

## STUDY OF ETHNOMEDICINAL PLANTS USED BY THE LOCAL PEOPLE OF RAIPURA UPAZILA OF NARSINGDI DISTRICT

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**Keywords:** Ethnomedicinal plants; Local people; Raipura Upazila; Threats; Conservation.

### Abstract

An ethnomedicinal investigation was conducted from July 2019 to June 2020 in Raipura Upazila, Narshingdi district. The main aim of this study was to record, integrate and document all the scattered distributions of traditional healthcare knowledge of medicinal plants. Data collection of ethnomedicinal plants were performed through key informant interviews, field interviews, checklist interviews, Plant interviews, semi - structured interviews and group discussion. A total of 87 medicinal species with 114 formularies to treat 69 ailments have been recorded. These species belong to 49 families. Most frequently used plant species are trees (43%) followed by herbs (31%), shrubs (21%) and climbers (5%). Oral consumption is the main mode of treatment in the study area followed by external application. The reported ailments were classified into 15 disease categories. Maximum plant species were reported to treat diarrhoea and dysentery. The highest Factor informant consensus (Fic) value was found in respiratory category (fever, cold, cough, pneumonia). The most cited species for this category are *Ocimum sanctum* L., *Nigella sativa* L. and *Jasticia adhatoda* L. Cardiovascular disease showed second highest Fic value. The most cited plant species for this category are *Terminalia arjuna* (Roxb. ex D.C.) Wight & Arn., *Tamarindus indica* L. and *Allium sativum* L. In this survey, 8 species scored 100% FI values for different disease categories. These are *Aerva sanguinolenta* (L.) Blume, *Neolamarckia cadamba* (Roxb.) Bosser, *Tamarindus indica* L., *Momordica charantia* L., *Cocos nucifera* L., *Ocimum sanctum* L., *Leucus aspera* (Willd.) Link. and *Jasticia adhatoda* L. Therefore, such plant species could be further analyzed for bioactive constituents that can lead to discovery of new and potential drugs. The study also revealed that the medicinal plants and traditional knowledge in Raipura Upazila are in threatened condition due to different disturbances and some suggestions have been recommended for conservation.

### Introduction

Ethnomedicine is the study of the traditional medicine practiced by various ethnic groups. Ethnomedicinal plants are very much popular for curing various ailments in local and ethnic communities at different parts of the world. The origins of over 50% of all pharmaceutical drugs could be traced back to ethnomedicine (Van Wyk *et al.*, 1997). According to data from the World Health Organization (WHO), about 80% of the world's population, mostly the rural people of developing countries still primarily rely on traditional medicines (Islam, 2006). Very recent past global herbal medicine market size was estimated to be US\$ 83 billion in 2019 and is expected to reach US\$ 550 billion by 2030 (<https://www.insightslice.com/herbal-medicine-market>). Before recent past this market was estimated to be US\$ 60 billion (Breevot, 1998). Currently, this market for medicinal plants and plant products has been rising day by day because of easy availability, effective in case of chronic diseases, less side effects, and cost effectively.

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World leaders gathered in Rio de Janeiro during 1992 to formulate biodiversity conservation policy including agenda 21 which gave emphasis on the documentation and sustainable utilization of traditional knowledge of medicinal plants. Most cultures possess a huge store of undocumented traditional knowledge of applying herbal remedies in disease treatment (Offiah *et al.*, 2011). The documentation of indigenous knowledge is an important aspect of conservation approach (Umair *et al.*, 2017). In addition, documenting the results of scientific research into traditional medicine may also help to conserve an important part of an indigenous people's cultural heritage for the future generations (Mahwasane *et al.*, 2013). Many articles have been published on medicinal plants included Mia and Huq (1988), Hassan and Khan (1986,1996), Alam *et al.*(1996), Uddin (2006), Uddin *et al.*( 2001), Khan *et al.*(2002),Yusuf *et al.* (2002), Uddin *et al.* (2004), Uddin *et al.* (2006, 2008, 2012, 2015, 2017), Yusuf *et al.* (2006), Uddin and Roy (2007), Uddin *et al.* (2011), Sajib and Uddin (2013), Rahman (2013), Uddin and Faruque (2013), Uddin and Hassan(2014), Rahman and Sarkar (2015), Kona and Rahman (2016), Yasmin and Rahman (2017) and Khatun and Rahman (2018). All such articles listed a good number of medicinal plants of particular areas of Bangladesh. Unfortunately, no such work of ethnomedicinal plants has been recorded in Raipura Upazila of Narshingdi district. In the present study an attempt has been made to record, integrate and document all the scattered distributions of traditional healthcare knowledge of medicinal plants in Raipura Upazila so that it can provide baseline data for future phytochemical studies to determine potential drugs.

