Medicinal plants used by the indigenous peoples of Banskhali Upazila of Chattogram district, Bangladesh

M. Julfiqar Sultanul Amir, Halima Tujj Sadia, Rainer W. Bussmann, M. Ashrafuzzaman

Correspondence

M. Julfiqar Sultanul Amir[1], Halima Tujj Sadia[1], Rainer W. Bussmann[2,3], M. Ashrafuzzaman[1]*

[1]Department of Crop Botany, Bangladesh Agricultural university, Mymensingh 2202, Bangladesh.
[2]Institute of Botany and Bakuriani Alpine Botanical Garden, Ilia State University Botanical Str. 1, 0105 Tbilisi, Georgia
[3]Department of Botany, State Museum of Natural History, 76133 Karlsruhe, Germany

*Corresponding Author: ashrafcbot@bau.edu.bd

Ethnobotany Research and Applications 31:68 (2025) - http://dx.doi.org/10.32859/era.31.68.1-15
Manuscript received: 22/06/25 - Revised manuscript received: 20/08/2025 - Published: 22/08/2025

Research

Abstract

Background: People use many plants from the very beginning of the civilization for medicinal purpose. The aim of this study was to document the use of medicinal plants in Banskhali upazila of Chattogram district, Bangladesh. The ethnobotanical results contain qualitative and quantitative information on medicinal plant diversity as well as local name, plant part used, disease category, application method and plant habit. This information is documented for the first time in this area.

Methods: A survey was conducted to collect data using group discussions and oral face-to-face interviews by using a semi-structured questionnaire covering personal information, information about plants and the importance of conserving valuable plant species among 220 residents of this area. Results were analyzed using quantitative indices of fidelity level (FL), frequency citation (FC), use value (UV), use report (UR) etc.

Results: This survey documented 71 plant species from 38 families, detailing their botanical names, local names, plant parts used and traditional applications. Asteraceae, Fabaceae, and Lamiaceae are most represented families each with 5 species, followed by Apiaceae, Apocynaceae, Combretaceae, Lauraceae, Malvaceae, Rutaceae, and Zingiberaceae (each with 3 species). Leaves were the most commonly used part, followed by fruits, bark, stems and flowers, and whole plants, along with other parts like bulbs, cloves, rhizomes, seeds, roots, and husks as crude form, extracts, decoctions, infusions or pastes. The study documented 11 ailment categories, like gastrointestinal disorders, skin diseases, menstrual disorders, arthritis, diabetes etc.

Conclusions: The study highlighted that elderly and illiterate individual preferred medicinal plants due to their affordability, distrust in modern medicine and aversion to surgery. However, these plants are threatened by exotic species, lack of awareness and overexploitation. The study advocates for immediate policy interventions to ensure their conservation.

Keywords: Bangladesh, Banshkhali, Chattogram, Indigenous people, Medicinal plants

Background

Bangladesh is a South Asian country located along the Bay of Bengal, bordered by India and Myanmar. According to the BBS (2022) Bangladesh with an area of the country is 1,47,570 k.m^2 and the population is 169.83 million. This low area and high population make it one of the most densely populated countries in the world. As it is an agriculturally developing country, most of the population lives in rural areas. A large number of people living below the poverty line. Due to limited access to the current health system and poverty, most rural residents rely on medicinal plants to meet their regular health needs. About 80% of the world's population uses alternative medicine (Pandey *et al.* 2013). These drugs are used for primary health care by rural populations in developing countries and wealthy countries where modern drugs predominate. About 31,128 species of flowering plants have been identified as valuable resources for humanity worldwide, of which 17,810 are used as medicine, 5,538 as human food, and 3,649 as fodder (Shrestha *et al.* 2018). Traditional herbal medicine in Bangladesh has a strong cultural and religious basis. It has been used by indigenous communities for centuries to treat various diseases. Due to favorable agroclimatic conditions and seasonal diversity, Bangladesh is rich in medicinal plant resources. With fertile soils and a tropical climate, more than 5,000 species of angiosperm plants have been recorded in the country (Pasha & Uddin 2013), of which about 250 are used in traditional medicine systems (Faruque & Uddin 2013). Due to the geographical location and socio-cultural characteristics of the country, it includes traditionally rooted elements influenced by local natives and Indian Ayurvedic and Unani medicine (Claquin 1981; Bhardwaj & Paul 1986). Traditional medicinal methods and ethnobotanical knowledge have been intricately integrated into local culture, frequently conveyed through speech by village elders, herbalists (kabiraj) and faith healers. Environmental degradation, deforestation, and migration of traditional healers to other professions are some of the reasons why many medicinal plants have disappeared. However, until now, no effort has been made to collect and preserve traditional knowledge of medicinal plant practice from this region. This is therefore the pioneering documentation of medicinal plants in this region. This paper provides an overview of the ethnobotanical practices of this region. It not only contributes to the preservation of this knowledge but also presents this knowledge to the scientific world to help facilitate drug discovery based on ethnopharmacology.

Materials and Methods

Study area

The study area is located in the chattogram district, the largest port city of Bangladesh. It is 50km away from the district headquarter. Its geographical coordinates are 22°02’’55’N and 91°56’’30'E (Fig. 1). It is geographically bounded by the Bay of Bengal, which forms its western border and hilly forested area in the east. Anwara upazila by the north and cox bazar district by the south. According BBS (2015) Banshkhali has an area of approximately 376.9 km2 is noted for its varied topography, including coastal plains, low hills, rivers, and mangrove forests create a unique landscape suitable for both agriculture and biodiversity, including a variety of medicinal plant species. Banskhali features an ecopark that highlights its rich botanical diversity. According to BBS (2023), Banshkhali upazila has 111,765 houses and 537,555 inhabitants, of whom number of males (49.98%) and female 268,853 (50.01%). The literacy rate, which was 71.32%, was lower than the national average of 74.8%. The population of Banshkhali is predominantly Muslim, with a minority Hindu and Buddhist community.

