

Snakelore and indigenous snakebite remedies practiced by some tribals of Rajasthan

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An ethnomedicinal survey of plants, which are especially used for the treatment of snakebite in the tribal (*Bhil, Meena, Garasia, Sahariya, Damor, Kathodia*) dominated areas of Rajasthan, was conducted to access the potentiality of herbs treating snakebite cases for modern therapeutic treatment of snakebites. The information is based on exhaustive interviews with specialist (doctor) and non-specialist person (village headman, priest and tribal folks) practicing snakebite cases. The people belonging to primitive or aboriginal culture possess a good deal of information about medicinal utility of plant diversity. Of 44 plant species used to treat snakebite victims, 39 belong to dicotyledonous group, while 5 species belongs to monocotyledons. Plant species along with part/s used and the mode of administration for treatment of venomous snakebite incidences are given. Besides, several myths related to snakes prevalent among the tribal and rural people of the study area are also discussed.

Keywords: Snakelore, Folk medicine, *Bhil, Meena, Garasia, Sahariya, Damor, Kathodia*, Rajasthan

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Snakebite is a common acute medical emergency faced by tribal and rural populations in tropical and subtropical countries with heavy rainfall and humid climate¹. Conservative sources estimate that number of snakebite incidents globally reach one million, resulting in 6,00,000 envenomations and more than 20,000 deaths annually^{2,3}. In India alone, more than 2,00,000 snakebite cases are reported⁴. Antiserum is the only therapeutic agent available throughout the world. Traditional healers use a wide range of plants to treat many ailments including snakebites. Folk herbal snakebite remedies are of interest since they may have recognizable therapeutic or toxic effect. Rajasthan, the largest state of the country lies between 23° 3' to 30° 12' N longitude and 69° 30' to 78° 17' E latitude. Many tribes are scattered in different parts of the state. The main tribes are *Bhil, Meena, Garasia, Damor, Sahariya, Kathodia*, etc. These tribal communities are mainly settled in different remote hilly forested tracts of the state, especially towards southern and Southeastern parts. Snakes have adapted to the most varied and diverse ecological conditions

and have predominantly colonized the warmer, densely vegetated areas of tropic^{5,6}. There are 222 known species of snakes in India, out of the total 3,273 species of snakes found globally. Out of these 222 snake species, 52 are partly or wholly venomous⁷⁻¹⁰. These species comprise capable swimmers, fast runners, accomplished burrowers, tree dwellers and perfect gliders. People living in rural and tribal areas of Rajasthan rely mostly on traditional medicines for the treatment of snakebites. Ethnomedicinal studies on tribal and rural areas of Rajasthan have been carried out by many workers¹¹⁻²². However, the documentation of traditional medicine for the treatment of snakebites has never been done in a systematic manner. In last few years, work on the snakes of Rajasthan was carried out²³⁻³⁵. Consequently, the objective of the study was to document the snakelore prevalent among all the ethnic groups of the region including various myths prevalent about the snakes and the remedies used to treat snakebite cases. Moreover, an attempt has been made to highlight the chemical composition and potential pharmacological activities of these plant species which are frequently used by the tribals against snakebite.

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Methodology

Ethnomedicinal surveys were conducted repeatedly in different seasons and areas of Rajasthan during 2000-2007. Ethnomedicinal information on wild plants used for snakebite as well as common myths related to snake and snakebites were collected through interviewing local informants after prior informed consent. The local informants were the specialist (snakebite doctors) and non-specialist (medicine-men, men and women working in the field, priest, and village headman, etc.) mostly above the age of 50 yrs. To determine the authenticity of information collected during field work, repeated verification of data from different informants and in different times was done. Thus, only the specific and reliable information cross-checked with at least 13 informants have been incorporated in the study. A structured questionnaire was used to collect data on local plant names, uses, parts used, and mode of preparation and administration. During the survey, some interesting folk uses of plants have come to light which are not mentioned. The collected medicinal plants were identified through floras and Herbarium of FRI, Dehradun³⁶⁻³⁸. All the collected specimens were deposited in the Herbarium of Laboratory of Ethnobotany and Agrostology, Department of Botany, ML Sukhadia University, Udaipur for authentication of information and further references. The information about the medicinal properties of plants are given.

