



Endangered Medicinal Plants Used in Traditional Herbal Medicines in the South-East Rajasthan (Hadoti Region)

Aparna Pareek^{*1}, Shalini Maheshwari²

¹Department of Botany, University of Rajasthan, Jaipur – 302004, Rajasthan, India

²Department of Life Sciences, Career Point University, Kota, Rajasthan, India



Article History:

Received on: 09 Apr 2020

Revised on: 28 May 2021

Accepted on: 04 Jun 2021

Keywords:

Endangered,
Ethno-medicinal,
Conservation,
Indigenous,
Hadoti Region,
Traditional Knowledge

ABSTRACT

The present study was carried out to gather information about Ethno-botanical knowledge of tribal people and ethnic races those are residing in forests of south-east Rajasthan since ages. A large number of wild and cultivated plants are being used by them to treat various ailments due to limited access to modern health care services. The study was carried out in an unexplored remote tribal area of South east region of Rajasthan to investigate and document the existing ethno-medicinal knowledge on local flora which is rich and diversified in important medicinal plants. The ethno-medicinal knowledge in the study area is gradually heading towards extinction because the old age community members being the main bearer of this knowledge are passing away and younger generation is not interested to take it. Herbal practitioners in the area have sufficient traditional knowledge, but mostly, they are reluctant to disclose it to other community members. Hence, the current study was planned with the objectives to record the traditional knowledge of study area mainly pertaining to endangered Ethno-medicinal plants of the proposed area of study. The study was conducted through direct interviews with 35 Herbal practitioners and 240 informants from the study area. Data was collected through semi-structured questionnaires from the community members and local herbal. We presented thirty most used species by ancestral healers of Hadoti to cure different ailments and their medicinal uses. This study also provide details regarding Habitat, Mode of transfer, Abundance Status, Effect and popularity and Cultivation practices (status of plant) of selected 30 plants.

*Corresponding Author

Name: Aparna Pareek

Phone: 9829265096

Email: aparna992000@yahoo.com

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v12i3.4784>

Production and Hosted by

IJRPS | www.ijrps.com

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INTRODUCTION

Rajasthan is the largest state of India with its different geographical features with dense forests, rivers, deserts and plateaus. The south-eastern part of Rajasthan is known as the Hadoti region and it includes 4 districts: Kota, Baran, Bundi and Jhalawar. (Agrawal, 2017; Balakrishnan *et al.*, 2009; Kumar *et al.*, 2005)

Due to the presence of dense forest patches in all four districts, a considerable number of people, especially tribal, are still dependent on these forests for treating various diseases. The plants growing around them form an integral part of their culture (Choudhary *et al.*, 2008).



Figure 1: Map of Rajasthan Showing study area Hadoti Region. (Source: Atlas of Rajasthan, 2011. Government of Rajasthan, Jodhpur.)

The tribal and local people of the area are largely dependent on their traditional healthcare system, which is based on the plants growing in nearby forests (Cresswell and Clark, 2011; Hada and Katewa, 2015; Sharma and Sharma, 2018). Hadoti Plateau, with rich floristic diversity, is situated at the edge of Malwa Plateau. The region has one of the best scopes of genetic resources for future development in the peninsula due to flourishing biodiversity. It possesses a great potentiality in the form of gen-pool due to the wide range of Flora and fauna. The contribution of the Hadoti region in the regulation of climate and rainfall patterns is very important. Kota is located at $25^{\circ}11'N$ $75^{\circ}50'E$ / $25.18^{\circ}N$ $75.83^{\circ}E$ with an average elevation of 271 meters (890ft above mean sea level). Most of the parts of this region are drained by the Chambal River and its tributaries like Kali-Sindh, Parwan, Aahu, Ujar, Parwati and Chandrabhaga etc. Figure 1.

The folk knowledge of medicinal plants species of the Southeast region of Rajasthan was unexplored. We, for the first time, conducted this quantitative

study in the area to document medicinal plants uses, to preserve traditional knowledge, and also to motivate the local residents against the disappearing wealth of traditional knowledge of medicinal flora.

