



DOCUMENTING THE PLANTS ACTIVE AGAINST VARIOUS DISEASES BASED ON TRADITIONAL KNOWLEDGE

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Abstract

Background: Traditional knowledge (TK) can be described as an indispensable part of the identity of the ethnic communities. This knowledge can be of different types including the TK of medicinal plants. However, with the advancement of allopathic medicines, this knowledge is deteriorating.

Objective: The main objective of the current study is to record the traditional use of plants for treating diseases or conditions in humans in the lower Brahmaputra Valley zones of Assam.

Materials and methods: A survey was conducted using semi-structured questionnaires to collect data on plant-based medicines from among 25 traditional healers from the various districts of lower Brahmaputra Valley zones through face-to-face interviews and discussions. The acquired information was compiled through the UR (Use report). The scientific name of the plants was verified using WFO (<https://wfoplantlist.org/plantlist>).

Results: A total of 40 plant species having medicinal use belonging to 36 genera and 24 families have been reported. The leaves were mainly used by extracting the juice for the preparation of drug formulation. Besides, the dysentery is most commonly treated illness using the herbal medicines.

Conclusions: The people mainly from the ethnic communities residing in the lower Brahmaputra Valley zones of Assam are found to be familiar with the use of medicines made from natural sources that are plants. Many important diseases are cured by using herbal medicines in their crude form. Therefore, further analysis is required to identify the active principles involved in their mechanism of action that can be utilized in the development of novel drug.

Keywords: Ethnic, Traditional knowledge, Medicinal plants, Lower Brahmaputra Valley zones, Assam

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Background

Traditional knowledge is the wisdom and skill gained by experiences that were then maintained and passed on to the successive generation (Karunamoorthi *et al.* 2013). It forms the identity and culture of some of the indigenous communities in different parts of the world. Traditional knowledge of important plants and their utilization against different illnesses is the consequence of many years of experience (Lu *et al.* 2022, Mukherjee & Mao 2022, Rajasekharan *et al.* 2023). The diseases caused by viruses, bacteria and other pathogens pose a serious health threat that cannot be ignored. The evolution of drug resistance is one of the major challenges (Tacconelli *et al.* 2018, Kim *et al.* 2021, Ma *et al.* 2021, Jalal *et al.* 2023).

Therefore, the development of new antimicrobial drugs having high efficiency, selective toxicity, and fewer side effects stays a critical requirement globally. Plants having medicinal properties are therefore becoming the major focus in antimicrobial drug development as they are readily available, economical, and have fewer adverse effects (Mouhajir *et al.* 2001, Sagar & Kumar 2020, Nesari *et al.* 2021). However, the application of plant-based resources in drug development must be confirmed through stringent trials. The knowledge of the traditional use of plants against various microbial diseases is an important factor that will help to identify potential candidates for drug development (Fabricant & Farnsworth 2001). Assam is the largest state in the North-Eastern region. The various regions of Assam are bestowed with a rich diversity of flora which is mainly due to mildly hot and humid climate along with heterogeneous physiography. The forests are mainly tropical and subtropical providing a wide range of plants to be utilized by the communities that mainly depend on the plants for their livelihood. Assam has heterogeneous inhabitants with ethnic and socio-cultural diversity (Assam State Biodiversity Board 2023).

Assam provides a rich source of indigenous and traditional knowledge that needs immediate attention as it is gradually deteriorating with time and advancement in synthetic medicines (Bhattacharjya *et al.* 2023). Assam is one of the seven-sister states situated in North-East India covering an area of 78,438 square km. The Brahmaputra river valleys are one of the chief geographical regions of Assam. Our study was focused on the lower Brahmaputra Valley that includes the districts of Kamrup Rural and Metro, Darrang, Udalguri, Baksa, Nalbari, Barpeta, Kokrajhar, Bongaigaon, Chirang, Goalpara, and

Dhubri. The major group of indigenous communities residing in these areas includes the Bodo, Rabha, Karbi, Tea-tribe, Sarania and Tiwa. This study aims at investigating and assessing the antimicrobial properties of the preparations of some plants used by local communities of Assam who are known for their invaluable traditional knowledge

Materials and Methods

Survey design

A comprehensive cross-sectional field study was directed in different areas of the Lower Brahmaputra valley of Assam during the years 2021 and 2022. The informants in our study mainly included the elderly people who have the knowledge of the traditional use of the plants. The interview with the knowledgeable people was conducted by using semi-structured questions. Prior informed consent was verbally taken from every informant before beginning the interview.

