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Research Article

MEDICINAL PLANTS BIODIVERSITY AND ETHNO-MEDICINAL PLANTS USE BY THE TRIBAL COMMUNITY IN CHITTAGONG HILL TRACTS, BANGLADESH

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ABSTRACT

Since the time of immemorial, plants were used for multiple socio-cultural and economic uses. Medicinal use is one of the services that plants provide for human welfare. The practice of traditional medicine is common in Chittagong Hill Tracts although it is not utterly studies and documented. So, the aim of this study is to conduct an ethnobotanical survey of medicinal plants used for treatment of human health problems in the 3 districts of Chittagong Hill Tracts. For that reason, a cross sectional study and systematic sampling technique was employed to select possible sampling sites and medicinal practitioners. A total of 15 sampling sites from 3 districts were selected and a total of 17 informants were selected and interviewed. Ethnobotanical data was gathered using semi-structured interview, group discussion and field observation and analyzed using descriptive statistics, informants' consensus and fidelity level index. A total of 69 medicinal plant species were used to treat human health problems, are discovered. Of these, nearly 32 species (46.4%) are harvested from only *ex-situ* while 14 species (20.3%) are harvested from *in-situ* and the rest 23 species (33.3%) are gathered from both *in-situ* and *ex-situ*. On the other hand, about 32 species (46.4%) are found to be herbs, 21 species (30.4%) shrubs, 9 species (13%) trees and 7 climbers (10.2%) species. With regards to plant parts, leaves share the largest proportion with 56% followed by roots with 19%. The majority of plant remedies (56.4%) are found to be administered via oral followed by topical (40.2%). On the other hand, the average informants' consensus factor calculated (μ ICF = 0.75) shows the presence of high intra-cultural uniformity amongst practitioners in using plants for multiple purposes.

Keywords: Biodiversity, Medicinal Plants, Indigenous Knowledge, Ethnomedicine, Traditional Medicinal Practitioners, Use-Categories.

INTRODUCTION

Bangladesh possesses a rich flora of medicinal plants. Spread over an area of about 55,000 square miles and endowed by nature with a very favourable climate, Bangladesh possesses what is perhaps one of the richest floras-of all other areas of the similar size on the surface of the Globe. A great variety of plants grow in its forests, jungles, waste lands and in the roadsides. Out of the estimated 5000 species of higher plants growing in this country more than a thousand are regarded as having medicinal properties of one kind or the other. These plants grow here both wild and under cultivation. Many of the food, vegetable, beverage, spice and ornamental plants grown or are available in this country contain medicinally useful chemical substances and constitute important items of drugs or therapeutic agents of various medicinal preparations, particularly of Unani, Ayurvedic and Homeopathic

medicines. Out of these estimated 1000 wild and cultivated medicinal plants available in this country only about 450 to 550 have so far been enumerated with documentation of information on their chemical constituents, medicinal properties and uses.

Chittagong Hill Tracts, consisting of Khagrachhari, Rangamati and Bandarban Districts and occupying 13,184 sq km of south-eastern part of Bangladesh, is rich in floral diversity. The forest composition could be broadly classified into tropical semi-evergreen to wet-green, deciduous, bamboo brakes and grasslands¹. At least 12 ethnic communities live in this region of which Chakma is the largest tribe concentrating in the Chakma circle of Rangamati and part of Khagrachhari Districts. They are followed by the Marma who are almost evenly distributed in all three districts. Tripura are concentrated in Khagrachhari. The other smaller ethnic communities are concentrated in Bandarban District².