The vast use of medicinal plants reported shows the significance of indigenous herbal preparations among local people of the area for their health care. (Kapoor and Kumar, 2015; Kapoor and Lakhera, 2013; Katewa and Guria, 1997) Knowledge about the medicinal use of plants is rapidly disappearing in the area as a new generation is unwilling to take an interest in medicinal plant use, and knowledgeable persons keep their knowledge a secret (Anita *et al.*, 2010; Meena *et al.*, 2014; Ram *et al.*, 2016). Thus, the indigenous use of plants needs several conservational strategies and further investigation for better utilization of natural resources.

Ethnographic and socio-economic background of the study area

Hadoti region is the main tribal belt of Rajasthan in which Bhil, Meena, Damor, Sahariyas Kalbelia, Kan-

Table 1: Useful endangered plants in the south east region of Rajasthan

S. No.	Plant Name	Botanical Name	Habitat	Mode of Transfer	Abundance Status	Effect and Popularity	Cultivation Practices (Status of Plant)
1.	Arjuna	<i>Terminalia arjuna</i>	T	Seeds	Threatened	High	W
2.	Salai guggal/ Shallakki	<i>Boswellia serrata</i>	T	Seeds	Threatened	High	W
3.	Madan phal	<i>Randia dumentorum</i>	T	Seeds	Critically endangered	High	W
4.	Ratti/Safed Gunja	<i>Abarus precatorius</i>	S	Seeds	Threatened	High	W
5.	Vacha	<i>Acorus calamus</i>	H	Roots	Vulnerable	High	W
6.	Kali musli	<i>Curculigo orchides</i>	H	Rhizom	Sporadic	Low	W
7.	Kalpvrksha	<i>Adansonia digitata</i>	T	Seed and stem cutting	Endangered	Low	W
8.	Khadira/Katha	<i>Acacia catechu</i>	T	Seed and stem cutting	Vulnerable species	Low	W
9.	Kaamla/Sindor	<i>Mallotus phillippinensis</i>	S	Seeds	Vulnerable species	High	W
10.	Sita Ashok	<i>Sarraca asoca</i>	T	Seeds	Vulnerable species	High	W
11.	Kaal megh	<i>Andrographis paniculata</i>	H	Roots	Not known	Low	W
12.	Jeevanti	<i>Leptadenia reticulata</i>	CL	Bulb	Vulnerable species	High	W
13.	Chiraunji	<i>Buchanania lanzen</i>	T	Seeds	Threatened	High	C
14.	Guggal	<i>Commiphora mukul</i>	T	Stem cutting	Critically endangered	Very high	W
15.	Gambhari	<i>Gmelina arborea</i>	T	Seeds	Threatened	High	W
16.	Tins/Tinsh	<i>Ougeinia oogenesis</i>	T	Seeds	Sporadic	Low	W

Continued on next page

Table 1 continued

S. No.	Plant Name	Botanical Name	Habitat	Mode of Transfer	Abundance Status	Effect and Popularity	Cultivation Practices (Status of Plant)
17.	Mansarohinni	<i>Soymida febrifuga</i>	T	Seeds	Endangered	High	W
18.	Gangdi	<i>Grewia latifolia</i>	S	Roots	Threatened	High	W
19.	Vridhdaru/ Vidhara	<i>Argyria speciosa</i>	CL	Stem cutting and seeds	Endangered	High	W
20.	Malkangni/ Jyotishmati	<i>Celestrus paniculatus</i>	CL	Seeds	Threatened	Very high	W
21.	Mandukparni	<i>Centella asiatica</i>	H	Roots	Vulnerable	Very high	W
22.	Bilwaparni	<i>Naringi crenulata</i>	T	Seeds/ Stem cutting	Endangered species	Very high	W
23.	Kadaya	<i>Sterculia urenus</i>	T	Seeds/ Stem cutting	Threatened	Very high	W
24.	Adusa/ Vasaka	<i>Adhatoda vasica</i>	S	Seeds/ Stem cutting	Vulnerable	Very high	W
25.	Amrita/ Giloy	<i>Tinospora cordifolia</i>	CL	Stem cutting	Presently safe	Very high	C
26.	Mulethi	<i>Glycyrrhiza glabra</i>	S	Stem cutting	Vulnerable	Very high	C
27.	Nirgundi	<i>Vitex nirgundo</i>	T	Seeds	Threatened	Very high	W
28.	Akol	<i>Alangium salvifolium</i>	T	Seeds/ Stem cutting	Threatened	Very high	W
29.	Gudmaar	<i>Gymnema sylvestre</i>	CL	Cutting	Vulnerable	Very high	W
30.	Vijaysaar	<i>Pterocarpus marsupium</i>	T	Seeds/ cutting	Threatened	Very high	W

