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Traditional healing practices for treatment of animal bites among tribes of India: A systematic review

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Animal bites are a significant concern of public health and mortality throughout the world, wherein India reports the highest number of deaths due to snakebites. The tribes of India (Scheduled Tribes or STs), constituting about 8.6% of India's population with a total of more than 104 million, mostly inhabit remote and inaccessible areas, with their subsistence and habitation being primarily forest-derived. This forest-based lifestyle exposes tribal populations to animal bites which are often lethal, and at the same time, it is the forest only on which tribes are dependent for getting their primary health care through the institution of traditional healer or ethnomedical practitioner who uses natural resources to cure various health issues. This system of knowledge and immense know-how of illness, diagnosis, treatment and utilization of natural resources (especially plants) in treatment of a myriad of ailments is transferred orally from one generation to another.

The present work is an attempt to assemble information related to various plants and practices being used as traditional medicine for treating animal bites by the tribes of India. The review was undertaken by categorising research articles focusing on tribes residing in different geographical zones of India (seven zones for the current purpose) and their treatment pattern involving usage of plants for various types of animal bites. We find that present work fills-in the critical gap by providing detailed analysis of 276 plant species being used in 423 herbal preparations for curing animal bites by 81 tribes of India. It is found that tribal populations residing in Southern parts of the country report the usage of highest number of medicinal plants, whereas scarce data is available on the traditional medicinal practices for curing animal bites in tribes of the Island zone (*i.e.*, in the Andaman & Nicobar Islands). This facet of tribal lifestyle, involving usage of natural resources around them for healthcare, is in a way exemplary of their survivability in tough forested conditions since time immemorial, and, thus should be treated as a success story in itself.

Keywords: Animal bite, Ethnomedicine, Snakebite, Traditional healer, Tribe

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According to the World Health Organization (WHO) animal bites are a major public health problem worldwide in terms of morbidity and mortality, among both children and adults, with rising incidences of bites from the snake, dog, cat, and monkey[1]. Even animal sting reactions could be allergic and lead to emotional stress and behavioural aggression. About 5.4 million people are bitten by snake every year in the world, resulting in 1.8 to 2.7 million envenoming from snakes. Recently, WHO categorised snakebite as a Neglected Tropical Disease (NTD) as deaths caused by snakebite annually are between 81,410 and 137,880, with an additional 400,000 amputations and other severe health consequences[2]. Following snake bite, scorpion bite causes an estimated 3,250 deaths every year, while more than 1.2 million stings occur worldwide[3]. Similarly, dog bites account for 76-94% of animal bite injuries[1]. Dog bites and monkey bites are major source of rabies throughout the world. In Asia and Africa alone, rabies infection reached a death toll to thousands of deaths every year[4].

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Abbreviations

Ant bite- An, Bark- B, Bee bite- Be, Branch- Br, Bulb- Bl, Centipede bite- Cn, Corn- C, Culm- Cu, Dog bite- Dg, Endosperm- En, Fish bite- Fs, Flower- Fl, Frog bite- Fg, Frond- Fr, Fruit- F, Gum- G, Inflorescence- In, Insect bite- In, Jackal bite- Jk, Latex- Lt, Leaf- L, Leech bite- Lc, Petiole- Pt, Pig bite- Pg, Pod- P, Rhizome- Rh, Root Bark- R B, Root- R, Scorpion bite/sting- Sc, Seed- S, Snake bite- Sn, Spider bite- Sp, Stem bark- St B, Stem- St, Total Tribal Proportion- TTP, Tuber- T, Wasp bite- Ws, Whole Plant- Wp, Wood- W.

Animal bite mortality in India

India represents the highest mortality rate due to snakebite, globally. The estimated deaths by snake

bites from 2000-2019 were about 1.2 million with 58,000 per year. On the other hand, estimated cases could be 30 times higher than the official data[5]. Only 50 out of 285 species contain venom whereas four species are responsible for fatal bites *viz*., Cobra (*Naja naja*), Russell's viper (*Daboia russelii*), Common Krait (*Bungarus caeruleus*), and Saw-scaled Viper (*Echis carinatus*[6]). Followed by snakebite, scorpion bites also contribute to the mortality rates, but due to under-declaration and insufficiency of studies, scarce data is available on scorpion stings in India[5]. Around the world, annual estimated number of scorpion stings cases exceeds 1.23 million, of which over 32,250 may be fatal whereas India lacks data for scorpion stings[3]. India has total of 113 scorpion species belonging to 25 genera and 6 families wherein family *Buthidae* is of prime significance due to its lethality[7]. Further, Indian streets are home to 35 million dogs which contribute to 17.4 million bite cases annually leading to about 18,000 to 20,000 cases of human rabies every year[8].