### Materials and Methods

Raipura is an Upazila of Narsingdi District belonging to Dhaka Division. The area covers 312.77 sq. km. It is bounded by Narsingdi Sadar, Banchharampur and Nabinagar Upazilas on the South, Belabo and Bhairab Upazilas on the North, Brahmanbaria Sadar, Nabinagar Upazilas on the East and Shibpur, Narsingdi Sadar Upazilas on the West. Raipura Upazila consists of 24 Union Parishads. These are Amirganj, Adiabadd, Alipura, Banshgari, Chander Kandi, Chandpur, Char Aralia, Char Madhua, Char Subuddi, Daukar Char, Hairmara, Maheshpur, Morjal, Mirzanagar, Mirzapur, Mirzarchar, Musapur, Nilakhya, Palashtali, Paratali, Radhanagar, Roypura, Sreenagar, and Uttar Bakharnagar. In Narsingdi, the wet season is warm, oppressive and cloudy and the dry season is warm and mostly clear. Monthly rainfall varies from 6 to 430 mm throughout the year. The study area has been visited five times in different seasons from July 2019 to June 2020. The data of medicinal plant uses have been recorded through key informant interview, field interview, checklist interview, plant interview, semi-structured interview and group discussions.

A total of 187 local informants have been interviewed during the ethnomedicinal survey. The informants were in age range of 21-90 years old. Education levels of the informants were from illiterate up to Bachelor Degree. Professionally the informants were mostly farmers, traditional healers and shopkeepers. During the survey, information on medicinal plants, their local names, parts used and treatment modes have been recorded. Voucher specimen for each medicinal plant has been made using standard herbarium techniques (Hyland, 1972; Alexiades, 1996). The specimens were identified consulting with different floras Viz., Hooker (1872-1897), Prain (1903), Uddin and Hassan (2004), Siddiqui *et al.* (2007c) and Ahmed *et al.* (2008a, 2008b, 2009b, 2009c, 2009d and 2009e). Specimens available at Dhaka University Salar Khan Herbarium (DUSH) were also consulted in identifying the collected plant specimens. The updated nomenclature of the species followed Siddiqui *et al.* (2007c) and Ahmed *et al.* (2008a, 2008b, 2009b, 2009c, 2009d and 2009e). Voucher specimens were deposited at the Dhaka University Salar Khan Herbarium (DUSH).

In order to estimate the use diversity of the medicinal plants, Factor of informant consensus (Fic) was calculated (Heinrich *et al.*, 1998). Citation frequency (Cf) values were estimated using the formula: (number of people interviewed citing species/ the total number of people interviewed) x 100 (Friedman *et al.*, 1986). The Fidelity level (Fl) value is useful for identifying the informants most preferred species in use for treating certain ailments (Friedman *et al.*, 1986). Fl value was calculated using the formula:  $Fl = Ip/Iu \times 100$ , where Ip is number of informants who indicate use of a species for the same major ailment, Iu is the total number of informants who mentioned the same plant for any other use. Medicinal plants that are widely used by the local people for a particular ailment have higher Fl values than those which are less popular.

### Results and Discussion

A total of 87 medicinal plant species belonging to 49 families with 114 formularies has been recorded from the present survey. The results indicate the rich diversity of ethnomedicinal plants with their different uses in the study area. For each species scientific name, local name, family, habit, parts used, ailments and treatment modes have been recorded. It is evident that local people of the study area has a great knowledge about medicinal plants. Such knowledge has been inherited from generation to generation. No written documents have been found during the survey. The present results also indicated that people of Raipura Upazila has emphasized on using medicinal plants with a diversity of application methods.