Myths

Several myths are prevalent about snakes, their behaviour, dietary habits, habitats, etc. among the tribal, rural and even in urban masses of Rajasthan. Tribal people relate the snakes so much with themselves that they consider some snakes good and some snake bad for example *Ptyas mucosus* is the totemic snake of the *Bhurias* which is a clan of the tribe *Bhil*. Similarly, *Python molurus* is considered an esteemed serpent by the *Bhils* (Fig. 1). Similarly,

another snake species, *Xenochrophis piscator*, locally called as *Dindu* is considered as ancestor of the *Dindor* clans of *Bhil*; hence their name *Dindor*, i.e. off springs of *Dindu*. *Bhil* and *Garasia* tribes also conserve the snake *Python molurus* as they think that killing of the snake will cause drought in that year. Indian Python (*Python molurus*) likes proximity of water so *Bhil* and *Garasia* tribals protect the species believing that it brings rain. Moreover, statues of cobra are also worshiped by the tribals and non-tribals and victims of snakebites are brought to these places where *Bhopas* (local healers) treat the patients. A snake temple, locally known as *Gatodji ka Devra* situated in remote areas of Rajasthan is used as lie detector (Figs 2, 3). There are several primary beliefs/practices associated with snakebite incidences. There are some sacred places in the remote areas of Rajasthan, locally known as *Devra*. Some *Devras* are especially dedicated to treat snakebite patients. The important among them are *Gogaji* (Fig. 4), *Tejaji* (mostly situated in the western part of the Rajasthan) and *Devnarayanji* (situated in the central Rajasthan). The snakebite healers generally live in vicinity of these sacred places; treat the patient in front of the deity, with the belief that the treatment is made effective by the deities. In most instances, snake doctoring practices/lore are highly guarded secrets, due to the belief that loss of secrecy of medicine results in the loss of potency of medicine, moreover, this secrecy also protect and elevate the status of the practitioners (Table 1).

Result and Discussion

Though worldwide only 7% of snake species are reported as venomous, annual morbidity and mortality rates from snakebites are relatively high and most of the fatal cases occur where access to antivenin is not readily available³⁹⁻⁴². In Rajasthan, out of 36 snake species, 6 are venomous and 6 are mildly venomous (Table 2). Among them most abundant and widely

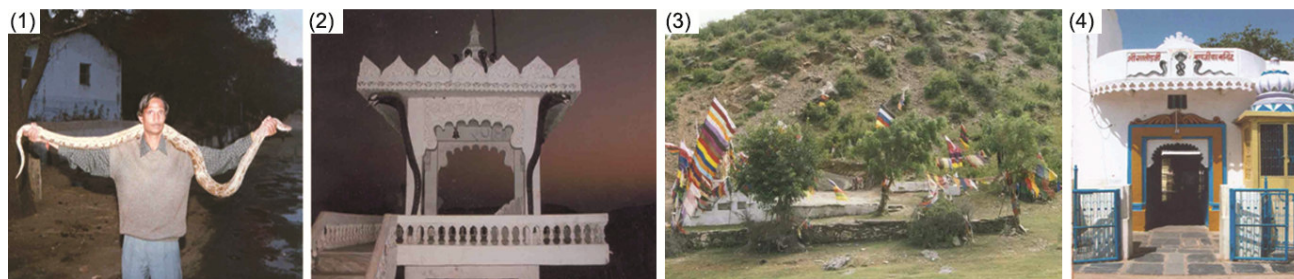


Fig. 1—A tribal holding a harmless Python; Fig. 2—An emblem of Cobra's in a snake temple; Fig. 3—Goga Ji Devra (sacred snake place) with coloured flags; Fig. 4—A snake temple known as Gatodji temple harbouring snakes

