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Review Article

Spatial Mapping of Ethno Medicinal Knowledge with Specific Reference to *Bacopa monnieri* (L.) Pennell in India

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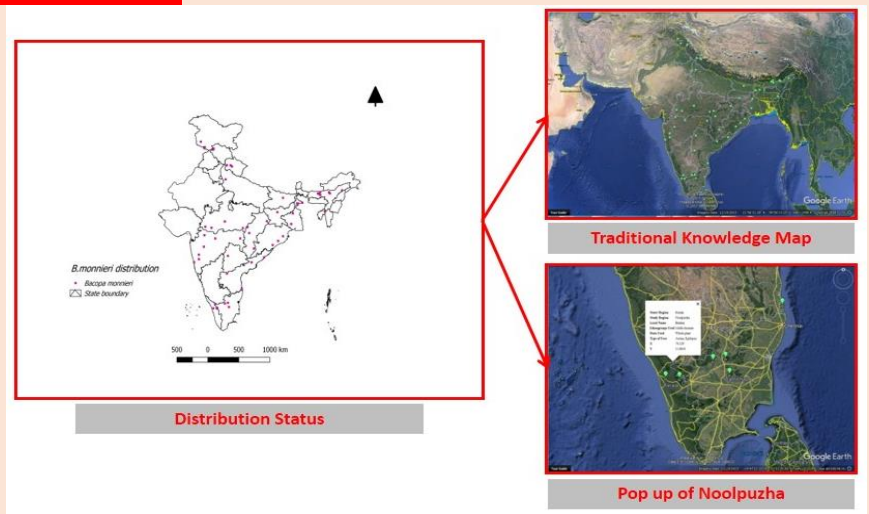
ABSTRACT

Introduction: This review consolidates reported ethnomedical uses of *B.monnieri,* which are currently dispersed, on a spatial platform. ***Methods:*** The ethnic medicinal uses of *B.monnieri* across several local communities and ethnic groups in India were mapped on Quantum GIS 2.10.1-Pisa (Q.GIS) and Google earth. ***Results:*** The present study resulted in the spatial documentation of *B. monnieri* in India. The spatial database reposits ethnomedical knowledge specific to *B. monnieri* nurtured within one hundred and twenty one communities in fifty three locations. The plant is identified in more than twenty different vernacular names. ***Conclusion:*** Traditional knowledge mapping associated with *B.monnieri* in India provides opportunities for meta-analysis of ethnomedical database and heralds new possibilities in knowledge discovery.

KEYWORDS

Brahmi, Ethno botany, GIS, Traditional knowledge.

PICTORAL ABSTRACT



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1. Introduction

Primordial literatures in India have cited the potential uses of medicinal plants to treat various human ailments. Traditional knowledge associated with herbal medicine is considered as the basis of all systems of traditional remedies in India. Most of the medicinal plants of India are extensively used in the preparation of Ayurvedic, traditional and tribal systems of medicine. *Bacopa monnieri* is a highly valuable creeping herb belongs to Scorphulariaceae family. It is widely distributed in the wet and marshy lands throughout India, Nepal, Sri Lanka, China, Taiwan, and Hawaii.[1] The herb has been mentioned in several ancient Ayurvedic treatises including the *Charaka Samhita* since sixth century AD. The plant is recommended for curing different mental disorders including anxiety, poor cognition and lack of concentration, as a diuretic and as an energizer for the nervous systems. *B. monnieri* is locally known as Brahmi[2] in India. The widespread distribution across different habitat, it is often recognized by different names in different regions and languages. Brahmi is a small creeping perennial with numerous branches and small, oblong, relatively thick leaves which are arranged opposite to each other on the stem.[3] The present study introduces a GIS based method to collect and analyze available information reported on ethno medicinal uses and distribution of *B. monnieri* in India.[4] Compilation of traditional knowledge database and integrating with GIS will be easy to store and accessible for quick analysis. However, the potential application of GIS in traditional knowledge mapping of *B. monnieri* has been under explored in India. In view of the wide spread utilization of *B. monnieri* by various ethnic groups this study is an effort to compile the available information reported on its ethno botanical uses with the aid of GIS.

2. Materials and methods

The present study was carried out by collecting the primary data on ethno medicinal uses of *B. monnieri* from internet through Google search engine facility by means of specific search word as "*B. monnieri*". The literatures includes articles published by government and non-governmental agencies, publishing houses of national and international scientific journals etc. The information relating to region, vernacular name, ethno-groups, parts used and types of uses were extracted from each article and compiled it together. Later the ethno botanical uses of *B. monnieri* among various indigenous communities in India were geo- tagged on a Quantum GIS 2.1.0 'Pisa' (Q.GIS) platform. The database created during this study was converted as kml file and for data visualization it was integrated with Google Earth.