**Table 1: Ethnomedicinal plants and their uses in the study area (S=Shrub, H= Herb, T=Tree, C=Climber).**

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Abroma augustum</i> (L.) L.f.	Ulotkombol	Sterculiaceae	T	Stem	Weakness	Stem soaked water is taken
				Stem	Cold	Juice is taken
				Stem	Dysentery	Stem soaked in water is taken
				Stem	Constipation	Stem soaked in water is taken
				Stem	Urinary disease	Stem soaked in water with Menda stem and water is taken
<i>Achyranthus aspera</i> L.	Uphatlenga	Amaranthaceae	H	Root	Anthelmintic	Crushed juice is taken
				Whole plant	Gastritis	Chopped parts are boiled and water is taken
<i>Jasticia adhatoda</i> L.	Basak	Acanthaceae	S	Leaf	Cold	Leaf juice is taken
<i>Aegle marmelos</i> (L.) Corrêa	Bel	Rutaceae	T	Fruit	Analgesic	Fruit juice is taken
				Fruit	Dysentery	Fruit juice is taken
				Young fruit	Indigestion	Juice is taken
				Leaf	Stomach pain	Juice is taken
				Fruit	Dysentery	Fruit is soaked in water and juice is taken
				Fruit	Dysentery	Fruit juice is taken
				Fruit	Constipation	Fruit juice is taken
				Young fruit	Dysentery	Chopped and dried fruit is soaked in water and taken
Young fruit	Diarrhoea	Chopped and dried fruit is soaked in water and taken				

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Aerva sanguinolenta</i> (L.) Blume, Bijdr	Roktopata	Amaranthaceae	H	Leaf	Cut/ Wound	Leaf paste is applied
<i>Allium sativum</i> L.	Rosun	Liliaceae	H	Clove Clove Clove Clove Clove	Heart disease Cold Cold Body pain Rheumatic pain Heart disease	Cooked as jam and eaten Clove is mixed with mustard and applied to hands and feet Clove paste is taken Externally applied with warm oil Cooked as jam and taken Clove is taken
<i>Aloe vera</i> (L.)Burm. f.	Gritkumari	Aloaceae	S	Leaf	Antioxidant	Leaf juice is taken
<i>Alocasia macrorrhizos</i> (L.) G. Don	Fenkochu	Araceae	S	Leaf	Rheumatic pain	Dried leaf is cooked and taken
<i>Alstonia scholaris</i> (L.) R.Br	Chatim	Apocynaceae	T	Leaf	Diarrhoea	Leaf juice is taken
<i>Amaranthus cruentus</i> L.	Lalshak	Amaranthaceae	H	Leaf Leaf	Wound Anemia	Latex is applied Leaf is cooked and eaten
<i>Ananas comosus</i> (L.) Merr.	Anaros	Bromeliaceae	S	Leaf	Anti-worm	Juice is taken
<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees	Kalomegh	Acanthaceae	H	Fruit leaf Leaf Leaf Stem	Fever Liver problem Fever Dysentery Black fever	Fruit is taken Leaf juice is taken Juice is taken Juice is taken Stem juice is taken
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Kodom	Rubiaceae	T	Bark	Dysentery	Juice is taken
<i>Arachis hypogaea</i> L.	Badam	Fabaceae	H	Seed Seed	Heart disease Cancer	Seed is taken Seed is taken
<i>Artocarpus heterophyllus</i> Lamk.	Kathal	Moraceae	T	Latex	Skin disease	Latex is applied
<i>Asparagus racemosus</i> Willd.	Satamuli	Liliaceae	S	Root Root Root	Impotence Weakness Dysentery	Juice is taken Juice is taken Juice is taken
<i>Averrhoa bilimbi</i> L.	Bilombo	Oxalidaceae	T	fruit	High pressure	Fruit is taken
<i>Averrhoa carambola</i> L.	Kamranga	Oxalidaceae	T	Fruit Fruit	High pressure Fever	Fruit is taken Fruit is taken
<i>Azadirachta indica</i> A. Juss.	Neem	Meliaceae	T	Leaf Leaf Leaf Leaf Leaf	Diarrhoea Hair fall Diabetes Diabetes Cold Allergy	Leaf fried or juice is taken Leaf paste is mixed with oil and applied on hair Leaf paste is taken Leaf juice is taken Juice is taken Leaf paste is applied