Table 1—Ethnomedicinal plants used to treat snakebite victims

Plant name/ Local name/ Common English name	Mode of Administration	Tribe	Biological activities
<i>Abelmoschus moschatus</i> Medicus (Malvaceae) <i>Jangli bhindi</i> Musk-Mallow	Seed paste is taken orally with milk as an antidote.	<i>Bhil, Meena, Sahariya</i>	-
<i>Abrus precatorius</i> Linn. (Fabaceae) <i>Chirmi, Chanboi Ratti, Charmoli,</i> Indian liquorice	Leaf extract is taken orally in snakebite.	<i>Bhil, Meena, Sahariya</i>	Anti-inflammatory and anti-allergic ⁵⁷ .
<i>Acacia nilotica</i> (Linn.) Willd. ex Del. (Mimosaceae) <i>Kikar, Tikar, Babul, Desi-babul, Babool</i> Indian Gum arabic tree	Crushed leaves are put in <i>Chilam</i> ; smoke is inhaled in scorpion sting and snakebite; acts as antidote and purifies blood.	<i>Bhil, Meena, Sahariya, Garasia</i>	Anti-inflammatory ⁵⁸
<i>Achyranthes aspera</i> Linn. (Amaranthaceae) <i>Andhijhara, Kanta, Kharia, Undhokanto,</i> Prickly chaff-flower plant	Root extract is taken orally by the tribals in scorpion bite and snakebite.	<i>Bhil, Meena, Sahariya</i>	Anti-inflammatory ⁵⁹
<i>Alangium salvifolium</i> (L.f.) Wang. (Alangiaceae) <i>Aankol, Ankola</i> Sage-leaved Alangium	Root extract is taken by the tribals orally as antivenom in snakebite. Acts as blood purifier.	<i>Bhil, Meena, Sahariya</i>	-
<i>Ailanthus excelsa</i> Roxb. (Simroubaceae) <i>Arru, Ardu, Paba</i> Tree of Heaven	Powdered bark is given with yoghurt as antivenom in snakebite and scorpion sting.	<i>Gujar, Meena</i>	-
<i>Anogeissus latifolia</i> (Roxb. ex DC.) Wall. ex Guill. & Perr. (Combretaceae) <i>Dhokada, Dhavada</i> Axle wood	Bark extract of is taken orally by the tribals as antivenom in snakebite.	<i>Meena, Damor</i>	-
<i>Argemone mexicana</i> Linn. (Papaveraceae) <i>Satyanashi, Dholari, Kateli</i> Yellow Mexican Poppy	Leaf extract is applied locally in snakebite.	<i>Bhil, Garasiya</i>	-
<i>Arisaema tortuosum</i> (Wall.) Schott (Araceae) <i>Haap rao dakaro, Suran, Khotukand</i> Jack-in-the-pulpit	Infusion of fresh bulb is taken orally thrice a day in snakebite.	<i>Meena, Kathodi, Damor</i>	-
<i>Aristolochia bracteolata</i> Lam. (Aristolochiaceae) <i>Kadhu, Kalipad</i> Worm killer	Leaf infusion of leaves is taken as antivenom in snakebite. Whole plant paste is applied on the snakebite wound.	<i>Gujar, Meena, Kalbeliya</i>	Anti-inflammatory ⁶⁰ , Wound healing ⁶¹
<i>Balanites aegyptiaca</i> (Linn.) Delile (Balanitaceae) <i>Hingor, Hingul, Hingota, Hingora, Hingot.</i> Soapberry tree	Paste of fruit is applied and taken in snakebite as antivenom and to purify blood; bark paste is given to animals in snakebite as antidote.	<i>Meena, Kalbeliya, Shariya</i>	Anti-inflammatory, antinociceptive ⁶²
<i>Buchanania lanzan</i> Spreng. (Anacardiaceae) <i>Char, Chironji</i> Almondette tree	Bark paste is applied locally in snakebite.	<i>Bhil, Meena, Sahariya</i>	-
<i>Butea monosperma</i> (Lam.) Taub. (Fabaceae) <i>Dhauk, Palas, Tesu, Khankra, Chhela</i> Flame of the Forest	Resin of this plant is applied locally in snakebite for early healing of wound.	<i>Meena</i>	-