3. Results and discussion

Mapping of traditional knowledge of *B. monnieri* (Figure 2 and 3) in India has compiled the diversified ethno botanical utility of the species. Utilization of different plant parts such as leaves, stem, tender shoot, fruits, roots and whole plant of *B. monnieri* are reported for more than thirty ailments by communities in different regions of India. In addition to this it is also used for culinary and cosmetics purposes. Table 1 summarizes the ethno medicinal uses of *B. monnieri* practiced by various ethno groups reported from different regions of India. Hundred and twenty one communities inhabits in fifty three localities identify *B. monnieri* by twenty two different vernacular names. The present study intends to bring together all the available information on ethno botanical uses of *B. monnieri* in single platform. Documentation helps to protect such valuable traditional knowledge from endangerment and Biopiracy.[5] Figure 1 depicts the distribution status of *B. monnieri* in different parts of India.

Table 1. Ethnic medicinal uses of *Bacopa monnieri* by various indigenous communities in India

SN	State/ Region	Study Region	Local Name	Ethnic groups	Parts Used	Type of Uses
1	Andhra Pradesh	Rayalaseema	Brahmi	Yanadis, Chenchus, Irulas, Yerukalas, Sugalis, Koyas, Reddi Dhoras, Konda Kapu, Kattunayaka, Manne Dora and Godabas	Whole plant	Neurotonic[6]
2	Andhra Pradesh	Polavaram forest area	Brahmi	Konda Reddy and Koya	Whole plant	Asthma[7]
3	Andhra Pradesh	Sriharikota	Brahmi	Yanadi	Leaves, whole plant	Whole plant as diuretic, leaves use to get relief from urinary problems[8]
4	Andhra Pradesh	Siddeswarm sacred grooves	Neerisam braniaku, Brahmi	Yanadis	Whole plant	Powder is given for nervous debility and as brain tonic[9]
5	Assam	Bajali sub-division	Brahmi	Kalita, Koch, Boro, Kosari, Rajbonshi, Nath, Brahmin	All parts of plant, leaf juice	All parts of plant is used as blood purifier, leaf juice is used as memory booster[10]
6	Assam	Upper Assam	Brahmi	Ahom	Leaves and stem juice	Blood purifier[11]
7	Assam	Nalbari district	Brahmi		Whole plant	Epilepsy, asthma, ulcers, tumors, ascites, enlarged spleen, indigestion, inflammations, leprosy, anemia and biliousness[12]
8	Assam	Baksa district	Thiphu, Bramhi	Bobo, Rabha, Garo	Tender shoot	Leaf and shoot as vegetable and extract taken to treat liver complaints[13]
9	Assam	Sonitpur district	Brahmi	Mishing	Whole plant	Brain tonic[14]
10	Assam	Kaziranga national park	Bhahmi	Mishing	Whole plant	Tonic for nerves, mental diseases, and brain tonic; leaf juice is given to infants in bronchitis; leaves used as vegetables[15]
11	Assam	Kamrup district	Brahmi haag/ Bami-belai	Boro, Rajbonghi, Khoronia Kochari and Nepali	Whole plant	Diabetics[16]
12	Chhattis garh	Durg	Brahmi-sak		Whole plant	Nerve tonic, asthma, snake bite[17]
13	Chhattis garh	Jashpur district	Brahmi	Kanwar	Leaves	Leaves are eaten as vegetable[18]
14	Chhattis garh	Deogudi sacred grove, Bastar district	Brahmi	Gond, Murias, Halba and Maria	Leaves	Fever[19]
15	Chhattis garh, Madhya	Achanakmar Amarkantak biosphere reserve	Bramhi	Baiga	Leaves, fruits & stem	Hair growth[20]

