Bangladesh J. Plant Taxon. **21**(1): 83-91, 2014 (June)

DETERMINATION OF INFORMANT CONSENSUS FACTOR OF ETHNOMEDICINAL PLANTS USED IN KALENGA FOREST, BANGLADESH

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Keywords: Determination; Medicinal uses; Consensus factor; Kalenga forest.

Abstract

The present article tried to document the ethnomedicinal uses of plants and determine the consensus factor among villagers of Kalenga forest area to evaluate the potential for new drugs of herbal origin. This study was conducted in 2010 using semi-structured questionnaire with villagers engaged in the forest management. The present study documented 35 plant species under 25 families for treatment of 11 categories of ailments using 52 medicinal formularies in Kalenga forest area. There was great agreement among the informants regarding ethnomedicinal uses of plants with Factor of Informants Consensus (FIC) value ranging from 0.50 to 0.95, with an average value of 0.73. The study revealed that most of the informants agreed in the use of *Litsea glutinosa* (Lour.) Roxb. to treat dysentery (FIC 0.95) that showed the highest fidelity level (95.23%). The results of the study also indicated that *L. glutinosa* might be used for the development of new, cheap, effective, and eco-friendly herbal formulations for healthcare management. Villager's views and our observations confirmed that *L. glutinosa* is a rare plant in the study area. Illegal and unsustainable collection of bark from this tree by the local crude drug traders considered as major causes of its depletion from nature.

Introduction

Studies on the ethnomedicinal uses of plants by the local people are often significant because it provides a gateway for the exploration of new drugs source from the herbal origin (Teklehaymanot and Giday, 2007). Right from its beginning, the documentation of traditional knowledge, especially on the medicinal uses of plants, has provided many important drugs of modern day (Balick and Cox, 1997; Flaster, 1996). According to WHO (2001), 80% of the world population uses natural remedies and traditional medicines for their primary healthcare. Documentation of medicinal usages of plants in Bangladesh has already been started. Some noticeable studies include Hassan and Khan (1986,1996), Mia and Huq (1988), Khan *et al.* (2002), Uddin and Hassan (2004), Uddin *et al.* (2004, 2006, 2012), Uddin (2006) and Uddin *et al*. (2008). All such works have listed the medicinal plants of particular area or community with their medicinal uses and none of these studies considered any quantitative consensus technique or ethno-directed technique for the analysis of medicinal uses of plants. In ethno-directed technique, plants are collected, which are used as medicine by the local people living in a specific area, for phytochemical and pharmacological analysis. Cox and Balick (1994) and Cordell (2000) state that this method plays a fundamental role in biodiversity prospecting. Proper selection of important plant species is a prerequisite to begin ethno-pharmacological, phytochemical and toxicological studies because of huge laboratory cost (Canalesa *et al*., 2005). For this purpose, it is necessary to determine the species that are most used to treat a particular illness. A useful tool to find a particular species is the Informant Consensus Factor (Frei *et al*., 1998; Heinrich *et al*., 1998). So

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the present study was designed to document the medicinal uses of plants and to determine consensus of such uses among the villagers of Kalenga forest area, in order to evaluate their potential for new drugs of herbal origin.

Materials and Methods

Kalenga forest area is located in the eastern part of Chunarughat Upazila of Habiganj district adjacent to the border of Tripura State of India and nearly 130 km northeast of Dhaka and approximately 80 km southwest of Sylhet city. The study area has been described in detail by Uddin *et al.* (2002).

The study area was visited four times in different seasons of the year of 2010. Voucher specimens for each species have been collected and processed using standard herbarium techniques (Hyland, 1972; Alexiades, 1996). The specimens were identified consulting different Floras, *viz.*, Hooker (1872-1897), Prain (1903), Uddin and Hassan (2004), Siddiqui *et al.* (2007) and Ahmed *et al.* (2008a, 2009a,b). Plant specimens available at Dhaka University Salar Khan Herbarium (DUSH) and Bangladesh National Herbarium (DACB) have also been consulted for confirmation of identified species. The updated nomenclature of the identified species followed Siddiqui *et al.* (2007) and Ahmed *et al.* (2008a,b, 2009a,b,c,d). Voucher specimens are deposited at DUSH.

