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Review Article

Ethnomedicinal plants used for snakebites in India: An overview**Manali Sughosh Upasani^a, Sughosh Vishweshwar Upasani^{b,*},
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ABSTRACT

Snakes have fascinated humankind for millennia. Snakebites are a serious medical, social, and economic problem that are experienced worldwide; however, they are most serious in tropical and subtropical countries. The reasons for this are 1) the presence of more species of the most dangerous snakes, 2) the inaccessibility of immediate medical treatment, and 3) poor health care. The goal of this study was to collect information concerning rare, less utilized, and less studied medicinal plants. More than 100 plants were found to have potential to be utilized as anti-snake venom across India. Data accumulated from a variety of literature sources revealed useful plant families, the parts of plants used, and how to utilize them. In India, there are over 520 plant species, belonging to approximately 122 families, which could be useful in the management of snakebites. This study was conducted to encourage researchers to create herbal antidotes, which will counteract snake venom. These may prove to be an inexpensive and easily assessable alternative, which would be of immense importance to society. Plants from families such as Acanthaceae, Arecaceae, Apocynaceae, Caesalpiniaceae, Asteraceae, Cucurbitaceae, Fabaceae, Euphorbiaceae, Lamiaceae, Rubiaceae, and Zingiberaceae are the most useful. In India, experts of folklore are using herbs either single or in combination with others.

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1. Introduction

For centuries, plants have been important in the treatment of a wide variety of illnesses, diseases, and disorders.^{1,2} The inherent traditional systems of medicine, along with information from conservative folklore, are serving a large section of the populace, particularly in rural and tribal areas, despite the dawn of modern medicine. Ethnobotany is the scientific and systematic study of traditional knowledge and customs of people concerning plants and their medical, religious, and other uses. Studies involve literature surveys, detailed investigations, analyses, interpretation, and conclusions concerning various research and scientific data. An ethno-medico-botanical appraisal includes discussions with natives, as well as utilization of available facts and data regarding folklore literature.³ Indigenous medicinal plant species have been added to several recent drug formulations and preparations for fundamental health care.³

2. Methodology

The current study provides a collection of information on medicinal plants that grow and can be utilized in various regions of India for snakebite treatment. The appropriate literature, including books, journals, and reports, was reviewed. The relevant information was searched using various electronic catalogs (e.g., Google Scholar, Medline, NISCAIR, Science Direct, Scirus, and Scopus) and keywords such as “anti-venom activity,” “ethno botany,” “ethno pharmacology,” “Indian,” “indigenous,” “medicinal plants,” “snake bite,” and “survey.” It was difficult to include all the information regarding medicinal plants used for snakebite treatment, and as such this study focused on information that would be easily accessible for researchers. Over the last few decades, people from different tribal communities have been recoding and maintaining data regarding traditional and tribal knowledge related to the use of medicinal plants. However, this information has, until now, not been made available to the modern world. In this regard, information on tribal and local use of various plants has been made available and a systematic “ready to use” list of medicinal plants has been formed. The list consists of data, including biological source(s), family, local name(s), part(s) used, method(s) of preparation/formulations, and reference(s). In this review, care was taken to ensure the identification of the herbal medicinal plants that were in the original resources (Table 1).

3. The Indian subcontinent and snakes

The Republic of India (3rd largest country in Asia and 7th by area in world) is a multilingual country home to a diverse culture with a rich and glorious heritage. India's land border covers 151,067 km, which is shared with neighboring countries, including Bangladesh (border shared = 40,967 km), China (3488 km), Pakistan (3323 km), Nepal (1751 km), Myanmar (1643 km), Bhutan (699 km), and Afghanistan (106 km). India's coastline covers 75,166 km, and land area including

island territories covers more than 3,287,260 km². Some of these countries were part of India before the partition.⁴

India has numerous and diverse medico-herbal plants. They are dispersed, depending upon geographical and ecological conditions, across the country. Of these, more than 1500 species have demonstrated significant medicinal properties.⁴ Envenomation, especially by snakebite, is a serious worldwide public health crisis.⁵⁻⁸ Inappropriate and unwarranted treatment results from reasons such as the failure to identify the snake species (venomous or non-venomous), which increases the risk of complications. According to the Integrated Taxonomic Information System (ITIS), Elapidae and Viperidae are the two major families of venomous snakes. Elapidae consists of 325 species distributed in 61 genera. Viperidae includes 224 species distributed in 22 genera. In and around India, approximately 216 species of snakes belong to these families, and only 52 are known to be poisonous.^{9,10} The ‘Big Four’ snakes cause the largest number of snakebite deaths on the Indian subcontinent. The ‘Big Four’ snakes consist of Russell's viper (*Daboia russelii*; Marathi translation, *ghonas tawarya*), Indian cobra (*Naja naja*; Marathi translation, *Nag*), saw-scaled viper (*Echis carinatus*; Marathi translation, *phoorsa*), and common krait (*Bungarus caeruleus*; Marathi translation, *manyar kanadar*) (Fig. 1).¹¹ Apart from these big four, the hump-nosed viper is also hazardous.¹² Envenomation is a ‘choice’ and voluntary action or reaction by snakes. Their bite is a natural protective defense mechanism. All venomous snakes have the ability to bite without including venom (dry bite).¹³ Farmers, fieldsmen, and outdoor workers find suffering from snakebites to be an occupational hazard.¹⁴ It is also a leading problem in rural areas of India. It is estimated that snakebite poisoning causes approximately 50,000 deaths annually, and the number is likely higher because not all cases from rural areas are reported.^{10,15}

4. Snake venom and snake anti-venoms

Snake venom is one of the most intense and ‘mysterious’ biological fluids within the animal kingdom, causing complex medical effects. This is because of the presence of complex mixtures of proteins, peptides, and contain at least 25 enzymes.^{16,17} Venom is a complicated combination of proteins (both enzymatic and non-enzymatic), peptides, and small organic compounds, such as acetylcholine citrate and nucleoside.^{18,19} There are many potential effects of snake envenomation on humans; however, a few broad categories of major clinical significance are:

1. Systemic myolysis
2. Flaccid (drooping) paralysis
3. Coagulopathy and hemorrhage
4. Cardiotoxicity
5. Renal damage or failure
6. Local tissue injury at the bite site

Each of these may cause a number of secondary effects, and each is associated with potential morbidity and mortality.³ Similar to other modern medicines, anti-venom can have side effects. In addition, it takes too long to develop and

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