Sampling

The present study was based on subjective sampling technique. It emphasizes on certain individuals in the communities who have the knowledge of plant utilization against a wide variety of diseases. These individuals have acquired the knowledge mainly from their ancestors and by trial and error methods.

Sample size

A total of 12 districts were included in our study area. Each of these districts have more than 500 villages. As it is not possible to sample every village in every districts, therefore, certain villages were chosen at random using some prior information. We interacted with more than 200 individual in the study area out of which only 25 were found to have the TK of the plants used for therapeutic purposes. The informants were chosen by random sampling method.

Data processing

Data collection tool

A thorough list of questionnaires was used to interview the traditional healers/practitioners about the medicinal use of various plants along with their vernacular names. Prior informed consent was taken verbally from all the healers before every interview. The data gathered from the respondents were then used to gather plants for voucher specimens (Jain & Borthakur 1980). The questionnaire during the interviews consisted of the name of the informant, the name of the plant species, the disease/ailment against which the plant is used, plant parts used, method of formulation,

dosage, and other additional information that must be heeded while using the particular plant as a healing agent.

Data repositories

The identified plants were collected, pressed and stored as the herbarium specimen (Jain & Rao 1977). The prepared herbarium specimens were deposited in the Herbarium of the PG Department of Botany, M.C. College (Gauhati University), Barpeta, Assam.

Data access

The online database WFO Plant List (<https://wfoplantlist.org/plant-list>) was used to correctly identify plant species and verify the botanical name of the plants.

Result

Socio-demographic characteristics

Out of the 25 traditional healers interviewed in our study, 16 were males and remaining females. These individuals were mainly old adults and elderly people in their sixties and above. The traditional use of plants for treating different illnesses was found to be very rare among young adults. They were mainly dependent on allopathic or homeopathic medicines. Some of the respondents were literate having matriculation or higher secondary education but most of them were illiterate. The males were mainly involved in farming, agriculture, and some small business and females were mainly looked after the households.

Table 1: Use report (UR) of plant species against various diseases in the districts of lower Brahmaputra Valley.