Plants have been serving as sources of drugs and pharmaceuticals for man and other animals since time immemorial. There are about half a million of plants now growing on earth. Many of these plants possess therapeutic and pharmaceutical properties. According to a recent survey by the United Nations Commission for Trade and Development (UNCTAD), more than 33 percent of modern drugs and medicinal products are derived from plants. The medicinal and pharmaceutical properties of these plants are due to the chemical substances they produce and store. The living plant, which may be regarded as a biosynthetic laboratory, produces or synthesis a large variety of such chemical substances during its normal metabolic activities. These include compounds that are utilized as food by man and other animals and also other compounds that exert physiological effects on them. This second group of the chemical substances, often referred to as secondary metabolites, gives plants their therapeutic and pharmaceutical properties.

Most of the tribal people still depend on local medicinal plants for the treatment of different diseases using the knowledge of herbal treatment they have inherited from their forefathers. But this ethno-medicinal knowledge and also the medicinal plants are depleting at an alarming rate due to availability of modern medical facilities and other socio-economic factors. On the other hand, this knowledge is valuable in searching new medicine for human welfare. In recent years interest in herbal medicines has increased considerably both at home and abroad as they are believed to be comparatively less toxic than the synthetics.

So far a limited work has been done to document ethno-medicinal plants in Chittagong Hill Tracts³⁻¹². Keeping this in mind, the present attempt has been undertaken to contribute to the documentation of this valuable knowledge and information from the area before these are totally lost.

RESEARCH MATERIALS AND METHODS

Study Area: Khagrachari, Rangamati and Bandarban are three districts of Chittagong Hill Tracts (CHT). Chittagong Hill Tracts the only extensive hill area in Bangladesh lies in southeastern part of the country (21°25'N to 23°45'N latitude and 91°54'E to 92°50'E longitude). The area of the Chittagong Hill Tracts is about 13,184 sq km, which is approximately one-tenth of the total area of Bangladesh. The hills are unsuitable for cultivation but natural vegetation remains widely. Jhum cultivation is being practiced on the hill slopes. Cotton, rice, tea and oilseeds are raised in the valleys between the hills. The hills, rivers and cliffs are covered with dense bamboo breaks, tall trees and creeper jungles. The valleys are covered with thick forest. The vegetation is characterized by semi-evergreen to tropical evergreen dominated by tall trees belonging to *Dipterocarpaceae*, *Euphorbiaceae*, *Lauraceae*, *Leguminosae* and *Rubiaceae*. Most of the hills are covered with forests containing valuable timber, trees, bamboos, canes and a kind of grass known as shan.

Study Sites and Informants Selection: A cross sectional survey along with systematic sampling was employed for

selection of study sites and informants. A preliminary survey was conducted on some villages of surveyed areas to sketch out the overall status of medicinal plant distribution and indigenous knowledge in the study area. Accordingly, the study sites within the district were systematically selected in accordance with their status of forest coverage and population settlement. In this regard, 15 sampling sites from 3 districts were surveyed. Similarly potential informants (medicinal practitioners) were selected systematically with the help of local elders and administrative leaders. As the result, a total of 17 informants (11 males and 6 females) between the age of 19 and 80 were systematically selected.

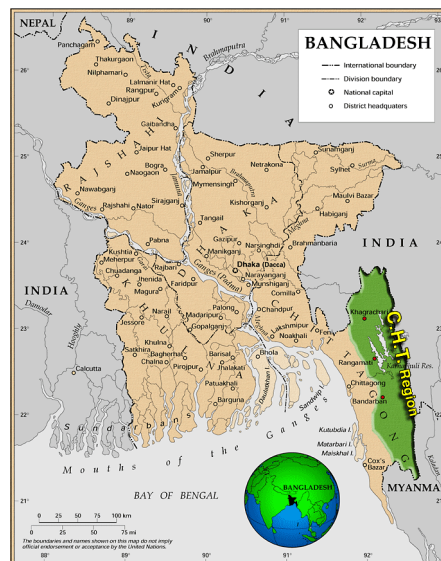


Figure 1: Chittagong Hill Tract in the Bangladesh Map

Interview and Discussion: Ethnobotanical data was collected using semistructured interviews and group discussion where two field visits were made to each sites based on procedures recommended by Martin and Alexiades^{13,14}. The survey was made in between February 2013 and April 2013. Data collection was made on the basis of checklist (questionnaire) items prepared. The items include information on informant's personal background, local names of medicinal plants used, diseases treated, dosage, routes of administration, sources and management of medicinal plants. Moreover, direct filed observation was also made when necessary.