Table 1—Ethnomedicinal plants used to treat snakebite victims—*Contd*

Plant name/ Local name/ Common English name	Mode of Administration	Tribe	Biological activities
<i>Caesalpinia bonduc</i> (Linn.) Roxb. (Caesalpiniaceae) <i>Kantkaranj, Katha</i> Fever nut	Root paste is applied externally by the tribals as antivenom in snakebite.	<i>Meena, Bhil</i>	Antipyretic ⁶³ and Anti-inflammatory ⁶⁴
<i>Calotropis gigantea</i> (Linn.) R.Br. (Asclepiadaceae) <i>Safed-akra, Akro, Shiv-oak.</i> Gigantic shallow wort	Root paste is applied locally in snakebite as antivenom.	<i>Meena, Bhil, Damor</i>	Antipyretic ⁶⁵ , Analgesic, Sedative, Anticonvulsant ⁶⁶
<i>Calotropis procera</i> Br. (Asclepiadaceae) <i>Akdo, Aak, Aakro</i> Swallow wort	Plant latex is applied in snakebite for early cure. Latex of <i>Calotropis procera</i> and <i>Mangifera indica</i> mixed with Conc HCl is applied locally.	<i>Guajr, Meena, Sahariya</i>	Anti-inflammatory ⁶⁷ , Analgesic ⁶⁸ , Antipyretic ⁶⁴
<i>Cassia fistula</i> Linn. (Caesalpiniaceae) <i>Amaltas, Bahawa, Garmale, Karmalo</i> Indian Laburnum	Powdered root is taken orally with water as antivenom in snakebite.	<i>Bhil</i>	Antipyretic, analgesic, immuno potentiating ⁶⁴
<i>Cayratia trifolia</i> (Linn.) Domin (Vitaceae) <i>Khatta nimbu, Tinpostia, Tal- patiya</i> Fox-grape	Root paste is taken orally as antivenom in snakebite.	<i>Meena, Bhil, Kathodi, Sahariya</i>	-
<i>Celastrus paniculata</i> Willd. (Celastraceae) <i>Mal-kangni, Mali</i> Climbing staff plant	Bark powder is taken with water to alleviate pain and inflammation caused due to snakebite.	<i>Bhil</i>	Sedative, Anti-convulsant ⁶⁹ , antipyretic, Anti-inflammatory, analgesic ⁶⁴
<i>Cissampelos pareira</i> Linn. (Menispermaceae) <i>Kalipar</i> Abuta	In the entire region of <i>Mewar</i> , tribals use root extract as an antidote in snakebite.	<i>Bhil, Meena</i>	Antinociceptive ⁷⁰ , anti-inflammatory ⁷¹ , Sedative ⁷²
<i>Clitoria ternatea</i> Linn. (Fabaceae) <i>Gokarni</i> Clitoria	Extract of root is taken orally by the tribals as antidote in snakebite.	<i>Bhil, Garasiya, Meena</i>	-
<i>Cocculus hirsutus</i> (Linn.) Diels (Menispermaceae) <i>Bajar-bel, Van-veela, Baar</i> Broom creeper	Leaf powder mixed with bark powder of <i>Azadirachta indica</i> is taken in snakebite.	<i>Meena, Bhil</i>	Anti-inflammatory and analgesic ⁷³
<i>Corallocarpus epigaeus</i> (Rottl. & Willd.) Hook. f. (Cucurbitaceae) <i>Marsikand, Kadwinai, Mirch bel, Kadvi bel</i> Indian Bryonia	Tuber decoction is taken orally by the tribals in snakebite as antivenom.	<i>Meena, Sahariya</i>	-
<i>Datura stramonium</i> Linn. (Solanaceae) <i>Kantawala- dhatura</i> Jimson weed	Extract of roots mixed with latex of <i>Calotropis procera</i> is applied and taken in scorpion sting and snakebite.	<i>Bhil</i>	Analgesic ⁷⁴
<i>Dioscorea pentaphylla</i> Linn. (Dioscoreaceae) <i>Lalwala, Ratalu vidarikand, Kada kanda</i> Five-leaf yam	Tuber extract is taken by tribals of southern Rajasthan as antivenom in snakebite.	<i>Garasiya, Meena, Bhil</i>	-
<i>Diospyros montana</i> Roxb. (Ebenaceae) <i>Vish Tendu</i> Mountain persimmon	Root extract is given orally in snakebite as antivenom.	<i>Meena, Kathodi, Bhil</i>	-

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Table 1—Ethnomedicinal plants used to treat snakebite victims—Contd