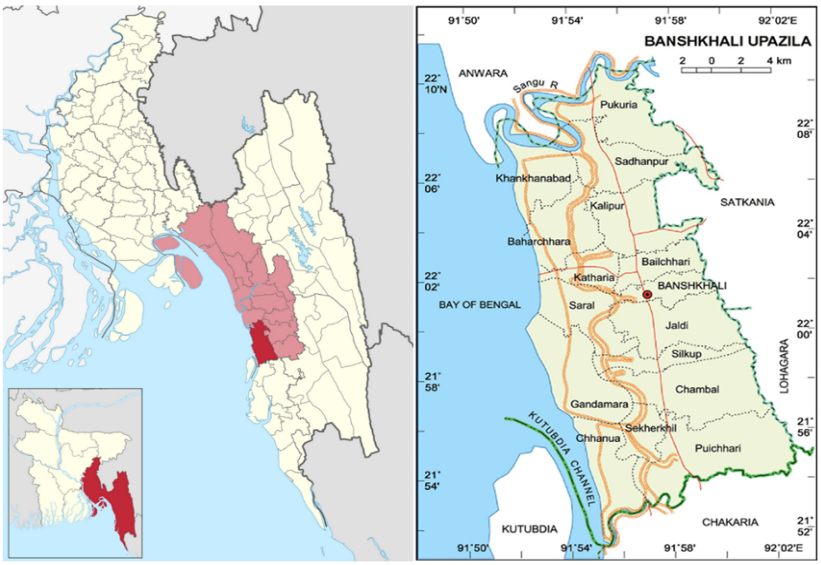


Figure 1. Map of the Banshkhali upazila, Chittagong, Bangladesh, showing the study area

Ethnobotanical surveys and data collection

Ethnobotanical data were collected by following The Participatory Rural Appraisal method through open-ended interviews with randomly selected informants and field interviews with key informants selected after the open-ended list (Martin 1995). A field survey was conducted using a semi-structured questionnaire that explored various aspects in an open-ended format to collect data from January 2024 to April 2024. During the interviews, information was recorded utilizing a data documentation sheet for open-ended and semi-structured questionnaires to gather ethnobotanical data. The questionnaire focused mainly on ethnobotanical claims and traditional beliefs of local communities and neighboring populations. The questionnaire included the following information: a) local name; b) part of the plant used; c) method of preparation; d) disease category; e) method of application; e) plant habit. Data related to the social profile of the participants, such as age, gender, educational level, and religion, were also recorded. The interviews were conducted in the local language, with the first author being a local resident. A total of 220 residents of the region were interviewed for ethnobotanical information. 155 women and 65 men were interviewed, including 15 healers or cobras. The informants were divided into four different age groups, namely: 20-30, 31-40, 41-50, and 51-70 years old. There were 60 students, 25 farmers, 90 housewives, 15 herbalists (kabiraj) and 30 people from other professions. And we analyzed this data by using Microsoft Excel application.

Table 1. Distribution of gender, age, profession and religion of informants interviewed

	Categories	Number of persons	Frequency
Gender	Male	65	29.5%
	Female	155	70.7%
Age (Years)	20-30	60	27.27%
	31-40	70	31.81%
	41-50	50	22.72%
	51-70	40	18.18%
Profession	Student	60	27.27%
	Farmer	25	11.36%
	Housewife	90	40.9%
	Kobiraj	15	6.81%
	Others	30	13.63%
Religion	Muslim	185	84.09%
	Hindu	25	11.36%
	Buddhiust	10	4.54%

Identification of Plants

The voucher specimens were identified and collected from the studied areas with the help of local people. The photographs of the specimen also captured. For the identification of the plants, we used digital photos, scientific literature (Hooker 1872-1897, Yusuf 2009, Uddin 2006) and consulted experts, both traditional healers and academic experts. We checked the nomenclature of the identified species with the Kew Science website (www.powo.science.kew.org).

Quantitative Analysis of ethnobotanical results

The collected data were arranged alphabetically according to the scientific name of the plants, as well as the local name, plant parts used, disease category, route of application, method of application and port. The results were analyzed and presented in more detail.

Fidelity level (FL)

The Fidelity level (FL) was calculated using the following formula as described by Friedman e*t al.* 1986 to determine the preferred species used in the treatment of a given disease, since several plant species are used in the treatment of the same category:

$$FL = (Np/N \times 100)$$

where Np is the number of informants mentioning the use of the plant for a given disease
and N is the total number of informants mentioning species for each disease.

A high FL value indicates a high frequency of use of plant species for the treatment of a certain category of diseases by informants in the study area.

Frequency citation (FC) and relative frequency citation (RFC)

The FC of the species of plants being utilized was evaluated using the formula:

FC = (Number of times a particular species was mentioned**/**total number of times that all species were mentioned) x100

and the relative frequency citation (RFC) index was done by using the following formula:

RFC=FC/N (0 <RFC <1) (Tardío & Pardo-de-Santayana 2008).

This index is obtained by dividing the number of informants mentioning a useful FC species or the frequency of citation mention by the total number of informants in the survey (N). The RFC value ranges from 0 (when no one mentions a plant as useful) to 1 (when all informants mention it as useful). The RFC index, which does not consider the category of use (UR, or utilization ratio, is a unique record of the use of a plant named by an individual).

Use value (UV) and use report (UR)

The Use value (UV) demonstrates the relative importance of plants known locally. It was calculated using the following formula:

$$UV=\sum U/n$$ (Phillips *et al.* 1994)

Where UV is the use value of a species, "U" is the number of use reports cited by each informant for a given plant species, and "n" is the total number of informants interviewed for a given plant. UV is used to determine the most commonly used plants (most frequently indicated) in the treatment of a disease, while the use ratio (UR) is the recorded use for each species.

Results and Discussion

Use of plants and demography

A total of 220 residents of Banskhali Upazila of Chattogram district, comprising 70.45% women, 29.54% men, and some traditional healers of different age groups, were surveyed. The informants were divided into four age groups. Most of the above informants belonged to the age group of 30-40 years (Table 1). In total, 38 families and 71 species with local names of plants, family names, uses and parts of plants used for medicinal value, use ratio, use value, frequency of citation (FC), a relative citation frequency (RFC), plant habit and application method are listed in appendix 1 and Table 2. The most represented families in terms of the number of species are Asteraceae, Fabaceae and Lamiaceae (with 5 species each) (Fig. 2). The dominancy of Fabaceae family may be due to the worldwide distribution of species from this family (Marles & Farnsworth 1995, Suleiman 2015) and furthermore the Fabaceae constitute the second largest family of Bangladesh (Pasha & Uddin 2013). The most used parts of the plants are their leaves (38.41%) (Fig. 3). The plants are often used as decoctions (38 plants), and a small amount is also used as juice, paste and oil. The largest number of plant species is used in the treatment of gastrointestinal diseases (35 types) (Table. 3). The highest RFC value was calculated for (0.56). The highest usage ratio was calculated at 160 usage ratios in appendix 1. Other study also reported similar results during an ethnobotanical survey conducted in Batan Island, Philippines, who also found that women play an important role in the island. preparation of traditional herbal medicines (Jamila & Mostafa 2014, Ahmad *et al.* 2014). Of all the plants identified, leaves were the main plant parts used, which is consistent with other studies (Ayyanar & Ignacimuthu 2011, Telefo *et al.* 2011). Leaf collection and processing are easy and do not significantly damage the plant compared to root or whole plant collection (Zheng & Xing 2009, Rehecho *et al.* 2011, Ankli *et al.* 1999). Leaves and seeds may contain or accumulate pharmacologically active plant agents.