Medicinal Plants Collection and Identification: Medicinal plants used by the local community on the study area were collected in adjacent to field walk interview and direct field observation with informants. Representative specimens possessing both reproductive and vegetative parts were collected to make the identification process easier. Medicinal plants collection was made by using basic botanical collecting tools. Sample specimens were labeled by the name of collectors, local and botanical name of the species; locality, habit and habitat of the species; collecting date, collecting number and indigenous use of the species. Identification of specimens was carried out on the field while collecting and processing plant specimens. However, unidentified medicinal plants were brought to Department of Botany, University of Chittagong for identification.

Statistical Analysis of Data: A descriptive statistic procedure like percentage and frequency distribution were employed for analyzing plant habit, plant parts used and routes of administration.

Informant Consensus: The level of homogeneity between information provided by different informants was calculated using informant's consensus factor (the number of informants citing a given medicinal plant species) as given by Leonti et.al.¹⁵. Seven use-categories were used for that purpose. An ICF value close to 1 is taken as an indication of high intra-cultural consensus, that is, more healers use the same plant species, whereas a value close to zero as a low probability of similarity in use of plants by different informants.

Fidelity Level Index: The fidelity level (FL) is the percentage of informants claiming the uses of a certain plant species for the same major purposes or ailment to treat as described by Alexiades¹⁴. So, FL was calculated as FL index = (Np/N), where Np is the number of informants that claim the use of a plant species to treat a particular disease and N is the number of informants that use the plants as a medicine to treat any disease. So, in this study, 16 medicinal plant species were systematically selected, and their FL index is analyzed for

their preference by the informant to treat stomachache, boil, constipation, diarrhea, fever, arthritis and jaundice.

RESULTS AND DISCUSSIONS

Ethnomedicinal Plant Species in the Study Area: Plants are the major sources of livelihood for the community of study area. Plants are in fact used as source of medicine, food, construction, forage and other financial incomes. This study came to document 69 species of plants used to treat human's health problems in 3 districts of Chittagong Hill Tract. The utilization of such a large number of medicinal plants by the people of the study area shows the everlasting dependency of local people on traditional medicinal plant for treatment of human health problems. In this study, the majority of medicinal plants are found to be harvested from farmland and home-gardens (Table 1). In this regard, 32 species (46.4%) are solely cultivated ones and 14 species (20.3%) are collected from wild habitats. This indicates the presence of proper management of medicinal plants in the study area that has to be encouraged and promoted by stakeholders.

Table 1: Frequency Distribution of Sources of Medicinal Plants in the Study Area

Source	No. of Medicinal plants	Percentage (%)
Wild (<i>In-situ</i>)	14	20.3
Cultivated (<i>Ex-situ</i>)	32	46.4
Both	23	33.3
Total	69	100

On the other hand, analysis of habits (Table 2) of plants documented shows that herbs share the largest proportion with 32 species (46.4%), followed by shrubs with 21 species (30.4%), trees with 9 species (13%) and climbers with 7 species (10.2%).