Plant name/ Local name/ Common English name	Mode of Administration	Tribe	Biological activities
<i>Euphorbia nerifolia</i> Linn. (Euphorbiaceae) <i>Danda- thor, Thuar</i> Indian spurge tree	Latex is applied locally on the wound as antivenom in snakebite.	<i>Bhil, Meena</i>	-
<i>Ficus racemosa</i> Linn. (Moraceae) <i>Gular, Umar, Umbio, Kusumati</i> Cluster fig	Bark decoction is used by the tribals as antivenom against snakebite.	<i>Bhil, Meena</i>	Anti-inflammatory ^{75,76}
<i>Gardenia turgida</i> Roxb. (Rubiaceae) <i>Padairi, Padatatu</i>	Root or bark extract is taken orally as antivenom in snakebite.	<i>Meena</i>	-
<i>Gloriosa superba</i> Linn. (Liliaceae) <i>Kalihari</i> Malabar glory lily	Paste of tuber is taken orally as antivenom in snakebite.	<i>Bhil, Meena</i>	-
<i>Hemidesmus indicus</i> (Linn.) R. Br. (Periplocaceae) <i>Dudhli, Garmali, Anantmul, Koorvi</i> Indian sarasaparilla	Decoction or powder of whole plant including roots is taken as an antidote in snakebite and as blood purifier.	<i>Meena, Bhil, Sahariya</i>	Anti-inflammatory, Antipyretic ⁷⁷ , Antipoison ⁴⁹ , Antinociceptive ⁷⁸
<i>Heteropogon contortus</i> (Linn.) P. Beauv. (Poaceae) <i>Suva ghass, Lapida, Lapia, Pallio, Lapadioo</i> Tangle head	Root paste is taken orally as well as applied locally in snakebite as antivenom.	<i>Bhil, Meena, Damor</i>	-
<i>Holarrhena pubescens</i> (Buch.-Ham.) Wall. Ex G. Don (Apocynaceae) <i>Kadwa Kodaya, Hadadiyo, Kadi</i> Tellicherry bark	Poultice of crushed root is tied in snakebite.	<i>Meena, Bhil</i>	-
<i>Luffa acutangula</i> (Linn.)Roxb. (Cucurbitaceae) <i>Jangli taroi</i> Ridged gourd	Powder of whole plant or crushed fruits is taken with water as antivenom in snakebite.	<i>Bhil</i>	-
<i>Madhuca indica</i> J. F. Gmel. (Sapotaceae) <i>Mahua, Mahuwa, Mauo</i> The honey tree	Bark extract is used as antivenom in snakebite.	<i>Meena, Bhil</i>	-
<i>Mitragyna parvifolia</i> (Roxb.) Korth (Rubiaceae) <i>Kadamb</i> Kaim	Paste of stem and root bark is applied locally in snakebite.	<i>Meena, Bhil</i>	-
<i>Polygonum barbatum</i> sub sp <i>gracile</i> Danser (Polygonaceae) <i>Ghar ki sabji</i> Joint weed	Leaf paste is applied externally as well as taken orally by the tribals in snakebite and insect bite.	<i>Bhil, Sahariya</i>	-
<i>Sarcostemma viminale</i> (Linn.) R. Br. (Asclepiadaceae) <i>Khir, Khimp</i> Rapunzel plant	Infusion of whole plant is applied by the rural people on wound of snakebite.	<i>Gijar, Meena</i>	-
<i>Sauromatum venosum</i> (Ait.) Kunth (Araceae) <i>Haap ro dakra, Suran</i> Voodoolily	Paste of tuber is applied locally as well as taken orally in snakebite.	<i>Bhil, Meena, Sahariya, Kathodia</i>	-
<i>Solanum nigrum</i> Linn. (Solanaceae) <i>Makoo, Saemi, Chirpot</i> Black night-shade	Leaf juice is applied locally on the wounds caused due to snakebite.	<i>Meena, Sahariya, Bhil</i>	Antipyretic ⁷⁹ , Anti-inflammatory ⁸⁰

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Table 1—Ethnomedicinal plants used to treat snakebite victims—*Contd*