Table 2. List of medicinal plants used by the local people of Banskhali, Chattogram

Scientific Name	Family	Local Name	Plant Part Used	Disease Category	Application Method	Plant Habit
Abroma augustum (L) L. fil.	Malvaceae	Ulotkombol	Leaf, Root, Bark	Dia, SexD, MD	Juice, Decoction [O]	T
Achyranthes aspera L.	Amaranthaceae	Afang	Leaf, Flower	HD	Amulet [E]	S
Acmella oleracea (L.) R.K.Jansen	Asteraceae	Holud Nakful	Flower	Others	Ointment[T]	H
Adhatoda vasica Nees	Acanthaceae	Basok	Leaf	FC, GD	Juice [O], Paste [T]	T
Allium cepa L.	Amaryllidaceae	Peyaj	Bulb	FC	Paste [O]	H
Allium sativum L.	Amaryllidaceae	Rosun	Clove	SD	Paste [O]	H
Aloe barbadensis Mill.	Asphodelaceae	Ghritokumari	Leaf	SD, GD	Juice [O], [T]	H
Ananas comosus (L.) Merr.	Bromeliaceae	Anarosh	Fruit, Leaf	FC, HD	Juice [O]	H
Andrographis paniculata (Burm.f.)	Acanthaceae	Kalomegh	Whole plant	GD, FC	Juice [O]	S
Arjemone mexicana L.	Papaveraceae	Shial kanta	Seed, Root	FC, Others	Oil [O], [T]	S
Asparagus racemosus Wild.	Asparagaceae	Shatamuli	Leaf, Root	MD, FC, GD	Decoction [O]	S
Azadirchata indica A.Juss.	Meliaceae	Neem	Bark, Fruit, leaf	SD, FC, CW	Paste [T], Decoction [O]	T
Bombax ceiba L.	Malvaceae	Shimul	Root	SexD	Raw, Oil, Decoction [O]	T
Calotropis gigantea (L.) W.T.Aiton	Apocynaceae	Akanda	Bark, Leaf	GD, FC	Decoction [O]	S
Camellia sinensis (L.) Kuntze	Theaceae	Tea	Leaf	Others, GD	Decoction [O]	S
Centella asiatica (L) Urb.	Apiaceae	Thankuni	Leaf	SD, CW, Others	Decoction [O], Paste [T]	H
Cinnamomum tamala (Buch. -Ham) T.Nees & C.H.Ebrem	Lauraceae	Tejpata	Leaf	SD, Others	Paste [T], Decoction [O]	T
Cinnamomum vernum J.Pers*l*	Lauraceae	Darucini	Bark	FC, GD, Others	Decoction [O]	T
Cissus quadrangularis L.	Vitaceae	Haarzora	Whole plant	MD, Others	Paste [T], Juice [O]	T
Citrus limon (L.) Osbeck	Rutaceae	Lebu	Leaf, Fruit	FC, Others	Juice [O]	S
Clitoria ternatea L.	Fabaceae	Oporajita	Flower, Root	FC, GD	Decoction [O]	V
Cucumis maderaspatanus L.	Cucurbitaceae	Telakucha	Whole plant	Dia, FC, GD	Juice [O]	H
Curcuma longa L.	Zingiberaceae	Holud	Rhizome	GD	Juice [O]	H
Curcuma zedoaria (Christm.) Roscoe	Zingiberaceae	Shoti	Rhizome	GD	Juice [O]	H
Cuscuta reflexa Roxb.	Convovulaceae	Shornolota	Stem	GD, GC, CW	Paste [T], Juice [O]	V
Cymbopogon citratus (DC.) Stapf	Poaceae	Lemon Grass	Leaf	FC, Others	Decoction [O]	H
Cynodon dactylon (L.) Pers.	Poaceae	Durba	Leaf	CW	Paste [T]	H

Datura metel L.	Solanaceae	Dhutura	Leaf	MD	Paste [T]	H
Eclipta prostrata (L.) L.	Asteraceae	Kalokeshi	Leaf	SD	Paste [T]	H
Elwendia persica (Boiss.)	Apiaceae	Kalojira	Fruit	GD, FC, SD	Raw, Oil [O], Paste [T]	S
Eryngium foetidum L.	Apiaceae	Bilati dhone	Leaf	FC, GD	Juice, Decoction [O]	H
Erythrina variegata L.	Fabaceae	Mandar	Bark	SD, GD, MD	Paste [T], Decoction [O]	T
Glycosmis pentaphylla	Rutaceae	Motkhila	Leaf, fruit	FC, HD, Others	Decoction [O]	S
Helianthus annuus L.	Asteraceae	Surzomukhi	Whole plant	SD, SexD, MD	Decoction [O], Paste[T]	S
Hemidesmus indicus (L.) R.Br.	Apocynaceae	Anantamul	Bark	FC, GD, SD	Decoction [O], Paste [T]	H
Hibiscus rosa-sinensis L.	Malvaceae	Joba	Flower	SD, GD	Juice [O], Paste [T]	S
Kaempferia rodunda	Zingiberaceae	Bhuichapa	Rhizome	FC, SD, Others	Paste [T], Decoction [O]	H
Kalanchoe pinnata (Lam.) Pers.	Crassulaceae	Pathorkuchi	Leaf	GD,	Juice, Decoction [O]	H
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Badhi	Bark	GD, CW	Decoction [O], Paste [T]	T
Lawsonia inermis L.	Lythraceae	Mehedi	Leaf	SD	Paste [T]	S
Litsea glutinosa (Lour.)	Lauraceae	Menda	Fruit, Leaf	Dia, FC, GD	Decoction [O], Paste [T]	S
Mangifera indica L.	Anacardiaceae	Aam	Leaf	GD	Decoction [T]	T
Mentha spicata L.	Lamiaceae	Pudina	Leaf	FC, GD, Others	Decoction [O], Paste [T]	H
Mesosphaerum suaveolens (L.) Kuntze	Lamiaceae	Thokma	Fruit, Leaf	DG	Juice [O]	S
Mesua ferrea L.	Calophyllaceae	Nageshwar	Leaf, Flower, Seed	SD, GD	Juice[O], Oil [T]	T
Mikania cordata (Burm.f.)	Asteraceae	Asamlota	Leaf	CW, GD, SD	Paste [T], Juice [O]	V
Morinda citrifolia L.	Rubiaceae	Noni	Fruit	Dia, Ar, Others	Raw [O]	T
Moringa oleifera Lam.	Moringaceae	Sajina	Leaf, New Stem	Dia, GD	Decoction [O]	T
Ocimum tenuiflorum L.	Lamiaceae	Tulshi	Leaf	FC, Others	Decoction [O]	H
Origanum vulgare L.	Lamiaceae	Oregano	Leaf	SH, FD	Decoction [O], Paste [T]	H
Oxalis corniculata L.	Oxalidaceae	Amrul	Leaf	FC, SD, ND	Decoction [O], Paste [T]	H
Phyllanthus emblica L.	Phyllanthaceae	Amloki	Fruit	GD, Others	Raw [O]	T
Piper betle L.	Piperaceae	Paan	Leaf	FC, CW, Others	Decoction [O], Paste [T]	S
Plantago ovata Forssk.	Plantaginaceae	Ishupgul	Husk	GD	Juice [O]	H
Portulaca oleracea L.	Portulacaceae	Nunia	Leaf	ND, CW	Decoction [O], Paste [T]	S
Psidium sativum L.	Myrtaceae	Guaba	Leaf, fruit	GD, SK	Raw [O], Paste [T]	T
Punica granatum L.	Lythraceae	Dalim	Fruit, Meristem	SD, GD	Raw [O]	S