Ethnomedicinal data has been collected through Participatory Rural Appraisal (PRA), which is based on interaction with indigenous people and direct observation in the field (Chambers, 1994; Martin, 1995). The data have been recorded through semi-structured interviews with villagers engaged in the forest management (Alexiades, 1996). A total of 42 people have been interviewed who are involved in forest management system. Once, these villagers lived inside the forest. After the declaration of Kalenga as a reserved forest they were evacuated from the forest and later forest department resettled them near their office with an agreement between forest department and villagers. They have to stay near forest office and protect forest in exchange of using marginal forest land for agriculture. During the field survey, information on uses of plants to treat different illnesses of human being, parts used, modes of preparation and administration of medicine have been collected. Based on the information obtained from the informants in the study area, all the reported ailments have been grouped into 11 categories.

The level of homogeneity among information provided by different informants was calculated by the Informants' Consensus Factor, FIC (Trotter and Logan, 1986) using the following formula:

$$FIC = Nur - Nt / (Nur - 1)$$

Where, Nur = number of use reports from informants for a particular plant-use category; Nt = number of taxa or species that are used for that plant use category for all informants.

FIC Values range between 0 and 1, where '1' indicates the highest level of informant consent.

The fidelity level (FL), the percentage of informants claiming the use of a certain plant species for the same major purpose, was calculated for the most frequently reported diseases or ailments as:

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

Where, Np = number of informants that claim a use of a plant species to treat a particular disease; N = number of informants that use the plants as a medicine to treat any given disease (Alexiades, 1996).

Results and Discussion

In the present study 35 plant species under 25 families in Kalenga forest area have been documented for treatment of 11 categories of ailments through 52 medicinal formularies. Out of 52 formularies, 45 were of oral application and rest 7 of external applications. Among the

recorded taxa, herbs are represented by 16 species followed by trees (13) and shrubs (6). For each species botanical name, family, voucher number, local name, ailments to be treated, mode of administration, and part(s) used were recorded (Table1). Use of plant parts as medicine among the informants shows variations. Leaves are mostly used part for majority of the medicinal plants, followed by fruits, bark, stem, petiole, whole plant and root (Table 1). Similar trend of harvesting leaves for medicinal use has also been reported from Lawachara National Park (Uddin *et al.*, 2012). In the present study area threat to the species is minimal as leaves are the leading plant part used for medicinal purposes. It was observed that the collection of bark as medicinal part from the wild were not sustainable. According to local people, this type of activity is carried out by the collectors related to illegal trade of medicinal plants. *Litsea glutinosa* is vulnerable to this kind of activity in the study area.

Table 1. Documentation of medicinal plants with scientific name, vernacular name, parts used, ailments and mode of administration

Botanical name/family/ voucher number	Vernacular name	Parts used	Ailments	Mode of administration
Averrhoa carambola L. Averrhoaceae, Z- 154	Kamranga	Fruits	Jaundice	Ripe fruits taken internally
Azadirachta indica A. Juss. Meliaceae, Z- 1097	Neem	Leaves	Allargy	Small tablets are made from leaf paste and taken internally
Bulbophyllum lilacinum Ridl. Orchidaceae, Z- 638	Ishwarmul	Petiole	Diabetes	Petiole juice taken internally
			Gastrict pain	Petiole juice taken internally
Cajanus cajan (L.) Millsp. Fabaceae, Z- 1133	Orhor	Leaves	Jaundice	Leaf juice taken internally
Centella asiatica (L.) Urban Apiaceae, Z- 1112	Tunimankuni	Whole plant	Dysentry	Whole plant is taken as juice or paste internally
Ceriscoides campanulata (Roxb.) Tirven, Rubiaceaen Z-1045	Behlom	Fruits	Jaundice	Fruits used in curry and taken internally
Chromolaena odorata (L.) King and Rob., Asteraceae Z-140	Pissais	Leaves	Cut and wound	Leaf paste applied externally
Clerodendrum viscosum Vent., Verbenaceae, Z- 220	Bhat	Leaves	Fever and Malaria	Leaf juice taken internally
			Anti-helminthes	Leaf juice taken internally
Cuscuta reflexa Roxb. Cuscutaceae, Z- 464	Sharnalata	Stem	Diarrhoea	Stem juice taken internally
Dalbergia sissoo Roxb. Fabaceae, Z- 190	Shishu	Leaves	Dysentery	Leaf juice taken internally
Datura metel L. Solanaceae, Z- 183	Dutra	Leaves	Allergy	Leaf juice applied externally
Dillenia indica L. Dilleniaceae, Z- 991	Chailta	Fruits	Jaundice	Ripe fruits taken internally

Table 1 Contd.)