Plant name/ Local name/ Common English name	Mode of Administration	Tribe	Biological activities
<i>Sterculia urens</i> Roxb. (Sterculiaceae) <i>Kadaya</i> Gulu	The gum mixed with CaCO ₃ is applied and also taken orally in snakebite.	<i>Meena, Damor</i>	-
<i>Tamarindus indica</i> Linn. (Caesalpiniaceae) <i>Imli</i> Tamarind	Seed paste is applied locally as antivenom in scorpion sting and snakebite.	<i>Bhil</i>	-
<i>Trichosanthes cucumerina</i> Linn. (Cucurbitaceae) <i>Indrani, Jangli- chichinda, Kechan</i> Snake gourd	Extract leaf powder is taken orally as an antivenom in snakebite.	<i>Bhil, Meena</i>	-
<i>Wrightia tinctoria</i> (Roxb.) R. Br. (Apocynaceae) <i>Kheer, Khani, Khirni</i> Pala indigo plant	Fresh leaves are chewed by tribals as soon as incidence of snakebite occurs.	<i>Meena, Bhil, Sahariya</i>	-

Table 2—Species of snakes present in Rajasthan

Latin name/ Common English name/ Local name	Venomous/ Non-venomous*	Frequency of bites	Habitat / location of occurrence	Abundance of species in the state
<i>Ahaetulla nasuta</i> Common vine snake <i>Leela udna hamp</i>	MV	Generally doesn't bite	Forest area of southern Rajasthan	Rare
<i>Ahaetulla nasuta</i> var. <i>isabellinus</i> Isabelline vine snake	MV	Generally doesn't bite	Forest area of southern Rajasthan	Rare
<i>Amphiesma stolata</i> Buffstriped keelback	NV	Never bites	Near ponds and streams, forest area, grasslands and fields	Less common
<i>Argyrogena fasciolata</i> Banded racer	NV	-	Dense forest area, hilly forest.	Rare
<i>Boiga forsteni</i> Forsten's cat snake	MV	Generally doesn't bite	High hills of Mt. Abu	Rare
<i>Boiga trigonata</i> Common cat snake	MV	Bites	Under banks and stones; hilly areas, forest, grasslands, human settlement	Common
<i>Bungarus caeruleus</i> Common krait	V	Bites	Hilly forest areas, grasslands and human settlement	Common
<i>Bungraus sindanus sindanus</i> Sind krait	V	Bites	Desert part of state	Rare
<i>Coelognathus helena helena</i> Common Trinket snake	NV	Generally doesn't bite	In termites moulds, rock crevices, on hedges; in Aravallis	Common
<i>Coelognathus helena monticollaris</i> Montane trinket snake	NV	Generally doesn't bite	Forested hilly southern and Southeast state	Rare
<i>Coluber gracilis</i> Slender racer	NV	Generally doesn't bite	Grasslands, scrubby zone and open forests of southern Rajasthan	Rare
<i>Coluber ventromaculatus</i> Glossy-bellied racer	NV	Generally doesn't bite	Sandy desert part; in scrubby area of arid zone	Less common
<i>C. fasciolata</i> Banded racer	NV	Generally doesn't bites	Forest area and heavy bushy zone (Present in Sitamata wildlife sanctuary, Dhariyawad and Pratapgarh zone)	Rare

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Table 2—Species of snakes present in Rajasthan—Contd