Rauvolfia tetraphylla L.	Apocynaceae	Shorpogondha	Fruit, Leaf	CW	Paste [T]	S
Senna alata (L.) Roxb.	Fabaceae	Dadmordon	Leaf	SD	Paste [T]	S
Smilax zeylanica L.	Smilacaceae	Kumari Lota	Whole plant	SexD, FC	Decoction [O], Paste [T]	V
Syzygium aromaticum (L.)	Myrtaceae	Long	Fruit	Others	Decoction [O], Paste [T]	S
Tagetes minuta L.	Asteraceae	Marigold	Leaf, Flower	CW	Paste [T]	S
Tamarindus indica L.	Fabaceae	Tetul	Fruit	GD, HD	Juice [O]	T
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Combretaceae	Arjun	Bark	GD, HD	Decoction [O]	T
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	Bohera	Bark, Seed	GD, SD	Decoction [O], Oil [T]	T
Terminalia chebula Retz.	Combretaceae	Horitoki	Fruit	GD, Others	Decoction [O]	T
Tinospora sinensis (Lour.) Merr.	Menispermaceae	Podmogoloncho	Stem	CW, Others	Decoction [O], Paste [T]	V
Trigonella foenum-graecum L.	Fabaceae	Methi	Seed	FC, GD	Decoction [O]	S
Vitex negundo L.	Lamiaceae	Nishinda	Leaf, Root	FC	Decoction [O]	S
Withania somnifera (L)	Solanaceae	Orshogondha	Leaf	SexD, GD	Decoction [O]	S
Zanthoxylum rhetsa (Roxb.) DC.	Rutaceae	Bajna	Fruit, Bark	Others	Decoction [O], Paste [T]	T

Legend:
Method: [O]=Orally, [T]=Tropically, [A]=Amulated,
Life form: [T]=Tree, [S]=Shrub, [H]=Herb, [V]=Vine
Disease: [GD]= Gastrointestinal Disorders, [FC]= Fever and Cold, [SexD]= Sexual Disorders, [CW]= Cuts and Wounds, [HD]= Hepatic Disorders, [SK]=Skin Disease, [ND]= Neurological Disorders, [Ar]= Arthritis, [Dia]=Diabetes, [MD]= Menstrual Disorders, [Others]= Miscellaneous Diseases

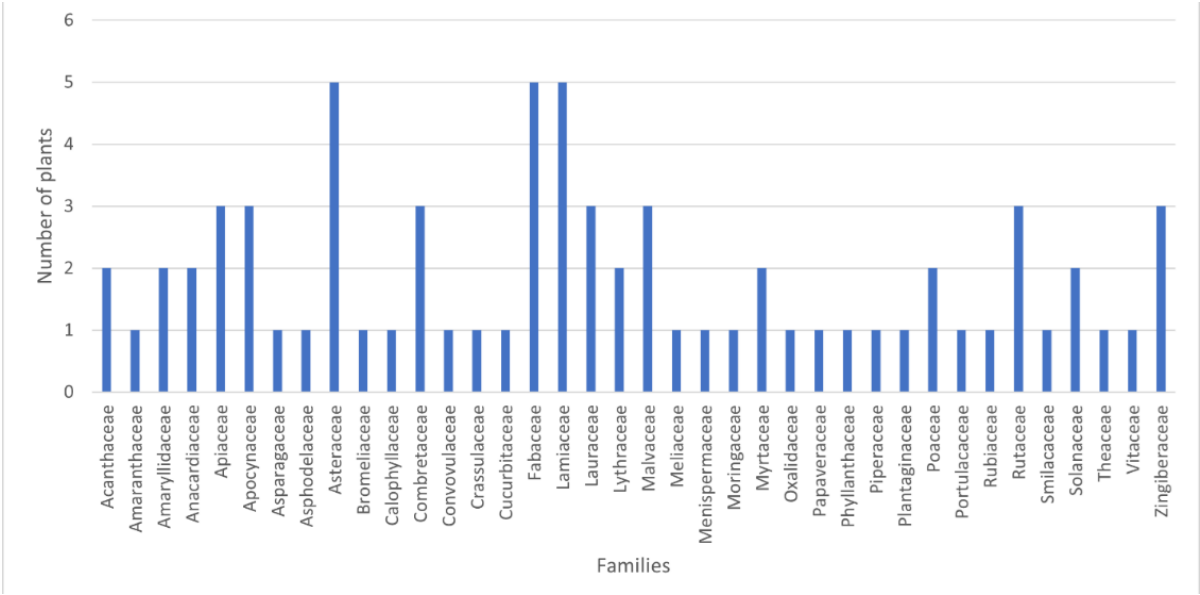


Figure 2. Number of plants of each family

Use Categories and Use reports of this area

Plant species are used by local people to treat various diseases. These diseases are grouped into 11 major disease classes. These include gastrointestinal disorders, skin diseases, menstrual disorders, arthritis, diabetes, sexual disorders, neurological disorders, liver disorders, cuts and wounds, fever and colds, and miscellaneous diseases (Table 3). The largest number of species was used in the treatment of gastrointestinal diseases (35 species), followed by respiratory disorders (Table. 3), followed by fever and colds and the skin disorders category with 26 and 19 plant species, respectively. Among the different classes of indigenous uses worldwide, different types of gastrointestinal disorders are prevalent, and a considerable number of plant species have been discovered to treat these diseases in different ethnic communities (Bennett & Prance 2000, Heinrich *et al.* 1998). Ethnopharmacological studies have shown that in some parts of the world, gastrointestinal disorders are the main category of use (Miraldi *et al.* 2001, Ghorbani 2005, Ghorbani *et al.* 2011).