The National Centre for Disease Control, New Delhi, India reported in 2018 that a steady increase in animal bites have been reported across the country from 2012 to 2018 under the Integrated Disease Surveillance Programme (IDSP), and most of these have occurred in rural areas which lack medical facilities and are scarce in public health infrastructure[9]. The tribes of India, which account for 8.6% of country's population totaling more than 104 million, dwell majorly in rural areas (90%) which are often hard-to-reach and in proximity of the forests. There are as many as 705 ethnic groups classified as Scheduled Tribes and 75 of them being further categorised as Particularly Vulnerable Tribal Groups (PVTGs) in India, for most of them forest is the source of sustenance with their economy highly dependent on forest derived products. Further, even though the tribes constitute merely 8.6% of the population, tribal areas (*i.e.*, areas where there is majority of tribal population) account for nearly 60% of the forest cover in the country[10]. This leads to greater encounters of tribal people with wild animals which possess potential dangers to their life. In such circumstances, tribes become highly dependent on their age-old traditional medicine system which revolves around the institution of the traditional healer or ethnomedical practitioner in the community.

Traditional medicine system and tribal traditional healers

The WHO is of the view that about 80% of the world's population depends on traditional medicine systems for their primary health care needs[11]. Over one-third of the world population lacks access to essential medicine, but traditional medicine system has the potential to bridge this gap. In case of India, 65% of the rural population is dependent on the medicinal plants for their primary health care, which is easily available and affordable in low-income countries[12].

In India, the ambit of traditional, complementary and alternative medicine systems is not just limited to the codified systems of AYUSH *i.e.*, Ayurveda, Yoga, Homeopathy, Unani, Siddha, Homeopathy and Sowa-Rigpa, but also covers the non-codified medicine system of the indigenous populations (tribes) which makes this domain of scientific enquiry more vibrant and full of potential. Among tribes, the key to the traditional medicine system is the healer or the ethnomedical practitioner of the community. She/he/they is revered as the link between nature-man-divine, often advancing the ancestral wisdom congregated over generations of living with nature[13]. The perception of disease in tribes is also complex to understand. Usually, disease or illness is thought to be associated with pollutants, misfortune, curse or people with evil eyes among tribal population[14]. Studies suggest that significant proportion of tribal population depend on traditional healers for immediate treatment for a variety of health issues including animal bites like for scorpion stings and others.

The traditional healer or ethnomedical practitioner is designated with different names in the tribal verbatim[15], like *Vaidu* and *Mukhia* among Bhil and Thakar tribes of Maharashtra, *Vaidhyar* in Peliyar and Muthuvar tribes of Tamilnadu, *Bhumkas* in Korku tribe of Maharashtra, etc. Generally, the ethnomedicinal knowledge is transferred from one generation to the next within the family, however, sometimes taboos are associated with transfer of this knowledge. Like Pradhan and Badola (2008) illustrated those traditional healers in the *Lepcha* tribe of Sikkim believe that if an unauthorized person attains the wisdom, medicine will show an adverse effect on the patient and healer must suffer ill fate from the wrath of deity[16].

In view of the above, the present work is an attempt to congregate information and wisdom related to various plants and practices being used as traditional medicine for treating animal bites by tribes of India. The review was undertaken by categorizing articles focusing on tribes residing in different zones of India (the whole of India is divided into seven

zones) and their treatment pattern involving usage of plants for various types of animal bites.

Methodology

The review of the literature was done using the electronic database for relevant information by using appropriate keywords like 'ethnomedicine among tribal population in India', 'ethnobotanical study on snakebite treatment', 'traditional healing practices for the treatment of animal bites in Indian tribes', 'snakebite', 'mortality', 'scorpion bite', 'faith', 'folklore' and 'indigenous'. The literature was focused on English language. A search on Google Scholar resulted into 19,100 research articles, review articles, reports, short communications and others. Subsequently, 75 research articles were downloaded for systematic review process. It is important to mention here that no particular software was used for searching the literature. Figure 1 shows the flow diagram illustrating review process.