Table 2: The location of ethnomedicinal plants of Hadoti Region

Site No.	District	Site Name	GPS readings		Tree community	Soil texture class	Climatic Zone
			Latitude	Longitude			
1.	Baran	Forest office				Black soil	5 th , South Eastern
	Kota	Shiv Temple, Borabas	25.192180	75.850840	Arjuna	Alluvial Soil, Black Soil	5 th , South Eastern
	Jhalawar	Jhirniya Nursery	24.590700	76.158500		Black Cotton Soil	5 th , South Eastern
2.	Baran	Kunda Kho	25.095900	76.505900	Salai guggal/ Shallakki	Alluvial Soil, Black Soil	5 th , South Eastern
	Jhalawar	Baghel ghati	24.590700	76.158500		Black Cotton Soil	5 th , South Eastern
	Kota	Ganesh Pura	25.234580	75.875670			
3.	Jhalawar	Dara Forest, Dargah Peer Baba	24.590700	76.158500	Madan phal	Black Cotton Soil	5 th , South Eastern
4.	Jhalawar	Bhawani Mandi	24.401800	75.809300	Safed musli	Black Cotton Soil	5 th , South Eastern
	Kota	Ramganj Mandi	24.651670	75.939250		Alluvial Soil, Black Soil	5 th , South Eastern
5.	Baran	Madho Kho	25.095900	76.505900	Gaangdi	Alluvial Soil, Black Soil	5 th , South Eastern
6.	Baran	Naharghar	25.095900	76.505900	Kali musli	Alluvial Soil, Black Soil	5 th , South Eastern
7.	Kota	Kohlipura	25.192180	75.850840	Kaith	Alluvial Soil, Black Soil	5 th , South Eastern
	Bundi	Ramghar Sanctuary, Ramesher Mahadev	23.627670	85.150500		Alluvial Soil, Black Soil	5 th , South Eastern
8.	Jhalawar	Jhalrapatan	24.590700	76.158500	Indra jao	Black Cotton Soil	5 th , South Eastern

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Table 2 continued

Site No.	District	Site Name	GPS readings		Tree community	Soil texture class	Climatic Zone
			Latitude	Longitude			
9.	Kota	Career point University, Alaniya	25.192180	75.850840	Badi kateli	Alluvial Soil, Black Soil	5 th , South Eastern
10.	Kota	Herbal Park, Rathi Industry	25.176050	75.927280	Chakramad/Pavaad	Alluvial Soil, Black Soil	5 th , South Eastern
11.	Kota	Herbal Park, Rathi Industry	25.176050	75.927280	Kaal megh	Alluvial Soil, Black Soil	5 th , South Eastern
12.	Baran	Mudiyar Kho	25.095900	76.505900	Jeevanti	Alluvial Soil, Black Soil	5 th , South Eastern
13.	Baran	Bhawarghar, Sitabadi	25.200870	77.146470	Chiraunji	Alluvial Soil, Black Soil	5 th , South Eastern
14.	Baran	Shahabad forest	25.200870	77.146470	Guggal	Alluvial Soil, Black Soil	5 th , South Eastern
	Jhalawar	Bagel Gati	24.590700	76.158500		Black Cotton Soil	5 th , South Eastern
15.	Kota	Nahar singhi Mata	25.158070	75.857910	Gambhari	Alluvial Soil, Black Soil	5 th , South Eastern
16.	Kota	Herbal Park, Rathi Industry	25.176050	75.927280	Malkangni	Alluvial Soil, Black Soil	5 th , South Eastern
	Kota	Jawahar Sagar Dam	25.778240	73.306130		Alluvial Soil, Black Soil	5 th , South Eastern
	Kota	Akelgarh, water station	25.175040	75.852720	Manduk-parni	Alluvial Soil, Black Soil	5 th , South Eastern
	Kota	Ganeshpura	25.234580	75.875670	Masarohiidi	Alluvial Soil, Black Soil	5 th , South Eastern
	Kota	Shahabad Fort	25.192181	75.850838	Mahabil-vaparni	Alluvial Soil, Black Soil	5 th , South Eastern

jar, and Saansi -Nut are the main tribes (Figure 1). Rajasthan is one of the largest states and has a great heritage related to these forests and aboriginals. India has suffered with the loss of its rich heritage due to urbanization and deforestation.