Table 3. Disease Category

Type	No of plant used	Disease Category	Common Diseases
GD	35	Gastrointestinal Disorders	Constipation, Ulcer, Diarrhea, Stomach problem, Digestion problem,
SD	19	Skin Diseases	Dandruff, Ring worm, Smallpox, Allergy, Hair loss, Pimple, Eczema
MD	6	Menstrual Disorders	Menstruation problem, Milk secretion problem in nursing mother, Abortion, Vaginal secretion
Ar	1	Arthritis	Arthritis
Dia	5	Diabetes	Diabetes
SexD	5	Sexual Disorders	Erectile dysfunction, Gonorrhea, Loss of sexual desire
ND	2	Neurological Disorders	Depression, Sleeping problem, Mental disorder, Toxicity
HD	5	Hepatic Disorders	Jaundice,
CW	11	Cuts and Wounds	Bleeding, Burn
FC	26	Fever and Cold	Malaria, Dengue, Cough, Asthma, Pneumonia, Cold
Others	18	Miscellaneous Diseases	Toothache, Headache, Dehydration, Oedema, Anemia, Pain, High blood pressure, Heart disease, Eye disease, Breaking Bone, Abdominal pain, Cancer

Plants parts used for medicinal purpose and their forms

Among the different parts of the plants used in therapy, leaves are used frequently (38.41%) (Fig.3). In some literature (Bonet *et al.* 1999, Neves *et al.* 2009) it was also noted that the leaves are more accessible or available in nature and are relatively more abundant as compared to other plant parts which may explain why they are used. Mostly plants are shrubs (34%) (Fig.4), due to this the people collect the aerial parts of plants and use their decoction and paste commonly. The herbaceous habit is also one of the dominant life forms in our study (containing 31%), but it is a common and widespread ecological phenomenon around the world (Ibrar *et al.* 2007, Jan *et al.* 2011). It is also noticed, that if only one plant part is required e.g.

leaf, flower or fruit for the need the local people collects the whole plant instead of single part, this practice of plant parts collections has adversely affected the population size. The other plant parts used by the local people were fruits (16.17 %), flower (6.7%) and others. Whole plants are used for 4.4% of plants (Fig. 3, Fig. 4). People used most of this medicine orally, some tropically and amulet (Fig. 5). Due to the extensive use of whole plant, the pressure on the survival of such wild populations has increased. The least used parts are tubers and roots, probably due to their low level of approach that very few plants have tubers in the area and the roots of shrubs and trees are very difficult to get.

Plant habit types

Among the plants documented, shrubs make up the largest portion containing 24 plants (34%), followed by herbs with 22 plants (31%), trees with 20 plants (28%), and vines at only 7% having 5 plants (Fig 6). Herbs and shrubs are naturally available in the area because of having reserve forest in one part of this area.