Dillenia pentagyna Roxb. Dilleniaceae, Z- 755	Harganja	Bark	Cut and wound	Inner bark applied externally
Eclipta alba (L.) Hassk. Asteraceae, Z- 1135	Kaissa	Whole plant	Gastrict pain	Whole plant juice taken internally
Glycosmis pentaphylla (Retz.) A. DC., Rutaceae, Z- 323	Hotigira	Leaves	Cut and wound	Leaf paste applied externally
			Jaundice	Leaf juice taken internally
Justicia adhatoda L. Acanthaceae, Z- 152	Bashak	Leaves	Cold and cough	Leaf juice taken internally
			Fever and Malaria	Leaf juice taken internally
			Impotence	Leaf juice taken internally
			Jaundice	Leaf juice taken internally
Justicia gendarussa Burm. f. Acanthaceae, Z- 1067	Kalobashak	Leaves	Fever and Malaria	Leaf juice taken internally
Leucas aspera (Willd.) Link. Lamiaceae, Z- 1101	Dolonshak	Leaves	Allergy	Fried leaf taken internally
			Cold and cough	Fried leaf taken internally
Litsea glutinosa (Lour.) Roxb. Lauraceae, Z- 31	Menda	Bark, Leaves	Dysentery	Juice of both leaf and bark taken internally
			Jaundice	Juice of both leaf and bark taken internally
Melocana baccifera (Roxb.) Kurz, Poaceae, Z-911	Mulibans surface	Stem surface	Cut and wound	Bark powder of stem applied externally
Mikania cordata (Burm. f.) Rob., Asteraceae, Z- 78	Assamilata	Leaves	Cut and wound	Leaf paste applied externally
			Diarrhoea	Leaf juice taken internally
			Gastrict pain	Leaf juice taken internally
Mimosa pudica L. Mimosaceae, Z- 80	Laizzabati	Roots	Diarrhoea	Root juice taken internally
Ocimum sanctum L. Lamiaceae, Z- 288	Tulsi	Leaves	Cold and cough	Leaf juice taken internally
Oroxylum indicum (L.) Kurz Bignoniaceae, Z- 431	Thona	Bark, Leaves, Flowers	Jaundice	Taken bark juice and fried leaves and flowers internally
Paedaria foetida L. Rubiaceae, Z- 1116	Gandhaveduli	Leaves	Diarrhoea	Leaf juice taken internally
Persicaria hydropiper (L.) Spach. Polygonaceae, Z- 772	Bishkatali	Leaves	Jaundice	Leaf juice taken internally
Phyllanthus emblica L. Euphorbiaceae, Z-369	Amloki	Fruits	Fever and Malaria	Ripe fruits taken internally
Scoparia dulcis L. Scrophulariaceae, Z-347	Bondhania	Leaves	Diarrhoea	Leaf juice taken internally

Table 1 Contd.)

Smilax macrophylla Roxb. Smilacaceae, Z-1029	Kumarilata	Shoot apex	Impotence	Shoot apex taken internally
Stephania japonica (Thunb.) Miers, Menispermaceae Z-315	Muchchanilata	Leaves	Diarrhoea	Leaf juice taken internally
			Cut and wound	Leaf paste applied externally
			Jaundice	Leaf paste taken internally
Sterculia villosa Roxb. *ex* Smith, Sterculiaceae, Z-135	Udal	Petiole	Diarrhoea	Petiole juice taken internally
			Gastrict pain	Petiole juice taken internally
			Impotence	Petiole juice taken internally
Terminalia arjuna (Roxb. *ex* DC.) Wight & Arn. Combretaceae, Z-47	Arjun	Bark	Diabetes	Bark juice taken internally
			Gastrict pain	Bark juice taken internally
			Impotence	Bark juice taken internally
T. bellirica (Gaertn.) Roxb. Combretaceae, Z-169	Bohera	Fruits	Fever and malaria	Ripe fruits taken internally
T. chebula Retz. Combretaceae, Z- 403	Horitaki	Fruits	Fever and malaria	Ripe fruits taken internally
			Jaundice	Ripe fruits taken internally
Tinospora cordifolia (Willd.) Hook. f. & Thoms. Menispermaceae, Z-1071	Padmaguruz	Stem	Anthelmintic	Stem juice taken internally