Tribals preserved this knowledge through their conservation-oriented approach that pass on from generation to generation through word of mouth.

Now, this is the time to preserve this knowledge in written form, so looking to the importance of ethnomedicinal plants in the safe cure of human beings, the present study is carried out.

MATERIALS AND METHODS

Study design and Sampling Techniques

The study involved 35 traditional healers and 260 informants from the study area who consented to participate in the study on a voluntary basis. The study began in February 2017 and was concluded in December 2018.

Tribal persons who have consented to participate in the study have been recruited, and the data have been collected using a questionnaire and during interactive sessions.

Different localities were visited and data has been collected through purposive, snowball, and random sampling techniques.

Purposive Sampling Technique

This method involves screening the individuals with sufficient knowledge and share valuable inputs freely with the scholar. We found that it is easy to get information regarding such healers in tribal settings as they are famous for treating various diseases in their village settings.

Snowball Sampling Technique

This technique was useful to get information from those healers who had no official permission to use their traditional knowledge for treating people. These persons were found through the suggestion of other informants on the condition of being confidential.

These people usually hesitated to coming out publicly and sharing their knowledge, so it was useful to find out these hidden participants who were eligible and potentially contribute to our requirement.

Random Sampling Techniques

This was an unbiased, true representation of the total population of the study area and the simplest technique of data collection, including the overall target population.

Each member carried an equal opportunity to become a part of the sampling process. Information were collected from general informants and non-healers, normally those people who were living in the study area for a long period of time.

They used their knowledge of indigenous medicinal plant for treatment for since long.

Identification of Plants

The entire collected flora was brought to the laboratory, identified them and classified to their respective species level. A list of the medicinal plant will be prepared on the basis of information collected from informers.

About 30 plants were selected for further study considering their:-

1. Potential use for normal and therapeutic purpose.
2. Consumption by tribals in various forms.
3. Availability of selected plants in different seasons.

Data Collection and analysis

The data were collected by visiting tribal localities, interviews of informers, observations and participation in their customs. Information's collected from tribal and traditional communities can be further categorized under these 4-categories-

Qualitative data

Uses of plants in various forms.

Quantitative data

Plant qualities as Bio-medicine.

Descriptive data

Information's regarding rituals, festivals and the role of flora in the daily customs of traditional communities.

Supportive data

Information such as socio-economic background, occupation, welfare status were included in this category.

The above-cited sampling methods were used for the selection of informants, and information regarding the ethnomedicinal use of plants was collected through semi-structured interviews. The collected data was analyzed through quantitative indices viz. relative frequency citation, use-value, and family use-value.

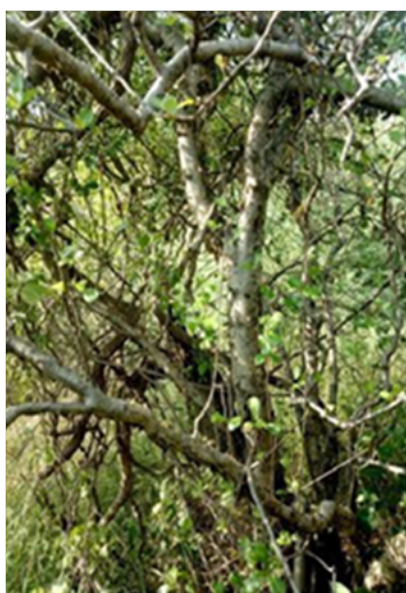
The conservation status of medicinal plants was enumerated with the help of the International Union



(A)



(B)



(C)



(D)

(A) Young sapling of Endangered *Naringi crenulata*. (B) Fruting stage of *Naringi crenulata* (C) A mature shrub of critically Endangered *Commiphora mukul* in Shahabad Forest. (D) A highly valued endangered plant *Leptadenia reticulata*.