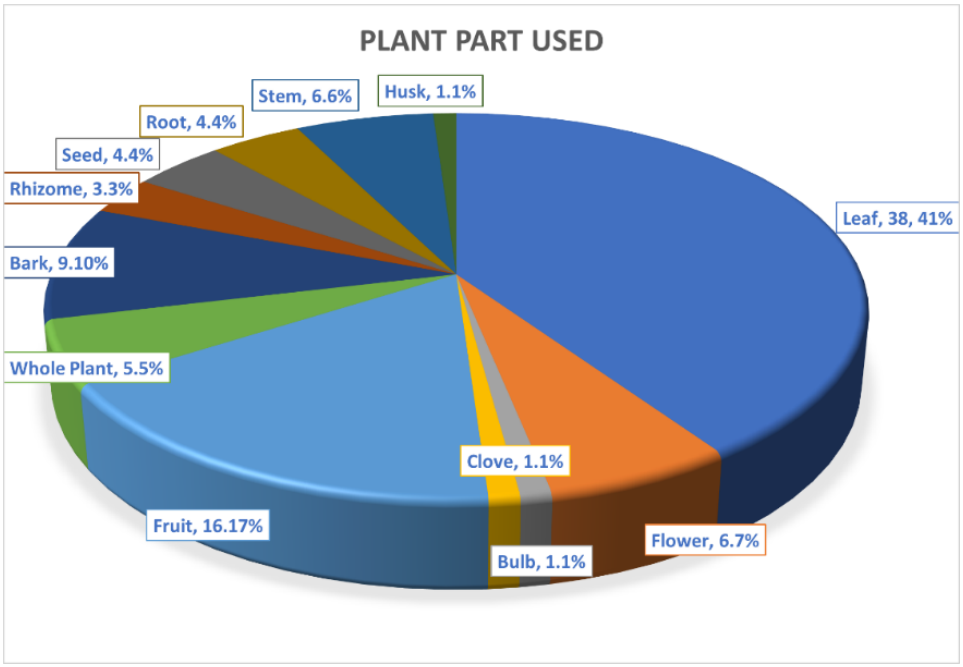


Figure 3. Percentage of plant part used

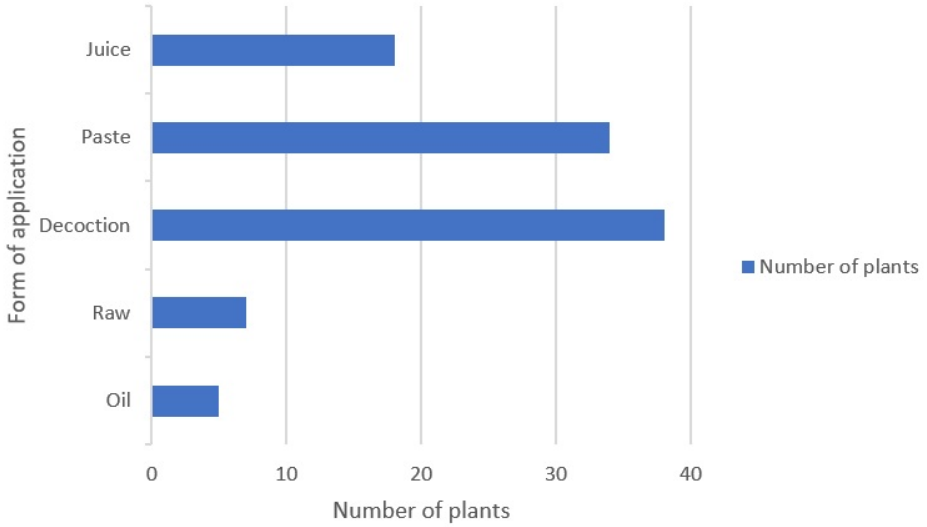


Figure 4. Number of plants used for different form of Application

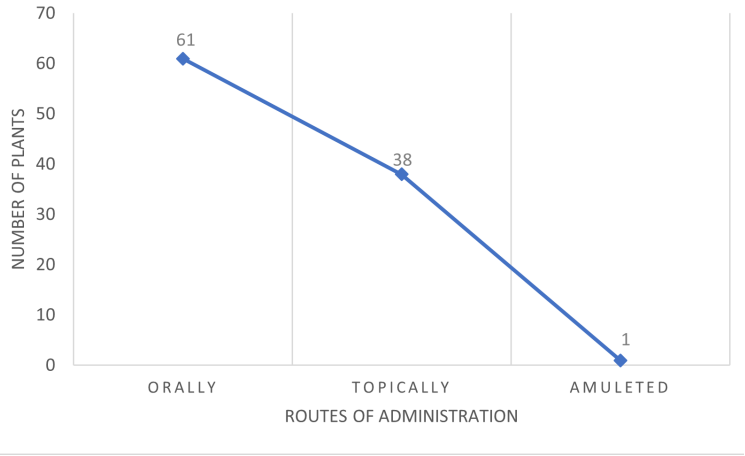


Figure 5. Routes of Administration of Medicinal Plants

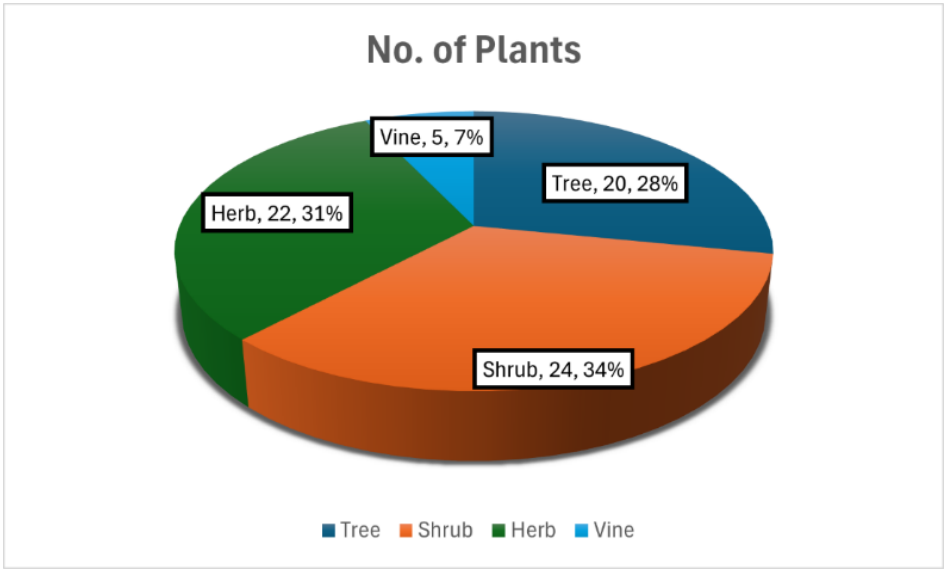


Figure 6. Proportion of different Plant habit types

Quantitative analysis

Use value (UV) and use report (UR)

The highest use values were reported for *Elwendia persica* (0.72), *Cynodon dactylon, Ocimum tenuiflorum* (each 0.68) (Appendix). Although it was impossible to match the quantitative data within the region particularly in Banskhali Upazila due to this is the first quantitative ethnobotanical report in the region. Highest use report was calculated for *Elwendia persica* and least use report were calculated for 10 species.

Frequency (FC) and relative frequency (RFC)

Highest RFC value was calculated for *Elwendia persica* (Boiss.) (0.64) and least RFC were calculated for *Bombax ceiba*, *Cuscuta reflexa, Datura metel* and some other plants (0.02 for each) (Appendix). It means that the species are the most Popular medicinal plants agreed by the majority of the informants and they are the most popular plants in Banskhali.

Threats to medicinal plants and indigenous knowledge in the area

Most people in the region are illiterate, especially in remote areas, and the only sources of income for local residents are agriculture, livestock, and the production of salt from seawater. Some of the local inhabitants collect medicinal plants and sell them to the local herb sellers at low prices, and these species are traded to pharmaceutical companies at highly favorable prices. Overgrazing, urbanization, and the eradication of medicinal plants pose serious threats in the region. These threats increase the risk of their extinction and require strict control of their protection by the authorities. The sustainable use of wild flora and the cultivation of medicinal plants in the region should be encouraged; this will significantly improve the socioeconomic situation of local residents.

Conclusion

This study documented the traditional uses of medicinal plants in Banskhali where traditional knowledge is gradually loss. For Documenting these practices, it should be included in the curriculum. Phytochemical and pharmacological studies are important to discover potential of herbal drug. Based on the present study, some recommendations are made for managing and preserving and sustainable use of the traditional ethnobotanical knowledge of local people: i) A fundamental task for protecting the knowledge and encouraging new generations to use medicinal plants in primary care; and ii) Local populations should also be trained in the sustainable use of medicinal plants.

Declarations

List of abbreviations: N/A

Ethics approval and consent to participate: No ethical approval was needed. Prior informed consent was taken orally from the participant.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: Not applicable

Funding: Not applicable

Author contributions: All authors contributed to the conceptualization and design of the study. JSA performed data collection and compilation. All authors were involved in data analysis, editing, and drafting of the manuscript. Ashrafuzzaman directly supervise the research and thoroughly revised the manuscript. Bussmann provided critical revisions and substantive improvements. All authors reviewed and approved the final version for submission

Acknowledgements

The authors acknowledge the farmers of Banskhali Upzila, Chattogram and the Teachers of Upzila High school involved in the study for their valuable inputs. The authors are also thankful to Prof. Dr. M. Ashrafuzzaman for his valuable guidance.

Literature Cited

Ahmad M, Sultana S, Fazl-i-Hadi S, Ben Hadda T, Rashid S, Zafar M, Khan MA, Khan MP, Yaseen G. 2014. An ethnobotanical study of medicinal plants in high mountainous region of Chail valley (District Swat-Pakistan). Journal of Ethnobiology and Ethnomedicine 10 :1-18. doi: 10.1186/1746-4269-10-36

Ankli A, Sticher O, Heinrich M. 1999. Medical ethnobotany of the Yucatec Maya : healers' consensus as a quantitative criterion. Economic Botany 53(2):144-160. doi: 10.1007/BF02866493

Ayyanar M, Ignacimuthu S. 2011. Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India. Journal of Ethnopharmacology 134(3) :851-864. doi: 10.1016/j.jep.2011.01.029

BBS 2015. Bangladesh population and housing census 2011. Community report Zila: Chittagong. Dhaka : Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. 841 p.

BBS 2022. Bangladesh Bureau of Statistics (BBS). Statistical yearbook Bangladesh 2022. 42nd edition. Report. https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b2db8758_8497_412c_a9ec_6bb299f8b3ab/2023-06-26-09-19-2edf60824b00a7114d8a51ef5d8ddbce.pdf (Accessed 05/05/2025)

BBS 2023. Population and housing census, 2022, Bangladesh Bureau of Statistics (BBS), Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh. (National Report; vol. 1).