	Pradesh					
16	Himachal Pradesh	Bhattiyat	Brami	Gaddis, Gujjar	Root, shoot	Bilious disorders, chronic and acute liver disorders associated with hepatomegaly[21]
17	Himachal Pradesh	Chamba	Brahmi	Gaddis, Gujjar	Leaves	Nervous tiredness[22]
18	Jammu & Kashmir	Manjakote	Jal-neem	Gujjar & Bakerwal	Leaves	Stomachache[23]
19	Jammu & Kashmir	Jammu province	Jal-neem	Gujjars, Bakerwals, Gaddis, Sipis and Paharis	Whole plant	Poor production of milk in cows[24]
20	Jharkhand	Hazaribag	Brahmi-sak	Local inhabitants	Whole plant	Nerve tonic, asthma, snake bite[25]
21	Jharkhand	Wildlife Sanctuary Topchanchi, Dhanbad	Brahmi	Munda, Santhal, Oraon, Kharia, Gond, Kol, Kanwar, & Savar	Leaves	Skin diseases[26]
22	Kerala	Noolpuzha	Brahmi	Mullu kuruma	Whole plant	Asthma, epilepsy[27]
23	Kerala	Malappuram district	Brahmi	Kattunaikkans	Whole plant	Epilepsy[28]
24	Kerala	Attappady	Brahmi	Irular, Mudugar, Kurumbar and Dhodugar	Leaves, stem	Enhance memory[29]
25	Madhya Pradesh	Nimar Region	Brammi	Kol, Karku, Sahaiya, Baiga, Bhil, Bhilala, Barela, Tadvi, Banjara, Grond, Korku and Mankar	Leaves	Memory[30]
26	Madhya Pradesh	Badwani District	Bramhi	Gond, Bhaiga, Korku, Bhil, Halba, Kaul, Pawara	Leaves	To cure back-ache after delivery[31]
27	Madhya Pradesh	Hoshangabad and Sehore districts	Brahmi	Bhil, Bhilala, Gond and Korku	Whole plant	Jaundice[32]
28	Madhya Pradesh	Balaghat District	Brahmi	Gond and Baiga	Whole plant	To increase sexual power[33]
29	Madhya Pradesh, Chhattisgarh	Achanakmar-Amarkantak Biosphere Reserve (AABR),	Brahmi	Baiga, Gond, Bharia, Bhils, Oraon, Kol, Kanwar and Uikey	Leaves	Epilepsy[34]
30	Maharashtra	Mula river valley region of Ahmednagar district.	Brahmi	Baragaon,Nandur,Daradgaon,Chikhalthana, Sakur, Ghargaon	Whole plant	Bone fracture, improvement of mental functions, promotes memory and urinary disorders, diuretic, blood purifier and laxative[35]
31	Maharashtra	Marathwada	Brahmi	Andh, Bhil, Pardhi, Thakar	Leaves	To prevent hairfall[36]
32	Maharashtra	Armori, Wadsa, Kurkheda, Korchi forest range of Gadchiroli District	Bhramimarrh	Gond and Madiya	Whole plant	Epilepsy, fever, Brain Tonic, rheumatism, Diarrhea, Abdominal diseases[37]
33	Maharashtra	Purandhar district	Bramhi	Dhangars and Gowlis	Leaves	Menstrual disorder[38]
34	Maharashtra	Nundurbar, Dhule and Jalgaon district.	Brahmmi	Bhills, Garits, Kokanis , Mavschis , Valvis , Pawras	Leaves	To cure nephrotoxicity/ kidney problems[39]
35	Maharashtra	Kanher and Mahadare Reservoir from Satara district,	Nir Brahmi	Ketkadi, Bhoi, Mahadev Koli, Pradhan, Tambat and Bhavsar	Whole plant	Astringent, bitter used in digestive, antinflammatory, cardiotonic, epilepsy, leprosy, lephantiasis, fever and general debility condition[40]
36	Maharashtra	Amba-barwa wild life sanctuary	Brahmi	Bhil,Bhilala, Nihal, Tadvi Bhil	Whole plant	Plant extract on skin itching[41]
37	Odisha	Khurda	Bramhi	Savaras	Leaves	Against malaria[42]
38	Odisha	South Odisha	Brahmi	Bhumia, Bonda, Dangaria Kandha, Didayi, Gadaba, Kandha, Koya, Kuti Kandha, Langia-Saura, Paika, Paraja, Sabara, Saura	Young shoots	As vegetable[43]
39	Odisha	Jajpur District	Braahmi	Kolha, Munda, Bonda and Santal	Leaves	Memory power, to treat chickenpox[44]
40	Tamil Nadu	Kolli hills	Neerbrami	Malayali tribals	Whole plant	Paste of the whole plant applied