Table 2: Percentage Distribution of Growth Forms of Medicinal Plants Recorded

Growth Form	No. of Medicinal plants	Percentage (%)
Herbs	32	46.4
Shrubs	21	30.4
Trees	09	13.0
Climbers	07	10.2
Total	69	100

Distribution of Medicinal Plants into Taxonomic Groups:

Analysis of taxonomic group of plants revealed that a total of 69 species belonging to 65 genera and 40 families are documented. On the other hand, the study showed that the species belonged to diversifies genera. In this regard, the genus *Kaempferia*, *Leea*, *Morinda* and *Plumbago* are found to have 2 species each. The remaining genera with one species each. With respect to families, *Asteraceae* & *Euphorbiaceae* shared the largest proportion, i.e. consisted of 6 species, followed by *Lamiaceae* & *Zingiberaceae* with 5 species each, *Fabaceae* having 4 species, *Acanthaceae* & *Rubiaceae* are found to have 3 species each and *Amaranthaceae*, *Leeaceae*, *Marantaceae* & *Plumbaginaceae* 2 species each and the remaining families with 1 species each.

Plant Parts Used for Remedies: Analysis for plants parts revealed that different parts of plants were used for preparation of remedies on the basis of types of disease to treat. Most importantly, leaves are found to frequently used plant part accounting for 56%, followed by roots making about 19% (Table 3). Ermias¹⁶ reported that roots take the highest proportion in the preparation of remedies previously. In fact, the frequent use of roots for medicinal preparations aggravates the loss of medicinal plants from their natural habitat. However, the use of leaves for preparation of most plant remedies possibly will reduce the possibility of the loss of medicinal plants from the source. The loss of plants usually occurs when roots, stem and bark are highly used for preparation that the mother plant is also harvested together.

Table 3: Frequency Distribution of Plant Parts Used to Prepare Remedies

Plant part	Frequency of occurrence	Percentage
Leaves	47	56.0
Roots	16	19.0
Rhizomes	7	8.3
Whole Plants	2	2.4
Barks	5	6.0
Bulbs	1	1.2
Seeds	1	1.2
Fruits	4	4.7
Dry flowers	1	1.2
Total	84	100

On the other hand, analysis of method of preparation indicated that plant parts are often rendered into different forms of remedies in accordance with the type ailment to be treated and the medical history of the subject patient. In this regard, from a total of 77 preparations (Table 4), oral mixture takes the highest share which account for about 56.4%, followed by topical having a share of 40.2%. Despite the existence of

variations of knowledge on preparation of remedies amongst different cultures, local peoples often tend to make remedies that are to some extent look alike. This is due to the fact that indigenous knowledge (IK) related to use of plant for healthcare maintenance is the reflection of the types and density of flora and fauna found in a given locality and the cultural background of the society in that area.

Table 4: Major Forms of Preparation of Plant Remedies in the Study Area

Forms of preparation	Frequency of occurrence	Percentage
Oral	42	56.4
Topical	31	40.2
Fumigation / Smoke	1	1.3
Drop in the nostril	2	2.6
Oral Drop	1	1.3
Total	77	100

Additive substances like local honey, water, black piper, ginger & garlic juice, oils and water are often supplemented while preparing some plant remedies. Uses of such additives are often improving the flavor and reduce the adverse effects of remedies including possibility of vomiting and abdominal discomfort due to some heavier remedies.

Informants' Consensus: As it was stated above, a total of 69 plants with medicinal importance are documented, these plants also found to have multiple use-categories, apart from their medicinal valued in the community. Therefore, based on the

information gathered, seven (7) use categories (Table 5) were set in which a total of 402 use-reports were recorded from 69 species of medicinal plants. Analysis of ICF showed that there exists a high consistency (uniformity) of plant consumption among local people in the study sites. As it can be depicted from table below, all ICF values (and also the mean ICF which is 0.75) are close to 1 showing the presence of homogeneity in use of plants for multiple purposes. Accordingly, construction use category takes the uppermost ICF value (0.96) followed by furniture with ICF value of 0.92.