Inclusion criteria

Research articles were selected on the basis of geographical distribution which was given by different anthropologists at different time periods where tribal communities are residing such as North zone, South zone, East zone, West zone, North-east zone, Central zone and Island region. Then research articles were categorized on the basis of traditional ways of treatment used by tribal communities in case of animal bites, including snake bite, dog bite, scorpion bite, wasp bite, bee bite and other animal or insect bites. Further, plant parts, route of administration, botanical and vernacular name of the plant species were taken into consideration. Thus, 62 research articles were finalized after undertaking the systematic review.

Exclusion criteria

Articles excluded from the review process are those which did not include: name of the tribal group using herbal medicine, complete preparation of medicine, mode of administration and plant part.

Findings

The present review reveals about 423 different traditional healing practices identified which are used by 81 tribes of seven tribal zones in India. A total of 276 medicinal value plant species were discovered in India for the treatment of animal bites among tribal communities. South zone represents highest number (113) of medicinal value plants for animal bite treatment whereas Island region represents only 12 plant species from the Andaman and Nicobar Islands for the animal bite cure. However, no data has been found in Lakshadweep Islands which are also inhabited by tribal communities. Traditional methods used by the traditional healers for treating animal

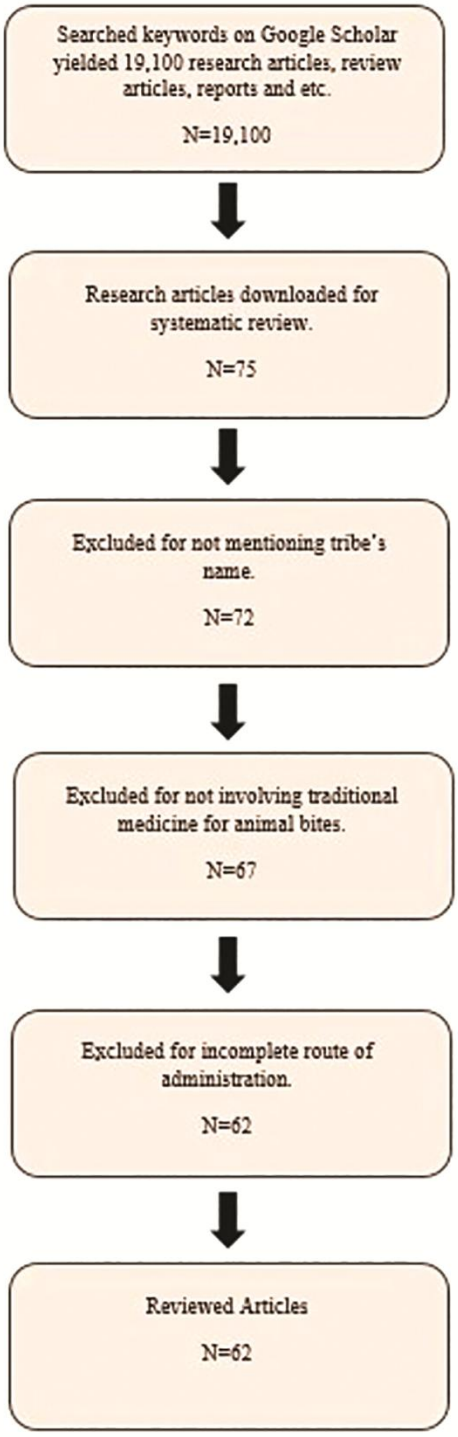

Fig. 1 — Flow diagram illustrating review process

bites include the following kinds of bites - snake bite (238), scorpion bite/sting (98), dog bite (29), insect bite (non-venomous) (21), bee bite (8), leech bite (5), spider bite (4), wasp sting (2), rat bite (2), venomous insect bite (2), fish bite (1), jackal bite (1), frog bite (1) and other venomous bites (14) (figures in brackets represent the number of traditional healing methods used to cure the bite). The zone wise details about traditional healing practices for animal bites among tribes is given in supplementary tables. Figure 2 represents the number of tribes using traditional medicine for animal bite treatment and number of medicinal value plants in each tribal zone.