Plate 1: Endangered Plants of Hadoti Region



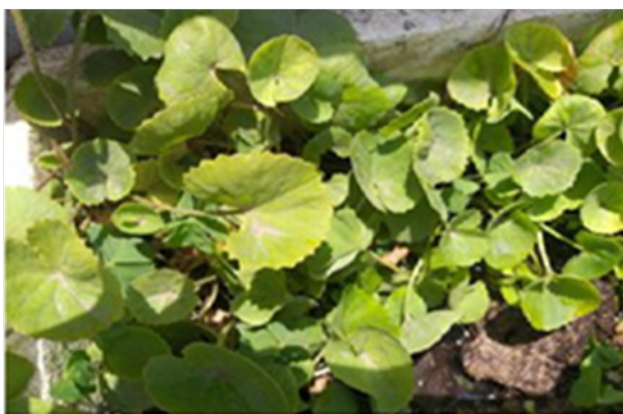
(A)



(B)



(C)



(D)

(A) An endangered highly effective plant *Celastrus paniculatus*. (B) *Argyrea speciosa*
(C) A young sapling of *Curculigo orchoides* (Kali Musli) (D) A Threatened plant
growing near water bodies *Centella asiatica* (Mandukparni)

Plate 2: Ethnomedicinal Plants of Hadoti Region

for Conservation of Nature Red List Categories and Criteria (2001). Plant samples were deposited at the Herbarium of Botany Department, the University of Rajasthan, for future reference.

Analyse status of Medicinal plants

This was assessed in terms of fieldwork and by interaction with some experienced Ayurvedic vaidya and farmers recently working in this field. Selected possibilities were also be analyzed to confirm the potential future of the medicinal plants. The threats to medicinal plants also found out, and their therapeutic application, effect and popularity were analyzed to conserve medicinal plants. Plants were classified as wild or cultivated on the basis of their availability for forest dwellers and different plant types such as herbs, shrubs and trees. On the basis of information retrieved from locals, we came to know about different plants that are more popular among them and the effect of plants on diseases. The abundance

was categorized as under:

Threatened - the species are to be taken care of for conservation (T)

Sporadic –plants growing in scattered patches and need careful monitoring(S)

Presently safe- These species seems presently safe but need the effort to protect them (PS)

Doubtful presence- Not known (D)

RESULTS

The present piece of work is shown in Table 1, which throws light on some of the plants used for multiple reasons by the ethnic communities of the South-east region of the state (Plate 1 and Plate 2). The location of the ethnomedicinal plants showing latitude and longitude during the survey are shown in Table 2.

CONCLUSION

The resurgence of interest in green medicine is mainly due to several reasons that the number of ailments and disorders are increasing day by day. Even some dreadful diseases like asthma, cancer, diabetes, epilepsy, Filariasis, jaundice, rheumatism, gout and arthritis are still not curable in modern allopathic systems of medicine. The loss of biodiversity resulting in the extinction of many useful species has also imposed a serious concern on global medical scientists and researchers. With this point of view, medicinal plants have become one of the main concerns of world conservation organizations. Systematically more attempts for the documentation of the medicinal plants of the Indian subcontinent are seriously required and is the need of the hour. There is also a need to establish herbal drug centers for collecting, processing and preparation of ethnomedicine and to develop cultivation, farming and further documentation of potential and promising ethnomedicinal plants in social forestry programmes for improving the lifestyle and economic condition of the local tribal and rural people. The proper establishment of some more wildlife sanctuaries, national parks and biosphere reserves in botanical rich areas and hot spots are also required for the protection and conservation of valuable biodiversity. Therefore, there is an urgent need to document complete biodiversity, prioritize useful threatened plants, and conserve them in-situ and ex-situ for sustainable utilization in health care and human welfare. The current study may thus prove to be of great use to the researchers, conservationists, foresters and people interested in herbal medicine. The documentation may further help to conserve the traditional knowledge and aid in the improvement of the local people of these areas.

Funding Support

The authors are thankful to the Department of Science and Technology, Government of Rajasthan, Jaipur, for the financial support.

Conflict of Interest

The authors declare that they have no conflict of interest.

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