Latin name/ Common English name/ Local name	Venomous/ Non-venomous*	Frequency of bites	Habitat / location of occurrence	Abundance of species in the state
<i>Daboia russellii</i> Russell's viper Chitti	V	Bites	Forest, arboreal habitat, grassland, scrub land and rocky areas	Less common
<i>Dendrelaphis tristis</i> Common Indian Bronzeback snake Udani	NV	Generally doesn't bite	Arboreal habitat	Less common
<i>Echis carinatus</i> Saw - scaled viper Pad, Chhoti chitti	V	Bites	Dry rocky, sandy, degraded forest and grasslands	Common
<i>Eryx johnii</i> Red sand Boa Dumuhi, Dam, Chakland	NV	Never bites	Dry places and sandy soil; in whole Rajasthan	Common
<i>Gongylophis conicus</i> Common sand Boa Dum	NV	Sometimes bite	Prefers arid zone, present throughout the state	Common
<i>Grypotyphlops acutus</i> Beaked worm snake Andha samp	NV	Never bites	In southern part of Rajasthan	Rare
<i>Lycodon aulicus</i> Common wolf snake Kilbildia	NV	Bites	Human habitations, stone pillars, near wells, hollow trees	Common
<i>Lycodon striatus</i> Shaw's wolf snake	NV	Usually doesn't bite	Hilly forest areas, grasslands, human habitations	Less common
<i>Lytorhynchus paradoxus</i> Sind awl-headed snake	NV	*	Sand dunes	Rare
<i>Macropisthodon plumbicolor</i> Green Keelback Leela hamp	NV	Never bites	Forest area and grasslands	Less common
<i>Naja oxiana</i> Central Asian cobra Nag	V	Bites	Northwestern part of the state	-
<i>Naja Naja</i> Spectacled cobra Nag	V	Bites	Throughout Rajasthan	Common
<i>Oligodon arnensis</i> Common kukri snake	NV	Generally doesn't bite	Hilly habitats and old houses	Less common
<i>Oligodon taeniolatus</i> Russell's Kukri snake	NV	Generally doesn't bite	Forest area and human settlements	Common
<i>Psammophis leithi</i> Leith's sand snake	MV	Bites	Forest area, arid zones, grassland	Less common
<i>Psammophis schokari</i> Afro-asian sand snake	MV	*	Sandy desert area of the state	Rare
<i>Ptyas mucosus</i> Common rat snake Dhaman	NV	Bites while in pressure	Forests, urban areas, grasslands, agricultural field, wet zone, etc.	Common
<i>Python molurus molurus</i> Indian rock python Ajar, Agar	NV	Bites while in pressure	In arid scrub jungles, grassland and forest areas	Less common
<i>Ramphotyphlops braminus</i> Brahminy worm snake Andha samp	NV	Never bites	Underground in damp localities	Common

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Table 2—Species of snakes present in Rajasthan—Contd

Latin name/ Common English name/ Local name	Venomous/ Non-venomous*	Frequency of bites	Habitat / location of occurrence	Abundance of species in the state
<i>Sibynophis subpunctatus</i> Dumeril's black headed snake	NV	Never bites	Under stones and in leaf litters in dense forest	Rare
<i>Spalerosophis arenarius</i> Red spotted royal snake <i>Ghora pachhad, Rajit banjar</i>	NV	Generally does not bites	Dry sandy areas	Less common
<i>Spalerosophis atriceps</i> Black-headed royal snake	NV	Generally does not bites	Dry sandy area	Common
<i>Xenochrophis piscator</i> Checkered keelback <i>Dindu</i>	NV	Bites	Water bodies	Common

NV- Non-venomous, MV-Mildly venomous, V-Venomous, *no information is available

distributed venomous snake species are cobra, krait, russell's viper and saw-scaled viper. Saw-scaled viper is much common in western part of the state. The ethnomedicinal surveys of the state shows that 44 plant species has been used by the local healers either as antidote or for ancillary treatment. The analysis based on these 44 plant species belonging to 30 families, reveals that majority of the plant species (39) belongs to Dicotyledonous group, while only 5 species belongs to Monocotyledons. Symptoms of snakebite include vomiting, bleeding, fever, pain and inflammation around the wound and this pathophysiology is a combined effect of various actions of the complex venom constituents. To subside all these symptoms, treatment is given in the form of decoction, powder, paste and extract and administrated both as orally and topically. Maximum snakebite remedies are prepared from roots (30%) and leaves (20%) (Fig. 5). Roots/tubers are used mostly because they contain higher concentration of bioactive compounds⁴³⁻⁴⁴. The bioactivity of these plant species is largely due to the presence of secondary constituents such as alkaloids, phenols, steroids, saponins and glycosides. These compounds have a broad range of therapeutic properties and are widely distributed among the angiosperms. Many of the compounds contained in these 46 species may not neutralize the venom itself but serve as analgesic, antiemetic, antiinflammatory, immunostimulant, local anesthetic and sedative, making them useful to alleviate some of the ancillary symptoms or responses. Out of the 44 species used as snakebite antidote, 13 possess, antiinflammatory activity, 9 species possess anticonvulsant and sedative activities