North Zone

North zone includes six states of India *i.e.*, Jammu and Kashmir, Himachal Pradesh, Punjab, Uttarakhand, Uttar Pradesh and Bihar. In this zone, 52 traditional remedies and 48 medicinal value plants were determined to be used for curing snake bite, dog bite, scorpion bite/sting, wasp sting, insect bite and venomous bite by 11 tribes residing in these states. The Tharu tribe of Uttar Pradesh reported maximum number (19) of plant species used for the treatment of snakebite, scorpion bite/sting, dog bite and insect bite by commonly using plant root and bark for medicine preparation. While the Kiratas and Gujjars of Himachal Pradesh are using only a single plant species *i.e.*, *Carissa opaca* in case of animal bite (snakebite) as mentioned in supplementary Table 1. It is interesting to note that various tribes like Baiga, Bhil, Kharwar, Tharu, Pangwal, Bakarwal and Gujjars have treatment of venomous animal bites which often proves to be lifesaving.

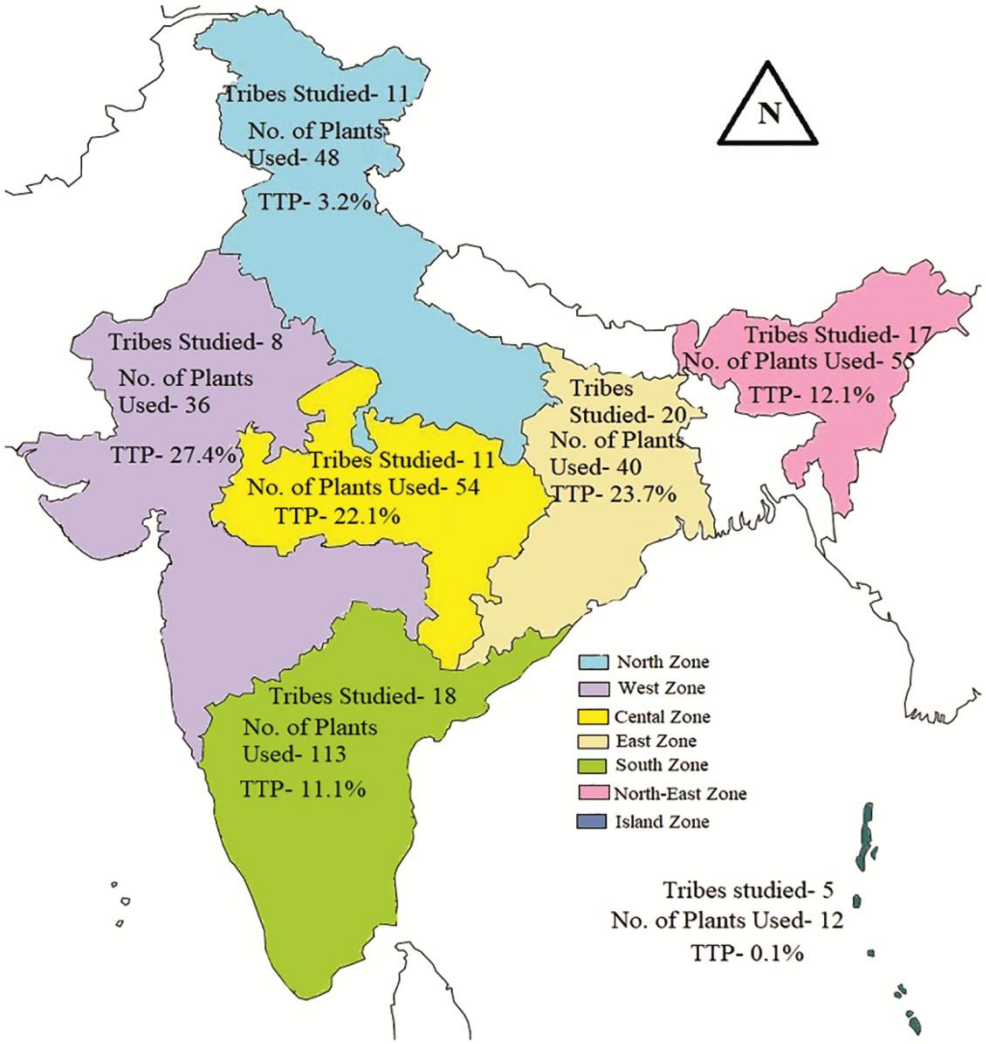

Fig. 2 — Number of tribes using traditional medicine for animal bite treatment and number of medicinal value plants in each tribal zone
Source of the outline map of India: https://www.mapsofindia.com/maps/india/outlinemapofindia.html

