceae*	Whole plant
85	*Aerva lanata* (Linn) Juss. ex. Schult.[53]	Polpala	*Amaranthaceae*	Plant extract
86	*Anogeissus latifolia* (Roxb. ex DC.)[55]	Thirmanu	*Combretaceae*	Stem bark paste for local application.
87	*Cassia auriculata* L. [55]	Tangedu	*Caesalpinaceae*	Juice of fresh macerated leaves is dropped in the ears.
88	*Coelosia argentea* L. [55]	Gurugu	*Amaranthaceae*	Fresh leaf paste for external application.
89	*Chloroxylon swietenia* DC. [55]	Billudu	*Flindersiaceae*	Fresh Stem bark paste ground in urine is used for external application.

90	*Dioscoria oppositifolia* L. [55]	Paralagaddalu	*Dioscoriaceae*	Powdered roots mixed with cow urine are used for external application.
91	*Gmelina arborea* Roxb. [55]	Gummudu	*Verbenaceae*	Fresh leaf paste for external application.
92	*Strychnos potatorum* L. [55]	Chilla ginjalu	*Loganiaceae*	Seed paste orally and externally.
93	*Tridex procumbens* L. [56]	Tikkikasa	*Asteraceae*	Leaves extract is put into ears to relive pain.
94	*Amomum subulatum* Roxb. [57]	Alaichi	*Zingiberaceae*	Paste of seeds is applied externally as antidote for scorpion-sting .
95	*Cissampelos pareira* L. [57]	Tamshaprip	*Menispermaceae*	Paste of root is applied externally as antidote on insect bite and scorpion sting.
96	*Cinnamomum iners* Reinw [58,59]	Tejpatra	*Lauraceae*	Leaves are used for scorpion sting.
97	*Desmodium gangeticum* D.C. [58,59,60]	Salaparni	*Fabaceae*	Roots
98	*Ferula foetida* Rege. [58]	Hing	*Umbelliferae*	Oleogum & resin are used in scorpion-sting.
99	*Pterocarpus Santalinus* Linn. [58,59,60]	Lal chandan	*Fabaceae*	Heart wood
100	Prosopis spicigera Linn. [64]	Sami, Shemi	*Fabaceae*	The bark is prescribed for scorpion sting.
101	*Heliotropium keralense* [66]	*Thelkatta*	*Boraginaeceae*	Leaves paste for local application.
102	*Calotropis gigantean* [67]	Tella jilledu	*Asclepiadaceae*	Roots
103	*Aristolochia elegans* Mast. [69]	Calico flower	*Aristolochiaceae*	Roots
104	*Artemisia campestris* L. [70]	Field sagewort	*Asteraceae*	Ethanolic extract of the leaves.

CONCLUSION

Data mentioned above clearly envisage that the herbal medications have excellent potential to treat various ailments including scorpion bite. They are largely used by all divisions of the population either directly as folk medications or indirectly in the preparation of recent pharmaceuticals. Herbal medicinal plants are an important element of indigenous medical systems globally. The information of medicinal plants has been accumulated in the course of several centuries based on various medicinal systems. The herbs used in the treatment of scorpion stings are easily available, common and cheaper. The method of preparation and mode of action is also simple and convenient. They are comparatively safer than synthetic drugs. Traditional medicinal knowledge is important not only for its potential contribution to drug development and market values but also for the healthcare professionals. Several medicinal plants with accepted therapeutic values in scorpion bite treatment are now attracting greater attention. The present review provides a base for enhancing scientists' attention towards consideration of ethnomedicinally important plants for scorpion bite treatment. The information available in this review could be helpful to scientists, drug designers, medicinal plant boards and other scientific bodies related to ayurvedic research in scorpion bite treatment. However, further studies are required to identify the phytochemicals responsible for anti-scorpion activity of these medicinal plants. Also pharmacological and clinical trials will help in the confirmation of the efficacy of the reported herbs.

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