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
				Leaf	Kidney disease	Leaf soaked water is taken
				Leaf	Allergy	Leaf boiled in water and applied externally
				Leaf	Allergy	leaf paste applied
				Leaf	Worm	Leaf fried or juice is taken
				Leaf	Brone	Leaf crushed with Durba and applied
<i>Barringtonia acutangula</i> (L.) Gaertn.	Hijol	Lecythidaceae	T	Leaf	Dysentery	Juice is taken
				Leaf	Cold	Leaf boiled, crushed in water and taken
<i>Bombax ceiba</i> L.	Shimul	Malvaceae	T	Leaf	Cold	leaf juice is taken
				Root	Heart disease	Root juice is taken
				Root	Weakness	Juice is taken
<i>Calotropis gigantea</i> (L.) Dryand	Akanda	Apocynaceae	S	Root	Weakness	Taken as food
				Leaf	Fracture	Leaf is burnt and applied
				Leaf	Chest pain	Leaf is boiled and applied to the chest
<i>Carica papaya</i> L.	Pepe	Caricaceae	T	Leaf	Body pain	Leaf is boiled and applied
				Fruit	Constipation	Fruit is cooked and taken
				Raw fruit	Gastritis	Fruit is cooked and taken
				Raw fruit	Gastritis	Fruit is taken
				Leaf	Dengue	Juice is taken
				Leaf	Ulcer	Juice is taken
				Leaf	Diabetes	Juice is taken
				fruit	liver problem	Fruit is taken
				Fruit	Heart disease	Fruit is cooked and taken
<i>Cassia fistula</i> L.	Shonalu	Caesalpinaceae	T	Fruit	Dysentery	Fruit pulp is taken
<i>Catharanthus roseus</i> L.	Nayantara	Apocynaceae	H	Flower	Diabetes	Flower is chewed
<i>Centella asiatica</i> L.	Thankuni	Apiaceae	H	Leaf	Leucorrhea	Leaf juice is taken
				Leaf	Diabetes	Juice is taken
				Leaf	Ulcer	Leaf juice is taken
				Leaf	Allergy	Leaf paste is applied
				Leaf	Anthelmintic	Juice is taken
				Leaf	Impotence	Leaf juice is taken
				Leaf	Gastritis	Juice is taken
				Leaf	Gastritis	Leaf crushed with Durba and juice is taken
				Leaf	Jaundice	Juice is taken
				Leaf	Memory boosting	Leaf juice is taken
				Leaf	Fever	Juice is taken
				Leaf	Heart disease	Juice is taken
				Leaf	Dysentery	Juice is taken
				Leaf	Dysentery	Juice is taken with goat milk

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Chromolaena odorata</i> (L.) R.M.King & H. Rob	Pishais	Asteraceae	S	Whole plant	Cold	Juice is taken
				Leaf	Fracture	leaf is boiled and used for fomentation
				Flower	Toothache	Juice is taken
				Leaf	Cut/ wound	Leaf paste is applied
<i>Citrus limon</i> (L.) Burm.	Lebu	Rutaceae	T	Whole plant	Dysentery	Plant juice is taken
				Fruit	Cancer	fruit is boiled and taken
<i>Clerodendrum infortunatum</i> L.	Bhat	Lamiaceae	S	Fruit	High pressure	Juice is taken
				Root	Dysentery	Juice is taken
<i>Clitoria ternatea</i> L.	Aparajita	Fabaceae	c	Leaf	Gastritis	Juice is taken
				Flower	Cold	Flower is chewed
<i>Coccinia grandis</i> (L.) Voigt	Kuchila	Cucurbitaceae	H	Leaf	Chest pain	Juice is taken
				Leaf	Blood purifier	Leaf cooked with Gondhovaduli leaf and eaten
				Leaf	Piles	Leaf paste is applied with salt
				Leaf	Jaundice	Leaf is cooked and eaten
				Leaf	Boil	Leaf paste is applied
				Leaf	Kidney stone	Leaf juice is taken
				Leaf	Dysentery	Leaf crushed in water then taken
						leaf juice is taken
				Leaf	Bone pain	Paste is cooked with spices is taken
				Leaf	Body pain	Leaf fried and taken
				Leaf	Gastritis	Paste is cooked with spices is taken
				Leaf	Diabetes	Leaf is cooked and taken
				Leaf	Diabetes	Leaf juice is taken in empty stomach
<i>Cocos nucifera</i> L.	Narikel	Areaceae	T	Root	Toothache	Root juice is taken
<i>Colocasia esculenta</i> (L.) Schott.	Kochu	Araceae	S	Root	Blood Dysentery	Cooked and eaten
				Root	Piles	Paste is applied
				Leaf	Blood coating	Leaf paste is applied
				Stem	Cut/ wound	Paste is applied
<i>Crateva magna</i> (Lour.) DC.	Borun	Capparaceae	T	Fruit	Constipation	Young fruit is taken
				Leaf	Rheumatic pain	Leaf paste is applied
<i>Cucumis sativus</i> L.	Shosha	Cucurbitaceae	V	Fruit	Heart disease	Fruit is taken
				Fruit	Overweight problem	Fruit is taken