Central Zone

Madhya Pradesh, Chattisgarh, western Rajasthan and northern Andhra Pradesh are considered under the central zone of India wherein Madhya Pradesh has the largest tribal population in the country. 61 herbal remedies by using 54 medicinal plants are identified among the tribal population of Madhya Pradesh and Chattisgarh. The Supplementary Table 2 describes in detail the herbal medicines and preparation used for treating different types of animal bites by tribes like Korwa, Birhore, Cherwa, Pando, Baiga, Saharia, etc. Importantly, usage of highest number of plant species (22) was reported collectively by Korku and Gond tribe of Madhya Pradesh followed by 14 plant species identified among Cherwa and Pando tribe of Chattisgarh. Root, whole plant and leaf were

Table 1 — Commonness and differences in usage of medicinal plants by tribes for treating animal bites across the geographical zones of India

S. No.	Plant species	North zone	Central zone	West zone	South zone	East zone	North-East zone	Island zone
1.	*Allium sativum*		Sc			Sn	Sn	
2.	*Andrographis paniculata*				Sn, Sc, Vn	Sn		
3.	*Annona squamosa*		Sn	Sc	Sn			Sn
4.	*Aristolochia bracteolate*			Sn, Sc	Sn			
5.	*Aristolochia indica*				Sn, Vn	Sn		
6.	*Azadirachta indica*		Sn		Vn	Sn		
7.	*Bacopa monnieri*		Sn		Dg, Sn			
8.	*Boerhavia diffusa*	Sn				Sn		
9.	*Boswellia serrata*	Sn				Sc		
10.	*Butea monosperma*	Sn	Sn					
11.	*Calotropis gigantea*			Sn	Sn	Sn		
12.	*Cassia fistula*	Sn			In	Sn		
13.	*Cassia occidentalis*		Sn		Sn			
14.	*Cassia tora*	Sn			Sn			
15.	*Cissampelos pariera*		Sn			In		
16.	*Costus speciosus*			Sn				Sn
17.	*Curcuma longa*				Sn		In, Lc	
18.	*Datura metel*					Sn	Dg	Sn
19.	*Drymaria cordata*					Sn	Sn, In	
20.	*Eclipta alba*				Sn			Sn
21.	*Emblica officinalis*		Sc		Sn	Sn		
22.	*Gmelina arborea*	Sn			Sc			
23.	*Gymnema sylvestre*		Sn		Sn, Sc	Sn		
24.	*Ipomoea pes-tigridis*	Sn, Dg	Sc					
25.	*Kalanchoe pinnata*				Sc	Sn	In	
26.	*Kigelia africana*	Sn			Sn, Sc			
27.	*Leucas aspera*	Sn	Sn		Sn	Sn		
28.	*Martynia annua*			Sc	Sc			
29.	*Mesua ferrea*	Sn					Sn, Sc	
30.	*Mimosa pudica*		Sn			Sn	Sc, Sp, In	
31.	*Mirabilis jalapa*					Sn	Sn	
32.	*Moringa oleifera*	Sn, Sc				Sn		
33.	*Ocimum tenuiflorum*				Sc	In, Lc		
34.	*Oroxylum indicum*		Sn		Sc	Dg		Sn, Cn
35.	*Piper nigrum*				Sn		Dg	
36.	*Rauvolfia serpentina*		Rt, Sn	Sn	Sn			
37.	*Ricinus communis*		Sc			In		
38.	*Rubia cordifolia*	Sn			Sc			
39.	*Scoparia dulcis*	Sn			Sn		Sn	
40.	*Semecarpus anacardium*	Vn				In, Dg, Jc		
41.	*Soymida febrifuga*		Sn			Sn		
42.	*Tamarindus indica*		Sc			Sn	Sn	
43.	*Tephrosia purpurea*	Sn	Sn					
44.	*Tinospora cordifolia*		Sn	Sn	Sn	Sn		
45.	*Tridax procumbens*	Sc, Ws				Sn		
46.	*Vitex negundo*				Vn	Sn		
47.	*Winthania somnifera*				Sn	Sn		

commonly used for medicine preparations such as paste, juice and decoction. Cherwa, Pando, Bhil, Baiga, Korku and Gond tribes reported the treatment of venomous animal bites.

West Zone

In the west zone, traditional remedies used by the tribal population of Maharashtra and Rajasthan are described. 9 tribes namely the Bhil or Bhilla, Korku, Garasia, Damor, Kathodia, Pawra, Thakar, Gond & Madia reported 49 traditional healing remedies and 36 medicinal value plant species for snake bite, scorpion bite/sting and dog bite. As shown in supplementary Table 3, Thakar tribe of Maharashtra represented highest number of formulations using 26 plant species for curing snakebite and scorpion bite/sting, while the Gond/Madia tribe uses only one plant species for the treatment of the dog bite. Korku, Pawra and Thakar tribes hold the ability to treat the venomous animal bites.