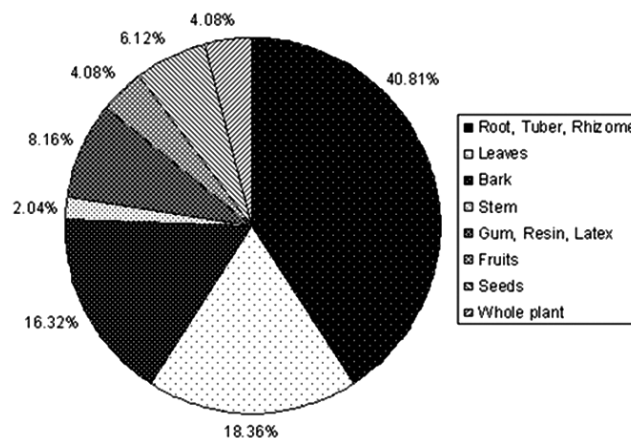


Fig. 5—Different plant parts used as snakebite remedies

and 11 species contain endothelin receptor antagonist activity against snake venom's sarafotoxins.

Plants having antiinflammatory property contain bioactive compounds such as coumarins, phenols, saponins, quercetin, tannins, luteolin, etc. and many of such species such as *Balanites aegyptiaca*, *Datura stramonium*, *Hemidesmus indicus*, *Calotropis procera* possess many of these chemical constituents⁴⁵⁻⁴⁷. One of the main objectives of snakebite treatment is to stop the victim from vomiting and for this purpose; a decoction made with the plants containing those bioactive compounds which inhibit muscular contraction (anticholinergic) in gastrointestinal tract is prepared. Species of reputed anticholinergic effect contain tropane alkaloids such as atropine, hyoscyamine and scopolamine⁴⁷⁻⁴⁸. *Datura stramonium* is one such plant species which might work as antiemetic and it contains tropane

alkaloids⁴⁹⁻⁵⁰. Although tribals use many plant species to treat snakebite cases but the most preferred and effective plant species are *Alangium salvifolium*, *Aristolochia bracteolata*, *Balanites aegyptiaca*, *Cissampelos pareira*, *Hemidesmus indicus* and *Gloriosa superba*. Many of these species contains phytochemicals responsible for various pharmacological actions which help in relieving the symptoms of snakebite. Species such as *Hemidesmus indicus* contains coumarinolignoids such as hemidesminine, hemidesminine-1, hemidesminine-2, triterpenoids and sitosterols. Moreover, p-methoxy-2-hydroxy benzoic acid and lupeol acetate isolated from the roots of the plant has been proved to possess significant anti-poisonous activity against viper venom and snake *Daboia russellii* by antagonizing venom-induced lethal haemorrhagic, coagulant and anticoagulant activity in experimental rodents and rabbits⁵¹⁻⁵⁴.

Similarly, *Balanites aegyptiaca* contains saponins, alkaloids such as N-trans-feruloyltyramine, N-cis-feruloyltyramine and other compounds such as vanillic acid, syringic acid, 3-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-1-propanone⁵⁵. *Aristolochia* sp contains triterpenoid such as aristophyllide A and alkaloid such as aristolochic acid and allantoin which on pharmacological investigations, have been found competitive inhibitors of three basic phospholipase A2 osoenzymes and adenosine triphosphatases enzymes of some snake venom stimulates the immune system⁵⁶. Presence of these compounds might be the reason for their effectiveness and therefore pharmacological screening of plant extracts and the isolated compounds is an essential step to prove efficacy of these plants against snakebites. Rajasthan harbors a vast diversity of medicinal plants²². During the study, it was found that despite gradual socio-culture transformation, local communities still possess substantial knowledge of plants and their uses. The reliance on folk medicines for healthcare is associated with the lack of modern medicines and medication, poverty and traditional belief of its effectiveness. Since, there is a complete lack of phyto-therapeutic evidence for many of the species, phytochemical and pharmacological studies need to be carried out in order to confirm the validity of properties attributed to these species.

Conclusion

The study concludes that because of some prevailing myths, people of the region kill the snakes and this human activity had a negative impact upon

the snakes in many ways. Moreover, clearance of their original habitats for cultivation, destruction of forests and the draining or poisoning of the waters have greatly restricted the distribution areas of these ecologically useful animals. Hence, in order to conserve snakes, awareness should be created among the tribals, rural and even urban masses that snakes have an important role in balancing the food chains in nature thus all the myths regarding the killing of the snakes should be strictly discarded.

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