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Curcuma longa</i> L.	Halood	Zingiberaceae	H	Rhizome	Jaundice	Paste is taken
				Rhizome	Skin disease	Juice is taken
				Rhizome	Skin disease	Rhizome is crushed with Neem leaf and paste is applied
<i>Cuscuta reflexa</i> Roxb.	Shornolota	Cuscutaceae	P	Whole plant	Anti-worm	Juice is taken with pineapple
				Leaf	Allergy	Leaf boiled in water and water is taken
				Leaf	Allergy	Leaf boiled in water and water is used for bath
<i>Cynodon dactylon</i> (L.) Pers.	Durba	Poaceae	H	Leaf	Blood purifier	Leaf juice is taken
				Leaf	Constipation	Leaf juice is taken
				Leaf	Urinary disease	Juice is taken
				Leaf	Dysentery	Juice is taken
				Whole plant	Impotence	Juice is taken for 3 days
<i>Datura metel</i> L.	Dhutura	Solanaceae	S	Leaf	Cut/ wound	Leaf paste is applied
				Fruit	Dog bite	Fruit paste is applied
				leaf	Rheumatic pain	Leaf paste is applied
				Fruit	Mental problem	Fruit crushed with Dontokolosh and Kamranga leaf and paste is applied on head
<i>Dillenia indica</i> L.	Chalta	Dilleniaceae	T	Fruit	High pressure	Juice is taken
				Fruit	Dysentery	Juice is taken
<i>Eclipta alba</i> L.	Kehuitta	Asteraceae	H	Leaf	Dysentery	Leaf juice is taken
				Leaf	Dysentery	Juice is taken
				Root	Cavity	Root is crushed with Durba leaf and paste is applied
				Leaf	Cut/ Wound	Leaf paste is applied
<i>Ficus racemosa</i> L.	Jogdumur	Moraceae	T	Leaf	Cold	Cooked and taken
				Leaf	asthma	Cooked and taken
				Leaf	Heart disease	Cooked and taken
				Fruit	Cold	Fruit is taken
				Leaf	Skin disease	Leaf paste is applied
				Fruit	Skin disease	Fruit paste is applied
				Fruit	Antioxidant	Fruit is fried and taken
<i>Fioria vitifolia</i> L.	Bonkarpas	Malvaceae	H	Flower	Hair tonic	Flower ash is applied on hair
				Whole plant	Diarrhoea	Powdered and taken with cold water
				Whole plant	Constipation	Powdered and taken with warm water

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode	
<i>Glycosmis pentaphylla</i> (Retz.) A. DC	Motkila	Rutaceae	T	Leaf	Anti-worm	Juice is taken	
				Leaf	Anti-worm	Leaf is chewed	
				Leaf	Diarrhoea	Juice is taken	
				Leaf	Child Diarrhoea	Leaf crushed with guava and pomegranate leaf and juice is taken	
				Leaf	Cut/ wound	Leaf paste is applied	
				Leaf	Heart disease	Leaf juice is taken	
				Leaf	Cavity	Leaf is crushed and applied on teeth	
				Leaf	Toothache	Leaf boiled water is used for gargling	
				Leaf	Jaundice	Leaf juice is taken with goat milk	
				Bark	Heart pain	Paste is applied on chest	
				Leaf	Weakness	Leaf juice is taken	
				H	Leaf	Ulcer	Leaf juice is taken
				<i>Gynura procumbens</i> (Lour.) Merr.	Diabetes pata	Asteraceae	S
Stem	Toothache	Used as brush					
<i>Heliotropium indicum</i> L.	Hatisur	Boraginaceae	H	Root	Pregnancy	Juice is taken	
<i>Hibiscus rosa-sinensis</i> L.	Joba	Malvaceae	S	Leaf	Cut injury	Leaf paste is applied	
				Flower	Infertility	Flower paste is taken with milk	
				Flower	Miscarriage	Flower paste is applied to stop bleeding	
				Flower	Leucorrhoea	Flower is crushed with Arjun bark and eaten	
				Leaf	Dysentery	Leaf juice is taken	
<i>Hyptis suaveolens</i> (L.) Poit.	Tokma	Lamiaceae	H	Seed	Dysentery	Seed is taken	
				Seed	Constipation	Seed is taken	
<i>Ichnocarpus frutescens</i> (L.) R. Br	Dudh pata	Apocynaceae	S	Leaf	Dysentery	Juice is taken	
<i>Ipomoea aquatica</i> Forssk.	Kolmi	Convolvulaceae	H	Leaf	Insect bite	Paste is applied	
<i>Kalanchoe pinnata</i> (Lam.) Pers	Pathor kuchi	Crassulaceae	H	Leaf	Body pain	Leaf is used for fomentation	
				Leaf	Kidney disease	Juice is taken	
<i>Lawsonia inermis</i> L.	Mehdi	Lythraceae	S	Leaf	Seizure	Leaf soaked water is taken	
				Fruit	Heart disease	Fruit juice is taken	
				Leaf	Skin disease	Paste is applied	
				Leaf	Diabetes	Juice is taken	



Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
				Leaf	Gastritis	Leaf is boiled and water is taken with sugar
				Leaf	Dandruff	Leaf paste is applied on head
				Leaf	Jaundice	Leaf soaked water is taken
				Leaf	White discharge of female	Leaf soaked water is taken
				Leaf	Urinary disease	Leaf soaked water is taken
<i>Leucus aspera</i> (Willd.) Link	Dontokolosh	Lamiaceae	H	Leaf	Cold	Leaf is cooked and taken
				Flower	Cold	Juice is taken with honey
				Flower	Cold	Juice is taken
<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	Menda	Lauraceae	T	Leaf	Impotence	Leaf juice is taken
				Leaf	Constipation	Leaf is crushed in water and taken
				Leaf	Seizure	Juice is taken
				Leaf	Dysentery	Leaf is crushed in water and taken
				Bark	Diarrhoea	Bark is crushed with mango and blackberry bark and taken
				Bark	Dysentery	Bark soaked water is taken
				Bark	Weakness	Bark soaked water is taken
				Leaf	Jaundice	Leaf juice is taken
<i>Mangifera indica</i> L.	Aam	Anacardiaceae	T	Raw fruit	High pressure	Fruit is taken
				Young fruit	Diarrhoea	Juice is taken
				Young fruit	Body pain	Powdered and taken
				Bark	Dysentery	Juice is taken
				Bark	Dysentery	Bark crushed with blackberry bark and juice is taken
				Young leaf	Gastritis	Juice is taken
				Young leaf	Diarrhoea	Leaf crushed with Sajna bark and taken with lime
				Bark	Jaundice	Juice is taken
				Leaf	Dysentery	Juice is taken
				Stem	Toothache	Stem is heated and applied to teeth
<i>Mentha arvensis</i> L.	Pudina	Lamiaceae	H	Leaf	Sexual disease	Juice is taken with milk for 7 days in empty stomach
				Leaf	Gonorrhoea	Juice is taken with milk for 7 days in empty stomach