South Zone

South zone represents the tribal population of Andhra Pradesh, Tamilnadu, and Karnataka. The supplementary Table 4 depicts 145 herbal remedies for curing snake bite, scorpion bite/sting, insect bite, dog bite, wasp sting, spider bite, centipede bite, fish bite and rat bite as reported for 16 tribes of this zone. A total of 113 plant species were found to be associated with traditional herbal preparations for the variety of animal bites in this zone. Malayali tribe of Tamilnadu represents maximum number (51) of herbal remedies for snake bite, scorpion bite, dog bite, and venomous bite treatment whereas, Peliyar and Malasar tribes of Andhra Pradesh denoted only three herbal remedies for snakebite and scorpion bite/sting cure. It was found that about 16 tribal groups of the South zone are capable of treating venomous animal bites which is perhaps the highest number for any of the zones.

East Zone

The East zone comprises of states of Jharkhand, Orissa and West Bengal wherein 47 traditional remedies using 39 medicinal value plants have been reported so far (supplementary Table 5). Santhal, Munda, Lodha and Oraon tribes of West Bengal reported the highest number (20) of traditional remedies and medicinal value plants for the cure of snakebite. Interestingly, Birhore, Didayi and Gurung tribes of Jharkhand, Orissa and West Bengal, respectively use one medicinal value plant (*Nicotiana tabacum*, *Soymida febrifuga*, *Drymaria cordata*) for snake bite and scorpion bite treatment. It has been reported that Santhal, Munda, Lodha and Oraon tribes can treat venomous animal bites.

North East Zone

The north-east zone covers traditional healing methods of the tribal population from the states of Mizoram, Arunachal Pradesh, Tripura, Sikkim, Nagaland, Manipur and Assam. The supplementary table 6 lists 57 traditional preparations represented with the use of 55 medicinal value plants by various tribes of the zone (supplementary Table 6). Rhizome of *Curcuma longa* is used by the Lusei, Pawis, Paites, Raltes, Pangs and Hmars tribal cluster for insect bite and Karbi tribe for leech bite. Leech bite, frog bite, pig bite and ant bite and their treatment by using herbal formulations in tribes is something unique, reported so far from this zone only.

Island Zone

Island zone represents the tribal population of Andaman and Nicobar Islands. This zone involves 12 medicinal value plants, which were discovered among Car-Nicobarese, Onge, Jarawas, tribals of Bay Island *viz*., the Onge, Jarawas and Great Andamanese.

As depicted in the supplementary Table 6 the Car-Nicobarese tribe of Andaman and Nicobar Island use four medicinal value plants for snakebite and centipede bite treatment followed by Onge and Jarawas (1), Onge, Jarawas and Great Andamanese (1). Car-nicobarese, Onges, Jarawas and tribals of Bay Island are capable of treating venomous animal bites. Treatment of centipede bite by plant based ethnomedicines is unique to tribes of the Andaman and Nicobar Islands.

Similarities and differences in tribal zones for various animal bites

Table 1 depicts the varied usage of same medicinal plant across different zones where in, it might or might not be used to treat similar kinds of animal bites. There are instances where the same plant species is being used to cure different types of animal bites like *Allium sativum* is used in Central zone (by Korku and Gond tribes of Madhya Pradesh) for treating scorpion bite/sting and in Noth-East (by Karbis tribe of Assam) and East zone (by Santhal, Munda, Lodha and Oraon tribes of West Bengal) for snakebite. At the same time, there are medicinal plants like *Leucas aspera* which are being used in