Family	Botanical name	Vernacular name	Parts used	Mode of administration	Used for
Acanthaceae	<i>Justicia adhatoda</i> L.	Rambasak	Leaves	Juice obtained from leaves is consumed with honey	Pneumonia
	<i>Rungia pectinata</i> Nees.		Whole plant	Juice extracted from whole plant is consumed orally.	Jaundice
Acoraceae	<i>Acorus calamus</i> L.	Bos	Roots	The powder obtained from the roots is consumed with honey	Dysentery
Amaranthaceae	<i>Alternanthera brasiliana</i> (L.) Kuntze	Bishalyakarani	Leaves	Juice extracted from the leaves is consumed orally.	Sore throat
	<i>Chenopodium album</i> L.	Bathua	Tender leaves	The juice extracted from the tender leaves is consumed twice daily	UTI
Apiaceae	<i>Centella asiatica</i> (L.) Urb.	Bor manimuni	Leaves, whole plant	Fresh juice extracted from the leaves or the whole plant is consumed directly	Pneumonia
Apocynaceae	<i>Calotropis gigantea</i> (L.) Dryand.	Akon	Bark	Powder made from dried bark is consumed with hot water	Leprosy
	<i>Catharanthus roseus</i> (L.) G. Don	Nayantara	Flowers	Flower juice is applied using cotton onto the affected parts after heating.	Conjunctivitis
Asteraceae	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	Bon narji	Leaves, flowers	Leaf paste is consumed along with honey or applied topically on the affected parts. The flower is consumed directly by chewing.	Tonsillitis, flu, bronchitis, cold sores
	<i>Ageratum conyzoides</i> L.	Jat tita	Leaves	Paste made from leaves is consumed with salt	Dysentery
	<i>Enydra fluctuans</i> Lour.	Helochi	Leaves, whole plant	Paste made from leaves is applied topically	Acne
	<i>Tagetes erecta</i> L.	Genda fool	Flowers	Decoction of flower is consumed directly	Ulcer
Basellaceae	<i>Basella alba</i> L.	Pui saak	Roots	Roots are consumed after boiling	Dysentery
Combretaceae	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Arjun	Bark	Powder made from dry bark is mixed with water and consumed thrice daily	Tuberculosis
Euphorbiaceae	<i>Euphorbia nerifolia</i> L.	Hiju	Leaves	Juice obtained from leaves is consumed with honey	Common cold
	<i>Euphorbia tithymaloides</i> L.	Ranghita	Leaves	Leaves decoction is consumed orally by adding salt or sugar to it	Common cold, laryngitis
	<i>Ricinus communis</i> L.	Aera	Seeds	Oil obtained from the seeds is applied onto the affected areas.	Genital warts
Fabaceae	<i>Bauhinia variegata</i> L.		Leaves, bark	Decoction of leaves or bark is used to wash the affected parts	Leprosy
	<i>Clitoria ternatea</i> L.	Aparajita	Flowers	Decoction of flowers is consumed directly	Acne
	<i>Mimosa pudica</i> L.	Lajuki lota	Leaves	Juice of the leaves is applied onto the affected parts	Gingivitis
	<i>Senna alata</i> (L.) Roxb.	Khorpat	Leaves	Juice extracted from tender leaves is consumed directly.	Hepatitis
Lamiaceae	<i>Ocimum gratissimum</i> L.	Ram tulokhi	Leaves	Leaves juice is applied on eyes twice daily.	Viral conjunctivitis
	<i>Ocimum tenuiflorum</i> L.	Tulokhi	Leaves	Leaf decoction is consumed orally. The leaf juice also consumed along with honey.	Common cold and sinusitis
Lythraceae	<i>Lawsonia inermis</i> L.	Jetuka	Leaves	Juice extracted from the leaves is applied directly	Acne
Malvaceae	<i>Corchorus capsularis</i> L.	Morapat	Leaves	Dried leaves are soaked in water overnight which is then consumed orally	Ulcer
	<i>Sida cordifolia</i> L.	Haru boriyal	Roots, tender leaves	1. Root juice is consumed with goat milk. 2. Juice of tender shoot is consumed orally.	1. Jaundice 2. Common cold
	<i>Sida rhombifolia</i> L.	Bor boriyal	Leaves, roots	Paste made out of leaves or roots is consumed orally.	Jaundice
Meliaceae	<i>Azadirachta indica</i> A. Juss.	Neem	Bark	Concoction of bark is applied topically using cotton balls	Acne
Menispermaceae	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook.f. & Thomson	Aamoi lota	Leaves	Concoction made by adding leaves of <i>Corchorus olitorius</i> L. and <i>Centella asiatica</i> is consumed directly.	Typhoid