						externally for dog bite[45]
41	Tamil Nadu	Palamalai	Neer brammi	Malayali tribals	Whole plant	Memory power[46]
42	Tamil Nadu	Servarayan hills	Niirbrahmi	Malayali tribals	Whole plant	Epilepsy, memory power, mental disorder, nervous weakness[47]
43	Telangana	Pocharam Wildlife Sanctuary	Brahmi	Yerukalas and the Lambadis	Whole plant	Cooling effect, tonic[48]
44	Tripura	Kanchanpur, Gandacherra, Baramura, Twidu, Amarpur, Karbook	Bramhi	Tripuri, Jamatia, Halam, Santhal and nontribal community.	Leaf	Jaundice[49]
45	Uttarakhand	Dehradun, Haridwar, Pauri and Udham Singh Nagar	Niir brahmi/ Brahmi	Gujjar	Leaves	Epilepsy[50]
46	Uttarakhand	Haridwar, Dehradun and Pauri.	Nir-brihmi/ Barmi	Gujjar	Whole plant	Whole plant crushed and applied externally on eczema[51]
47	Uttarakhand	Tehri Garhwal	Pan-Brahmi	Gujjars and Bhotiyas	Leaves	To cure flatulence in children[52]
48	Uttarpradesh	Aligarh, Bulandshahr, Budaun, Farrukhabad	Brahmi	Local people	Whole plant	Spermatorrhoea[53]
49	West Bengal	Hili, Panjul, Dhalpara, Jamalpur and Binsira	Brahmi	Santhals, Oraon and Munda	Whole plant	Nerve tonic, asthma, insanity, diuretic, tranquilizer[54]
50	West Bengal	Maldah district	Bramhi	Santal, Oraon, Malpaharias	Tender shoot	Vegetable[55]
51	West Bengal	Bamangola block	Brahmi-saag	Santhal, Oraon, Munda, Baskey, and Hembram	Young Shoot	Green vegetable[56]
52	West Bengal	Paschim Medinipur district	Brahmi	Lodha	Whole plant	Gonorrohea[57]
53	West Bengal	Birbhum Distr	Brahmi sak, Baramb	Santal, Kora and Orao	Whole plant	Improvement of intelligence & memory, youthful vitality[58]

Figure 1. Reported distribution status of *Bacopa monnieri* in different regions in India