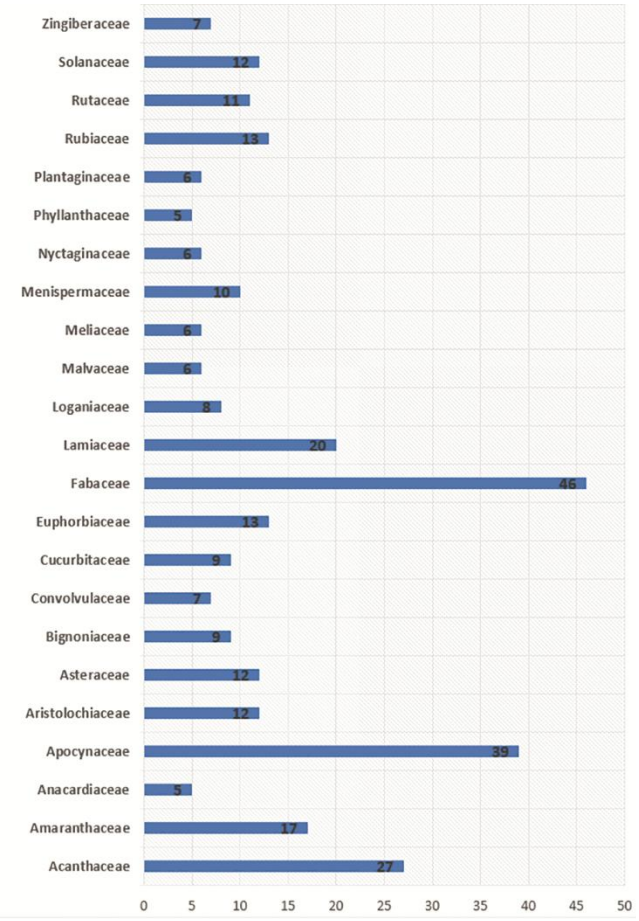

Fig. 3 — Distribution of medicinal plants family wise used in the treatment of animal bites >5 times by tribes of India

four zones for treating the same type of animal bite *i.e.*, snake bite *viz*., North zone, Central zone, South zone and East zone.

In continuation of the above, if we look at the distribution of medicinal plants which are being used by the tribes of India to cure animal bites according to their biological family, we find that there are 23 families to which five or more than five medicinal plants belong as per the available literature. The highest number of plants belongs to the family Fabaceae (46) and least to Anacardiaceae and Phyllanthaceae (5 each). Figure 3 depicts the family wise distribution of medicinal plants used in the treatment of animal bites.

Conclusion

Tribes being closer to nature encounter wild animals more often leading to higher chances of animal bites and also the presence of indigenous cure for it. The centre point of this traditional wisdom is the traditional healer, delivering healthcare nearby. It has been seen that traditional healers are preferred by tribal populations due to their '4A benefit' *viz.*, acceptability, accessibility, affordability and availability.

It is estimated that India has 15,000 higher-order plants, out of which 1500 medicinal plants have been identified and currently being used. Thus, there is huge potential to be drawn and what we have attempted here is just the tip of the iceberg wherein data pertaining to plants being used by tribes of India for just one particular health issue (*i.e.,* animal bites) has been collated and the results are so vivid. We find usage of 276 plant species for curing animal bites in 81 tribal communities. These plant species translate to identification of 423 traditional healing practices in the seven tribal zones of India, wherein South zone represents highest number (113) of medicinal value plants while the Island zone represented only 12 plant species from the famous Andaman and Nicobar Islands for animal bite cure. Ethnobotanically, further analysis of medicinal plants being used by tribes to cure animal bites according to their biological family reveals that there are 23 families to which five or more than five plants belong as per the available literature.

Apart from the diversity in usage of medicinal plants, there is also tremendous heterogeneity in terms of the kind of animal bites for which cures are present. The various animal bites found treatable in tribal traditional medicine system of India are: snakebite, scorpion bite/sting, dog bite, insect bite (venomous and non-venomous), bee bite, leech bite, spider bite, wasp sting, rat bite, fish bite, jackal bite, frog bite, pig bite, etc. In spite of this diversity, it was found that numerous tribes share common medicine for similar ailment, indicating the possibility of parallel development of medicine culture. Important to point here that many tribes like Bakarwal, Baiga, Bhil, Gujjar, Kharwar, Pangwal, Tharu, *etc.*, have treatment for venomous animal bites which often prove lifesaving in remote and inaccessible tribal areas. We also find that all zones have some unique kind of animal bite (*e.g.,* leech bite in the North-east zone) for which also tribal folks possess time-tested cures thus exemplifying their survival skills.