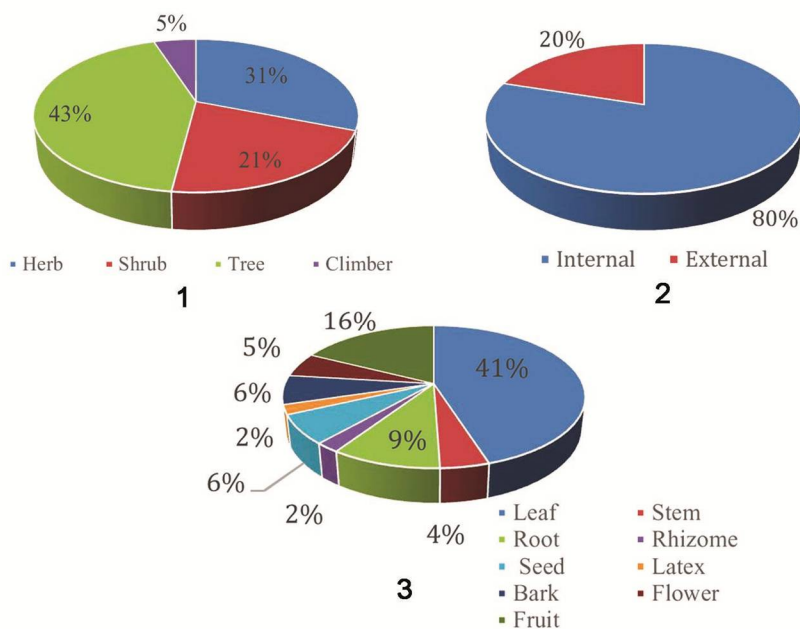
Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Mikania cordata</i> (Burm.f.) B.L. Rob.	Refugee lota	Asteraceae	C	Leaf	Blood Dysentery	Leaf juice is taken
				Leaf	Ulcer	Leaf paste is taken
				Leaf	Weakness	Juice is taken
				Leaf	Cut/ Wound	Leaf paste is applied
				Stem	Fracture	Used for binding
				Leaf	Headache	Leaf paste is applied on head
				Leaf	Gastritis	Juice is taken
				Leaf	Boil	Leaf is applied on boil
				Leaf	Dysentery	Leaf crushed in water then taken
<i>Mimosa pudica</i> L.	Lajjaboti	Mimosaceae	S	Leaf	Cut/ Wound	Leaf paste is applied
				Root	Dysentery	Juice is taken
				Root	Baby delivery problem	Root paste is e applied
<i>Momordica charantia</i> L.	Korola	Cucurbitaceae	V	Leaf	Dysentery	Juice is taken
				Fruit	Diabetes	Cooked and eaten
<i>Moringa oleifera</i> Lamk.	Sajna	Moringaceae	T	Leaf	Diarrhoea	Leaf juice is taken
				Leaf	Dysentery	Leaf juice is taken
				Leaf	Rheumatic pain	Leaf juice is taken
				Leaf	Cold	Curry is taken
				Leaf	Diabetes	Dried leaf is cooked and taken
				Bark	Heart disease	Bark paste is taken
				Bark	Cold	Bark paste is taken
				Bark	Asthma	Bark juice is taken
				Bark	Asthma	Juice taken for 3 days
				leaf	Cold	Leaf paste is taken
				leaf	Indigestion	Leaf fried and taken
				Bark	Cold	Bark cooked with onion and garlic and taken
				Leaf	Cold	Leaf fried and taken
Bark	Cold	Boiled and taken as a jam				
Leaf	Diabetes	Leaf fried and taken				
<i>Murraya paniculata</i> (L.)Jack.	Kamini	Rutaceae	T	Leaf	Toothache	Used as brush
<i>Musa acuminata</i> Colla.	Kola	Musaceae	T	Fruit	Dysentery	Fruit is soaked in water and taken with sugar
<i>Musa paradisiaca</i> L.	Kachkola	Musaceae	T	Fruit	Dysentery	Fruit is taken
				Fruit	Liver problem	Cooked and eaten
				Fruit	Diarrhoea	Fruit boiled and water is taken
				Fruit	Jaundice	Fruit is cooked and taken
<i>Nelumbo nucifera</i> Gaertn.	Poddoo	Nelumbonaceae	H	Fruit	Diarrhoea	Fruit is cooked and taken
				Leaf	Seizure	Leaf juice is taken

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Nigella sativa</i> L.	Kalojeere	Ranunculaceae	H	Seed	Rheumatic pain	seed paste is taken
				Seed	Distaste	Seed is taken
				Seed	Diarrhoea	Seed paste is taken
				Seed	Gastritis	Paste is taken
				Seed	Heart pain	Paste is taken
				Seed	Cold	Seed paste is taken
<i>Nyctanthes arbor-tristis</i> L.	Shiuli	Verbenaceae	T	Leaf	Piles	Leaf juice is taken
<i>Ocimum sanctum</i> L.	Tulsi	Lamiaceae	H	Leaf	Cold	Leaf juice with ginger taken
<i>Paederia foetida</i> L. Mant.	Gondhovadali	Rubiaceae	C	Seed	Constipation	Juice is taken
				Leaf	Sexual problem	Paste is cooked with spices and taken
				Leaf	Dysentery	Juice is taken
				Leaf	Ulcer	Juice is taken
				Leaf	Gastritis	Juice is taken
<i>Phyllanthus emblica</i> L.	Amloki	Euphorbiaceae	T	Fruit	Gastritis	Fruit is taken
				Fruit	Mouth sore	Fruit is taken
				Fruit	Heart pain	Powdered and taken
				Fruit	Hair tonic	Fruit juice is boiled with oil and then applied on hair
				Fruit	High pressure	Fruit is taken
<i>Psidium guajava</i> L.	Peyara	Myrtaceae	T	Fruit	Heart pain	Fruit is taken
				Young leaf	Gastritis	Leaf juice is applied
				Leaf	Toothache	Leaf boiled water is used for gargling
				Young leaf	Dysentery	Juice is taken
				Young leaf	Toothache	Leaf crushed with mango young leaf and applied
<i>Punica granatum</i> L.	Dalim	Punicaceae	T	Leaf	Diarrhoea	Leaf fried and taken
				Leaf	Child dysentery	Leaf is cooked and eaten by mothers
				Fruit peel	Cold	Boiled with in water and water is taken
				Young fruit	Diarrhoea	Fruit is taken
				Leaf	Pox	Leaf juice is taken
				Fruit	Dysentery	Raw fruit is taken
				Leaf	Heart pain	Leaf juice is taken
				Leaf	Burn	Leaf ash is applied
				Leaf	Anti-worm	Juice is taken
				Leaf	Dysentery	Leaf is crushed with Neem leaf and Tumeric and taken
				<i>Scoparia dulcis</i> L.	Chinipata	Scrophulariaceae
Leaf	Gastritis	Juice is taken				
Leaf	Dysentery	Juice is taken				