FIC values were determined to know the agreement among the informants of Kalenga forest area for use of plants to treat certain ailment categories. The FIC values are presented in the Table 2. It is clear that the FIC values varied from 0.50 up to 0.95 with an average value of 0.73. Dysentery has the highest FIC value 0.95 with 40 use-reports for 3 plant species. The species responsible for this high consensus was *Litsea glutinosa* with 40 of the 42 reported events, followed by impotence (FIC = 0.89; 30 use-reports, 4 species), Cold and Cough (FIC = 0.86; 16 use-reports, 3 species), Malarial fever (FIC= 0.85, 35 use reports, 6 species). Medicinal plants supposed to be efficient in treating particular ailment have high FIC values. The high FIC value for dysentery possibly showed that this ailment is common in the study area due to poor sanitation in the region and there is a better communication established among informants for treating this ailment category. High FIC values also indicate that the species traditionally used to treat these ailments are worth searching for bioactive compounds. The least agreement (FIC=0.50) between the informants was observed for plants used to cure jaundice and as anthelmintic. The low FIC value as recorded in our study could be due to a lack of communication among people in different areas.

To determine culturally important medicinal species in the society, Fidelity Level (FL) of plants has been calculated based on use reports which have been cited by ten or more informants for being used against a given ailment. The FL values are presented in Table 3. The analysis showed that the highest FL value found in *Litsea glutinosa* followed by *Andrographis paniculata,*

Oroxylum indicum, *Mikania cordata*, *Glycosmis pentaphylla*, *Cajanus cajan* and *Chromolaena odorata*. The least FL values were found in the cases of *Justicia adhatoda* and *Paedaria foetida*. FIC and FL analyses showed that the most commonly used species in the study area is *Litsea glutinosa* (FIC = 0.95) with 40 use-reports and FL value (95.23%). When selecting the most preferred plant species for each ailment category, we took the high Fidelity Level (%) in each category of ailment.

Table 2. Categories of ailments and informant consensus factor (FIC) for each category

Use categories	Number of taxa (Nt)	Number of use report (Nur)	Consensus factor
Dysentery	3	40	0.95
Impotence	4	30	0.89
Cold and cough	3	16	0.86
Malarial fever	6	35	0.85
Diabetes	2	8	0.85
Gastric pain	2	8	0.85
Cut and wound	7	29	0.78
Diarrhoea	8	25	0.70
Allergy	3	7	0.66
Jaundice	15	29	0.50
Anthelmintic	2	3	0.50

Table 3. Most frequently used plants for different ailment categories based on highest FL (%) in each ailment category (Total informants = 42).

Botanical name	Ailment categories	Citation for particular disease (use-report)	Fidelity level (%)
Litsea glutinosa	Dysentery	40	95.23
Andrographis paniculata	Malarial fever	33	78.00
Oroxylum indicum	Jaundice	26	61.9
Mikania cordata	Cut and wound	25	59.52
Glycomis pentaphylla	Jaundice	17	40.47
Cajanus cajan	Jaundice	16	38.09
Chromolaena odorata	Cut and wound	15	35.71
Justicia adhatoda	Cold and cough	10	23.80
Paedaria foetida	Diarrhoea	10	23.80

The present work is one of the initial afford to quantify the ethnomedicinal information in Bangladesh which provide better option for the selection of widely used medicinal plants for searching bioactive compounds to treat ailments. The study reported 35 medicinal plants with their uses from the Kalenga forest area. The efficacy and safety of all the reported ethnomedicinal plants need to be evaluated by phytochemical and pharmacological studies. Plants with high informant consensus factor, use report and fidelity level should be given priority to carry out bioassay and toxicity studies. From this study we suggest *Litsea glutinosa* for further ethnopharmacological studies, since this species has the high FIC and FL values. The results indicated that this species may be used for the development of new, cheap, effective, and eco-

friendly herbal formulations for healthcare management (Cox and Balick,1994; Balick and Cox, 1997; Flaster,1996; Heinrich, *et al*.1998; Ghorbani, 2005; Khafagi and Dewedar, 2000). Further use of these herbal formulations for healthcare management will require safety and efficacy testing. According to forest villagers and our observations in the field, *L. glutinosa* is now a very rare plant in the forest area. Illegal and unsustainable collection of bark from this tree by the local crude drug traders is one of the major causes of depletion of this species from nature. There is an urgent need to formulate suitable conservation strategies for naturally growing ethnomedicinal plants to overcome their depletion from natural resources and to make these practices more eco-friendly.

Acknowledgment

The authors are grateful to all the informants of the research area for sharing their knowledge. Cooperation of Forest Department during filed study is duly acknowledged.

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(Manuscript received on 27 January 2014; revised on 24 April 2014)