In terms of animal bites, tribal traditional healing methods are multipronged in their approach as the focus is on treating both body and mind, whereas modern medicine envisages it as a physiological ailment only focusing on the symptoms of illness. This holistic approach in indigenous groups is the hallmark of their traditional wisdom. Further, there is

evidence to suggest that substantial proportion of population across the globe and in India look upto traditional medicine in tribes for healthcare needs. Successful examples are presented by the Irula tribe in Tamil Nadu in production of an antidote for snake venom and Sugali tribe in Andhra Pradesh for plant-based antidote of venomous snakebites. These are the reasons for impetus from global organizations to encourage and support local governments for increasing research efforts, training facilities and exchange of information relating to traditional medicine. Concomitantly, tribal communities have echoed several barriers in accessing modern healthcare system. These barriers in clude, monetary issues; lack of medical doctors, equipment and medicine, quality interpersonal care; low level of education and poor behaviour and distance from the health facilities are the reasons narrated by the members of tribal groups. The present paper is a tiny effort in this direction with the endeavour to highlight the unearthed potentials of mere one facet of tribal traditional medicine system in India. The future of research on traditional medicine in tribes has great potential to undertake more in-depth studies which aim at benefitting the society at large.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at https://nopr.niscpr.res.in/jinfo/ijtk/IJTK_22(03)(2023)638-645_SupplData.pdf

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Conflict of Interest

Authors declare that there is no conflict of interest.

Author's Contributions

SS: Methodology, Investigation, Data Curation, Writing- Original draft preparation;

NS: Conceptualization, Supervision, Guided Analysis, Writing – Review & Editing

References

1 World Health Organization, Animal Bites, *WHO*, (2018), https://www.who.int/news-room/fact-sheets/detail/animal-bites.

2 World Health Organiation, Snakebite Envenoming, *WHO*, (2019), https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming.

3 Chippaux J P & Goyffon M, Epidemiology of Scorpionism: A Global Appraisal, *Acta Tropica*, 107 (2) (2008) 71-79, doi:10.1016/j.actatropica.2008.05.021.

4 World Health Organization, Rabies, *WHO*, (2019), https://www.who.int/news-room/fact-sheets/detail/rabies.

5 Mohapatra B, Warrell D A, Wilson S, Bhatia P, Dhingra N, *et al.*, Snakebite Mortality in India: A Nationally Representative Mortality Survey, *PLoS Negl Trop Dis*, 5 (4) (2011) 1-8, doi:10.1371/journal.pntd.0001018.

6 Whitaker R & Gerard M, Diversity and distribution of medically important snakes of India, In: *Clinical Toxicology in Asia Pacific and Africa Toxinology*, edited by Gopalakrishnakone P, Faiz A, Fernando R, Gnanathasan C, Habib A & Yang C C, (Springer), 2015, 115-36, doi:10.1007/978-94-007-6386-9.

7 Nagaraj S K, Dattatreya P & Boramuthi T K, Indian Scorpions collected in Karnataka: Maintenance in captivity, venom extraction and toxicity studies, *J Venom Anim Toxins Incl Trop Dis*, 21 (1) (2015) 1-7, doi:10.1186/s40409-015-0053-4.

8 Gogtay N J, Nagpal A, Mallad A, Patel K, Stimpson S J, *et al*., Demographics of animal bite victims & management practices in a tertiary care institute in Mumbai, Maharashtra, India, *Indian J Med Res*, 139 (3) (2014) 459-462, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4069742/.

9 National Centre for Disease Control, New Delhi, India. (2018), https://ncdc.mohfw.gov.in/WriteReadData/l892s/22346836321554360087.pdf

10 Annual Report 2021-2022, Ministry of Tribal Affairs, Government of India, (2022), https://tribal.nic.in/downloads/Statistics/AnnualReport/AREnglish2122.pdf

11 World Health Organization, WHO raditional Medicine Strategy 2014-2023, *WHO*, (2012) 1-76.

12 World Health Organization, A report on Traditional Medicines- Fifty-Sixth World Health Assembly, *WHO*, (2003), https://apps.who.int/gb/archive/pdf_files/WHA56/ea5618.pdf.

13 Saxena N, Kumar D & Das A, Connecting the unconnected: The way forward for public health to reach the unreached tribal communities in India, *Curr Sci*, 120 (1) (2021) 24-26, https://www.currentscience.ac.in/Volumes/120/01/0024.pdf.

14 Kipkore W, Wanjohi B, Rono H & Kigen G, A study of the medicinal plants used by the marakwet community in Kenya, *J Ethnobiol Ethnomed*, 10 (1) (2014), doi: 10.1186/1746-4269-10-24.

15 Jeyaprakash K, Ayyanar M, Geetha K N & Sekar T, Traditional uses of medicinal plants among the tribal people in Theni District (Western Ghats), Southern India, *Asian Pac J Trop Biomed*, 1 (1) (2011) S20-S25, doi: 10.1016/S2221-1691(11) 60115-9.