Bennett BC, Prance GT. 2000. Introduced plants in the indigenous pharmacopoeia of Northern South America. Economic Botany 54(1):90-102. doi: 10.1007/BF02866603

Bhardwaj SM, Paul BK. 1986. Medical pluralism and infant mortality in a rural area of Bangladesh. Social Science & Medicine 23(10):1003-1010. DOI: 10.1016/0277-9536(86)90257-1

Bonet MÀ, Parada M, Selga A, Valles J. 1999. Studies on pharmaceutical ethnobotany in the regions of L'Alt Empordà and Les Guilleries (Catalonia, Iberian Peninsula). Journal of Ethnopharmacology 68(1-3):145-168. doi: 10.1016/S0378-8741(99)00083-5

Claquin P. 1981. Private health care providers in rural Bangladesh. Social Science & Medicine. Part B: Medical Anthropology 15(2):153-157. doi: 10.1016/0160-7987(81)90038-7

Faruque O, Uddin SB. 2011. Ethnodiversity of medicinal plants used by Tripura community of Hazarikhil in Chittagong district of Bangladesh. Journal of Taxonomy and Biodiversity Research 5:27-32.

Friedman J, Yaniv Z, Dafni A, Palevitch D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among bedouins in the Negev desert, Israel. Journal of Ethnopharmacology 16:275-287.

Ghorbani A, Langenberger G, Feng L, Sauerborn J. 2011. Ethnobotanical study of medicinal plants utilised by Hani ethnicity in Naban river watershed national nature reserve, Yunnan, China. Journal of Ethnopharmacology 134(3):651-667. doi: 10.1016/j.jep.2011.01.011

Ghorbani A. 2005. Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran:(Part 1): General results. Journal of Ethnopharmacology 102(1):58-68 doi: 10.1016/j.jep.2005.05.035

Gürdal B, Kültür Ş. 2013. An ethnobotanical study of medicinal plants in Marmaris (Muğla, Turkey). Journal of Ethnopharmacology 146(1):113-126. doi: 10.1016/j.jep.2012.12.012

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Social science & medicine 47(11):1859-1871. doi: 10.1016/s0277-9536(98)00181-6

Hooker JD. (Ed) 1872-1897. The flora of British India, 1-7. L.Reeve Co. London, UK.

https://powo.science.kew.org. Accessed on June,2025.

Ibrar M, Hussain F, Sultan A. 2007. Ethnobotanical studies on plant resources of Ranyal hills, District Shangla, Pakistan. Pakistan Journal of Botany 39(2):329-337.

Jamila F, Mostafa E. 2014. Ethnobotanical survey of medicinal plants used by people in Oriental Morocco to manage various ailments. Journal of Ethnopharmacology 154(1):76-87. doi: 10.1016/j.jep.2014.03.016

Jan G, Khan MA, Farhatullah JF, Ahmad M, Jan M, Zafar M. 2011. Ethnobotanical studies on some useful plants of Dir Kohistan valleys, KPK, Pakistan. Pakistan Journal of Botany 43(4):1849-1852.

Marles RJ, Farnsworth NR. 1995. Antidiabetic plants and their active constituents. Phytomedicine 2(2):137-189. doi: 10.1016/S0944-7113(11)80059-0

Martin GJ. 1995. Ethnobotany: A methods manual. Chapman & Hall, London, U.K.

Miraldi E, Ferri S, Mostaghimi V. 2001. Botanical drugs and preparations in the traditional medicine of West Azerbaijan (Iran). Journal of Ethnopharmacology, 75(2-3):77-87. doi: 10.1016/s0378-8741(00)00381-0

Neves JM, Matos C, Moutinho C, Queiroz G, Gomes LR. 2009. Ethnopharmacological notes about ancient uses of medicinal plants in Trás-os-Montes (northern of Portugal). Journal of Ethnopharmacology 124(2):270-283. doi: 10.1016/j.jep.2009.04.041

Pandey MM, Rastogi S, Rawat AKS. 2013. Indian Traditional Ayurvedic System of Medicine and Nutritional Supplementation. Evidence-Based Complementary and Alternative Medicin, 13(1):1-12. doi: 10.1155/2013/376327

Pasha MK, Uddin SB. 2013. Dictionary of plant names of Bangladesh (vascular plants), Janokalyan Prokashani, Chittagong, Dhaka, Bangladesh.

Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez-Durand B C. 1994. Quantitative ethnobotany and Amazonian conservation. Conservation Biology 8(1):225-248. doi: 10.1046/j.1523-1739.1994. 08010225.x

Rehecho S, Uriarte-Pueyo I, Calvo J, Vivas LA, Calvo MI. 2011. Ethnopharmacological survey of medicinal plants in Nor-Yauyos, a part of the Landscape Reserve Nor-Yauyos-Cochas, Peru. Journal of Ethnopharmacology 133(1):75-85. doi: 10.1016/j.jep.2010.09.006

Shrestha KK, Bhattarai S, Bhandari P. 2018. Handbook of Flowering Plants of Nepal (Vol. 1 Gymnosperms and Angiosperms: Cycadaceae - Betulaceae), Scientific publishers, Jodhpur, India.

Siddiqui KU, Islam MA, Ahmed ZU, Begum ZNT, Hassan MA, Khondker M, Rahman MM, Kabir SMH, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU. (Eds) 2007. Encyclopedia of Flora and Fauna of Bangladesh, Vol. 1-11. Asiatic Society of Bangladesh, Dhaka, Bangladesh.

Suleiman MHA. 2015. An ethnobotanical survey of medicinal plants used by communities of Northern Kordofan region, Sudan. Journal of Ethnopharmacology 176:232-242. doi: 10.1016/j.jep.2015.10.039

Tardío J, Pardo-de-Santayana M. 2008. Cultural importance indices: a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). Economic Botany 62(1):24-39. doi: 10.1007/s12231-007-9004-5

Telefo PB, Lienou LL, Yemele MD, Lemfack MC, Mouokeu C, Goka CS, Tagne SR, Moundipa FP. 2011. Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. Journal of Ethnopharmacology 136(1):178-187. doi: 10.1016/j.jep.2011.04.036

Uddin SN. 2006. Traditional Uses of Ethnomedicinal Plants of the Chittagong Hill Tracts. Bangladesh National Harbarium, Dhaka, Bangladesh.

Yusuf M, Begum J, Hoque MN, Chowdhury JU. 2009. Medicinal Plants of Bangladesh- Revised and enlarged. Bangladesh Council of Scientific and Industrial Research Laboratories Chittagong, Bangladesh.