Table 5: Informants' Consensus Factor (ICF) Computed for Seven Use-Categories

Use category	No. of Species (n _i)	Percentage	Use- reports (n _{ur})	Percentage	ICF (n _{ur} -n _t / n _{ur} -1)
Medicinal	69	100	167	41.5	0.59
Food	15	21.7	34	8.5	0.58
Forage	7	7.9	25	6.2	0.75
Fence	12	17.4	38	9.5	0.70
Fire	24	34.8	98	24.4	0.76
Construction	2	2.9	27	6.7	0.96
Furniture	2	1.5	13	3.2	0.92
Mean ICF					0.75

Fidelity Level Index: Analysis of percentage of informants claiming the uses of a certain plant species for the same major purposes could not be taken as the only criteria to attest the efficacious of plant species. For that reason, sometimes, fidelity level index shall be computed to see the medicinal use values and relative preference of species by the local community in a given area. In this study, 16 medicinal plants

were systematically selected and analyzed for their fidelity level index that they give value in treating 7 diseases (Table 6). For instance, it seems that *Scoparia dulcis* L. (FL = 1.00) is more preferable than *Acorus calamus* L. (FL = 0.74) in treating stomachache. But total number of user of *Acorus calamus* L. is much higher than *Scoparia dulcis* L.

Table 6: Fidelity Level Index for Plant Species Used to Treat Different Common Diseases in the Study Area

Ailments	Species	Np	N	Fidelity index (Np/N)
Stomachache	<i>Acorus calamus</i> L.	23	31	0.74
	<i>Scoparia dulcis</i> L.	6	6	1.00
Boil	<i>Adiantum lunulatum</i> Burm.	37	46	0.80
	<i>Gelonium multiflorum</i>	11	14	0.79
	<i>Leea macrophylla</i> Roxb.	12	29	0.41
	<i>Litsea glutinosa</i> (Lour.) Rob.	12	13	0.92
Constipation	<i>Aloe indica</i> L.	66	62	0.94
Diarrhea	<i>Alpinia conchigera</i>	19	34	0.56
	<i>Kaempferia parviflora</i> Wall.	38	41	0.93
Fever	<i>Anisomeles indica</i> (L.) Kuntze.	22	35	0.63
	<i>Micromelum minutum</i> (Forst. f.)	17	31	0.55
	<i>Nelsonia campestris</i> R.Br.	23	27	0.85
Arthritis	<i>Croton caudatus</i> Geisel.	17	21	0.81
	<i>Measa montana</i> A. DC.	22	28	0.71
Jaundice	<i>Oroxylum indicum</i> Vent.	41	48	0.85
	<i>Plumbago zeylanica</i> L.	33	45	0.73

CONCLUSION AND RECOMMENDATION

The result of ethnobotanical survey of medicinal plants in 3 districts of Chittagong Hill Tract of Bangladesh revealed the existence of medicinal plants and use knowledge in the district. The local people predominantly use medicinal plants and some animals derived remedies for maintaining their primary healthcare. The majority of the local people used to acquire medicinal knowledge from their parents and partners in their locality. In this regard, a total of 69 medicinal plants used for treating human disease are documented though all villages of the districts were not surveyed. The discovery of utilization of such large diversity of plant species for medicinal purpose attributes to the continued dependency of local people on traditional medicine for their central healthcare system.

The majority of species are found to have herbal growth forms followed by shrubs and trees. Leaves followed by roots are the dominant plant parts used for preparation of most remedies. The larger proportions of remedies are administered for internal ailments through oral route, while some external infections are treated commonly using dermal (topical) route. The study discovered that deforestation, agricultural encroachment, drought and overgrazing are the major threat to medicinal plants and its associated knowledge in the districts. In addition, the death of some knowledgeable people before passing their great knowledge to the new generation is the other existed threat.

So, the study recommends that the government should organize traditional medicinal practitioners into associations, which has social and economic importance that their knowledge can be integrally used with modern medicine. Furthermore, *in-situ* and *ex-situ* conservation of medicinal plants should be practiced in the districts by training model medicinal practitioners to ensure the continuity of threatened medicinal plants. Moreover, further pharmaceutical investigation should be conducted on medicinal plant species so as to develop new drugs of organic kind.

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