Myrtaceae	<i>Psidium guajava</i> L.	Madhurium	Leaves	Juice extracted from tender leaves is mixed with salt and consumed directly	Dysentery, cholera
Phyllanthaceae	<i>Baccaurea ramiflora</i> Lour.	Leteku	Fruits	The juice extracted from the fruits is consumed orally.	Hepatitis
Piperaceae	<i>Piper nigrum</i> L.	Jaluk	Seeds	The seed decoction is consumed orally.	Common cold
Rubiaceae	<i>Paederia foetida</i> L.	Bhedailota	Leaves	Leaf juice is consumed directly	Dysentery
Rutaceae	<i>Citrus limon</i> (L.) Osbeck	Kaji nemu	Fruits	Fruit juice is applied topically onto the affected parts and washed out with water within 10 min of application.	Cold sores
Saururaceae	<i>Houttuynia cordata</i> Thunb.	Mesendari	Leaves	Leaves are first cooked by wrapping in banana leaf which is then directly consumed	Dysentery
Solanaceae	<i>Solanum torvum</i> Sw.	Hathibhekuri	Roots	Root juice is consumed orally.	Jaundice
	<i>Solanum virginianum</i> L.	Kantakari	Leaves, roots	1. About 2gm leaf juice + honey is consumed twice daily. 2. Root juice is consumed once daily.	1. Flu 2. Measles
Urticaceae	<i>Pouzolzia zeylanica</i> (L.) Benn.	Khiraikul	Leaves	Juice extracted from the leaves is poured into the ear using a dropper	Otitis media
Zingiberaceae	<i>Curcuma aromatica</i> Salisb.	Bon halodhi	Rhizome	Juice obtained from approximately 200 gm of rhizome is consumed directly	Ulcer
	<i>Hellenia speciosa</i> (J.Koenig) Govaerts	Devitokan	Roots	Root juice is extracted by boiling in water which is consumed orally.	Jaundice

Taxonomy identification

The plant species recorded in the present study are an outcome of the TK of plants of the local healers in the various district of lower Brahmaputra Valley. A total of 40 species of medicinal plants belonging to 36 genera and 24 families have been found. The notable genera are *Euphorbia*, *Ocimum*, *Sida* and *Solanum* spp. indicating their importance as herbal medicines in TK system. The

predominant families were Fabaceae and Asteraceae with four species each followed by Malvaceae and Euphorbiaceae having three species each. Two species have been reported each from the families Solanaceae, Acanthaceae, Amaranthaceae, Apocynaceae and Lamiaceae. The remaining families have been reported with only one species each as presented in Table 1.