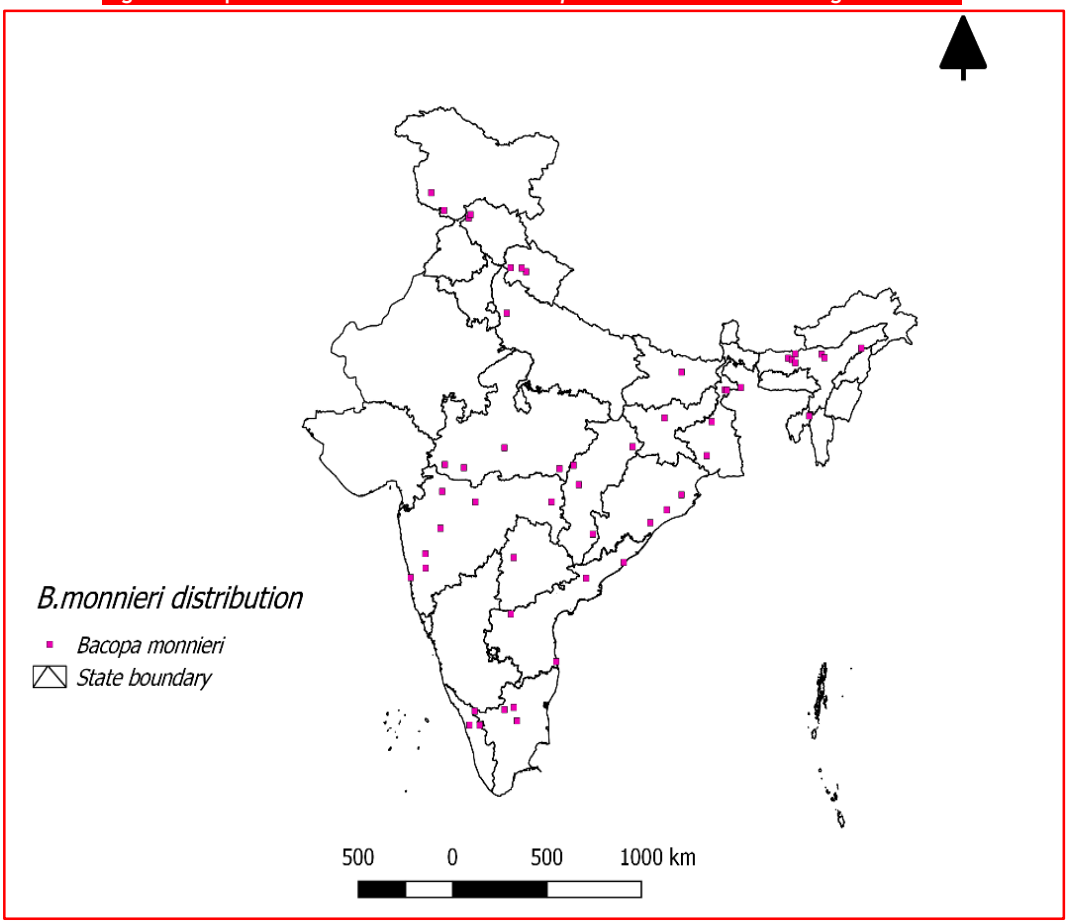


Figure 2. Traditional Knowledge Mapping of *Bacopa monnieri* in India

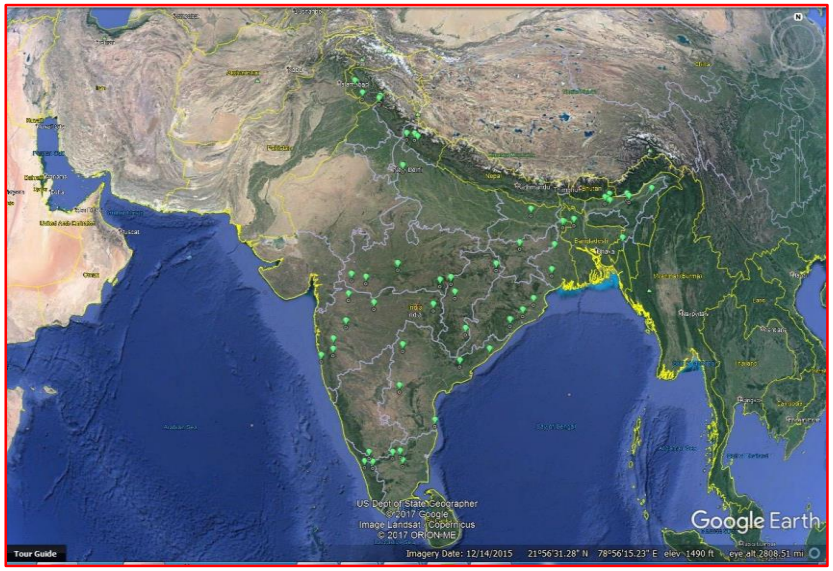
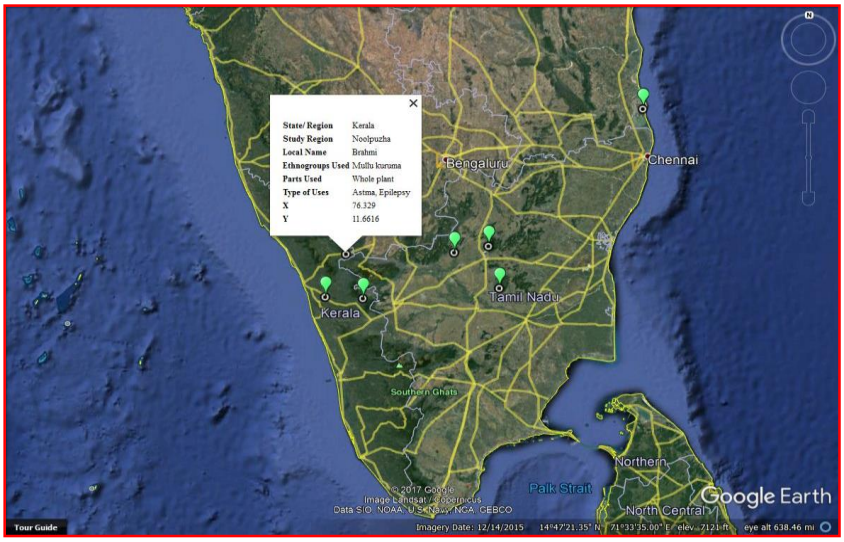


Figure 3. Pop up of Noolpuzha (Table 1: SN 22)



4. Conclusion

The present study provides a new vista for ethno botanical studies. Traditional knowledge mapping associated with *B. monnieri* in India has provided geospatial information on the distribution of *B. monnieri* which will be useful for effective conservation of the plant species.

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CONFLICT OF INTEREST None declared

CONTRIBUTORS Faseela VS did literature survey and data acquisition from various sources. Athira K contributed to GIS based analysis and design. Saroj KV contributed to conceptualization of the topic and manuscript editng. Sooraj NP contributed to GIS based analysis. Sajeev CR contributed to data analysis and GIS based analysis. Dr. Jaisanker R contributed to intellectual content and design.

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