Zheng XL, Xing FW. 2009. Ethnobotanical study on medicinal plants around Mt. Yinggeling, Hainan Island, china. Journal of Ethnopharmacology 124(2):197-210. doi: 10.1016/j.jep.2009.04.042

Appendix

Quantitative data of medicinal plants

Scientific Name	Voucher No.	Frequency of Citation	Use Value (UV)	Relative Frequency Citation (RFC)	Use Report (UR)
Abroma augustum (L) L. fil.	JSA-2024-66	1.76	0.04	0.04	10
Achyranthes aspera L.	JSA-2024-54	2.65	0.06	0.06	15
Acmella oleracea (L.) R.K.Jansen	JSA-2024-68	4.42	0.11	0.1	15
Adhatoda vasica Nees	JSA-2024-44	6.19	0.16	0.14	35
Allium cepa L.	JSA-2024-05	7.07	0.18	0.16	40
Allium sativum L.	JSA-2024-53	8.84	0.22	0.2	50
Aloe barbadensis Mill.	JSA-2024-09	15.04	0.3	0.34	85
Ananas comosus (L.) Merr.	JSA-2024-14	5.31	0.11	0.12	30
Andrographis paniculata (Burm.f.)	JSA-2024-67	11.51	0.29	0.26	35
Arjemone mexicana L.	JSA-2024-04	1.76	0.04	0.04	10
Asparagus racemosus Wild.	JSA-2024-43	5.31	0.13	0.12	30
Azadirchata indica A.Juss.	JSA-2024-51	22.12	0.56	0.5	125
Bombax ceiba L.	JSA-2024-39	0.88	0.02	0.02	5
Calotropis gigantea (L.) W.T.Aiton	JSA-2024-63	1.77	0.04	0.04	10
Camellia sinensis (L.) Kuntze	JSA-2024-52	17.69	0.45	0.4	100
Centella asiatica (L) Urb.	JSA-2024-34	20.35	0.52	0.46	115
Cinnamomum tamala (Buch. -Ham) T.Nees & C.H.Ebrem	JSA-2024-30	2.65	0.06	0.06	15
Cinnamomum vernum J.Pers*l*	JSA-2024-03	2.65	0.06	0.06	15
Cissus quadrangularis L.	JSA-2024-13	3.54	0.09	0.08	20
Citrus limon (L.) Osbeck	JSA-2024-18	19.46	0.09	0.44	20
Clitoria ternatea L.	JSA-2024-19	9.73	0.25	0.22	55
Cucumis maderaspatanus L.	JSA-2024-17	0.88	0.02	0.1	5
Curcuma longa L.	JSA-2024-36	7.96	0,2	0.18	45
Curcuma zedoaria (Christm.) Roscoe	JSA-2024-69	1.77	0.04	0.04	5
Cuscuta reflexa Roxb.	JSA-2024-57	0.88	0.02	0.02	5
Cymbopogon citratus (DC.) Stapf	JSA-2024-56	20.35	0.52	0.46	115
Cynodon dactylon (L.) Pers.	JSA-2024-27	26.55	0.68	0.6	150
Datura metel L.	JSA-2024-61	0.88	0.02	0.02	5
Eclipta prostrata (L.) L.	JSA-2024-23	9.73	0.25	0.22	55
Elwendia persica (Boiss.)	JSA-2024-28	28.32	0.72	0.64	160
Eryngium foetidum L.	JSA-2024-42	9.73	0.25	0.22	55
Erythrina variegata L.	JSA-2024-40	0.88	0.02	0.02	5
Glycosmis pentaphylla	JSA-2024-47	0.88	0.02	0.02	5
Helianthus annuus L.	JSA-2024-64	2.65	0.06	0.06	15
Hemidesmus indicus (L.) R.Br.	JSA-2024-71	1.76	0.04	0.04	10
Hibiscus rosa-sinensis L.	JSA-2024-70	5.31	0.11	0.12	10
Kaempferia rodunda	JSA-2024-59	2.65	0.06	0.06	15
Kalanchoe pinnata (Lam.) Pers.	JSA-2024-62	1.76	0.04	0.04	10
Lannea coromandelica (Houtt.) Merr.	JSA-2024-11	0.88	0.02	0.02	5

Lawsonia inermis L.	JSA-2024-41	15.04	0.29	0.34	65
Litsea glutinosa (Lour.)	JSA-2024-06	0.88	0.02	0.02	5
Mangifera indica L.	JSA-2024-58	7.96	0.15	0.14	35
Mentha spicata L.	JSA-2024-60	15.93	0.31	0.36	70
Mesosphaerum suaveolens (L.) Kuntze	JSA-2024-65	10.06	0.34	0.38	75
Mesua ferrea L.	JSA-2024-20	1.76	0.04	0.04	10
Mikania cordata (Burm.f.)	JSA-2024-16	1.76	0.04	0.04	10
Morinda citrifolia L.	JSA-2024-15	2.65	0.06	0.06	15
Moringa oleifera Lam.	JSA-2024-49	20.35	0.52	0.46	115
Ocimum tenuiflorum L.	JSA-2024-22	26.55	0.68	0.6	150
Origanum vulgare L.	JSA-2024-08	1.77	0.04	0.04	10
Oxalis corniculata L.	JSA-2024-35	3.54	0.09	0.08	20
Phyllanthus emblica L.	JSA-2024-48	14.16	0.29	0.32	65
Piper betle L.	JSA-2024-32	11.51	0.2	0.26	50
Plantago ovata Forssk.	JSA-2024-38	25.66	0.52	0.58	115
Portulaca oleracea L.	JSA-2024-24	1.76	0.04	0.04	10
Psidium sativum L.	JSA-2024-10	4.42	0.11	0.1	25
Punica granatum L.	JSA-2024-37	3.54	0.09	0.08	20
Rauvolfia tetraphylla L.	JSA-2024-25	0.88	0.02	0.02	5
Senna alata (L.) Roxb.	JSA-2024-02	6.19	0.07	0.14	30
Smilax zeylanica L.	JSA-2024-01	3.54	0.09	0.08	20
Syzygium aromaticum (L.)	JSA-2024-29	3.54	0.09	0.08	20
Tagetes minuta L.	JSA-2024-31	5.31	0.09	0.12	20
Tamarindus indica L.	JSA-2024-40	8.85	0.18	0.2	40
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	JSA-2024-50	12.39	0.24	0.28	55
Terminalia bellirica (Gaertn.) Roxb.	JSA-2024-26	20.35	0.4	0.46	90
Terminalia chebula Retz.	JSA-2024-46	23	0.47	0.5	105
Tinospora sinensis (Lour.) Merr.	JSA-2024-45	0.88	0.02	0.02	5
Trigonella foenum-graecum L.	JSA-2024-07	15.93	0.31	0.36	70
Vitex negundo L.	JSA-2024-12	3.54	0.09	0.3	20
Withania somnifera (L)	JSA-2024-21	2.65	0.06	0.06	15
Zanthoxylum rhetsa (Roxb.) DC.	JSA-2024-33	4.24	0.11	0.1	25