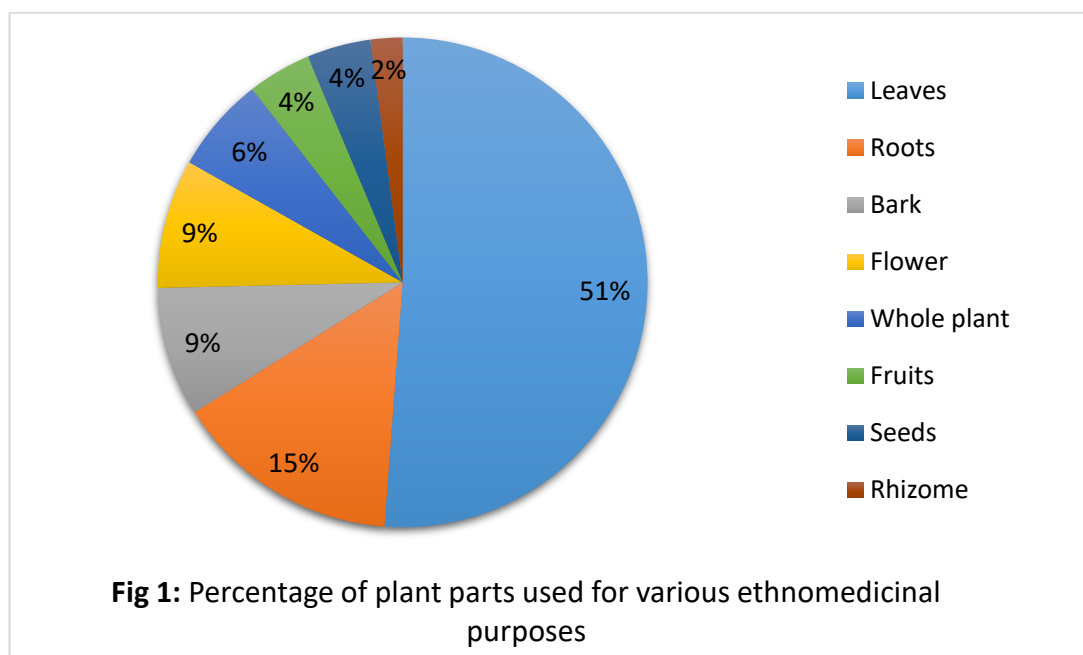


Fig 1: Percentage of plant parts used for various ethnomedicinal purposes

Most commonly used plant parts

Different parts of the plants such as leaves, fruits, roots, seeds, bark, flowers, rhizomes, stems and sometimes the whole plants are used by the traditional healers to make the herbal formulation. A thorough analysis showed that leaves accounts for 51% followed by roots 14%. These two plants parts are highly important for preparation herbal medicines. The utilization percentage of the remaining parts are depicted in Fig 1.

Analysis of use reports based on the treatment of different diseases/conditions

The various diseases or conditions cured by using different herbal remedies were compiled randomly. The identification of different diseases were done on the basis of key symptoms as described by the traditional healers. The total number of user reports reported for various diseases/conditions is 48. It has been seen that most of the plants were used to treat dysentery followed by common cold and jaundice. The remaining use

reports of the plants against different diseases are shown in Table 2.

Table 2: The number of used reports against different diseases/categories.

Sl. No.	Diseases/conditions	Number of use reports
1	Dysentery	6
2	Jaundice	5
3	Common cold	5
4	Acne	4
5	Ulcer	3
6	Pneumonia	2
7	Flu	2
8	Cold sores	2
9	Leprosy	2
10	Conjunctivitis	2
11	Hepatitis	2
12	Laryngitis	1
13	Tuberculosis	1
14	Genital warts	1
15	Sore throat	1
16	UTI (urinary tract infection)	1
17	Tonsillitis	1
18	Bronchitis	1
19	Gingivitis	1
20	Sinusitis	1
21	Typhoid	1
22	Cholera	1
23	Measles	1
24	Otitis media	1
	Total	48

Discussion

The important recorded during the survey are Fabaceae and Asteraceae. This indicates their importance among the traditional healers as a medicinal plant. Besides, among these families, the notable genera are *Euphorbia*, *Ocimum*, *Sida* and *Solanum* spp. The study reveals that the local communities suffering from gastrointestinal, respiratory and metabolic disorders mainly prefer plant based medicines. An important finding of the present study is the treatment of leprosy (Hansen's disease). It is deadly disease caused by bacterium *Mycobacterium leprae*. If the treatment is not given at immediately, the disease can become fatal (Scollard *et al.* 2006). The people living in remote areas of Assam have poor access to modern synthetic medicine system (Sharma & Singh 2022). They suffer the highest due to different diseases, therefore, the knowledge of plants for the treatment of particular disease is treasure to them.

Conclusion

Traditional healers are the people who have the wisdom and knowledge of the use of plants for the treatment of different diseases/conditions. The

districts of the Lower Brahmaputra Valley zones of Assam (India) possesses rich in plant diversity which in turn serves as the richest repository of plants having medicinal properties. The TK of medicinal use of plants is however getting diminished with time and the preference of people for modern medicine such as allopathic and homoeopathic. Hence, there is an urgent need to preserve this knowledge for future generations. With the advancement of synthetic medicines, pathogens are also becoming advanced in their resistance. There is high demand for novel sources of drugs which can be fulfilled by these valuable TKs.

The crude form of the drug is mainly used by traditional healers. However, only a few active principles are associated with the cure of the disease. Thus, these reported plants must be thoroughly analysed by phytochemical and other techniques to identify those active principles. This will greatly help in drug development strategies.

Ethics approval and consent to participate

Prior informed consent was taken verbally from all the healers before every interview.

Consent for publication

Not applicable

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None

Author's Contribution

JA: Writing the original draft; Conceptualization; Data acquisition; Analysis and Interpretation of data.

DKB: Data acquisition; Review and Overall management of the study.

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