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Sida cordifolia</i> L.	Baillodi	Malvaceae	S	Root	Headache	Root juice is taken
				Leaf	Boil	Leaf paste is applied
				Root	Weakness	Root juice is taken
<i>Smilax macrophylla</i> Roxb.	Kumari lota	Smilacaceae	V	Stem	Sexual disease	Stem is taken
<i>Solanum nigrum</i> L.	Titbegun	Solanaceae	S	Leaf	Itching	Leaf is burnt and applied
<i>Spondias pinnata</i> (L.f.) Kurz.	Amra	Anacardiaceae	T	Fruit	High pressure	Fruit is taken
				Fruit	Heart pain	Fruit is taken
				fruit	Diabetes	Fruit is taken
<i>Streblus asper</i> Lour.	Sheora	Moraceae	T	Latex	Boil	Latex is applied
<i>Swietenia mahagoni</i> Jacq.	Mehogony	Meliaceae	T	Seed	Diabetes	Seed soaked water is taken
<i>Syzygium cumini</i> (L.) Skeels	Jam	Myrtaceae	T	Bark	Dysentery	Juice is taken
				Leaf	Gastritis	Juice is taken
				Seed	Diabetes	Powder is taken
<i>Tagetes erecta</i> L.	Gada	Asteraceae	S	Seed	Heart pain	Seed is powdered with mango seed and taken
				Leaf	Cut/ Wound	Leaf paste is applied
				Leaf	Liver problem	Leaf juice is taken
<i>Tamarindus indica</i> L.	Tetul	Caesalpiniaceae	T	Fruit	High pressure	Fruit juice is taken
<i>Terminalia arjuna</i> (Roxb. ex DC) Wight & Arn.	Arjun	Combretaceae	T	Bark	Constipation	Bark paste is taken
				Bark	Dysentery	Paste is taken
				Bark	Dysentery	Bark is crushed with Thankuni leaf and paste is taken
				Bark	Heart disease	Paste is taken
				Bark	Heart disease	Bark soaked in water and both are taken
				Bark	Diabetes	Juice is taken
				Bark	Weakness	Bark soaked water is taken
				Bark	Heart disease	Bark soaked water is taken
				Bark	Gastritis	Bark powder is taken with water
				Bark	Heart disease	Bark powder is taken with water
				<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Bohera	Combretaceae
Fruit	Antioxidant	Fruit powdered with Amlaki fruit and Arjun bark and taken				
<i>Terminalia chebula</i> Retz.	Haritaki	Combretaceae	T	Leaf	Seizure	Leaf crushed with Bohera leaf and taken with water
<i>Zanthoxylum rhetsa</i> (Roxb.) D.C.	Bajna	Rutaceae	T	Seed	Body pain	Seed oil is applied

Scientific name	Local name	Family	Habit	Parts used	Ailments	Treatment mode
<i>Zingiber officinale</i> Rosc.	Ada	Zingiberaceae	H	Thorn	Waist pain	Externally bound on waist
				Thorn	Cold	Powder is taken
				Rhizome	Gastritis	Juice is taken with lemon juice
				Rhizome	Nausea	Juice is taken
				Rhizome	Heart disease	Juice is taken
				Rhizome	Stomach pain	Boiled with salt in water and water is orally taken
<i>Ziziphus mauritiana</i> Lamk.	Boroi	Rhamnaceae	T	Fruit	High pressure	Fruit is taken
				Leaf	Old dysentery	Leaf is crushed with ginger and taken

Among the medicinal plants, most frequently used plant species are trees (43%) followed by herbs (31%), shrubs (21%) and climbers (5%). (Fig.1). Out of 114 formularies, 80% were of internal application and the rest 20% were of external applications (Fig. 2). Leaf is the most commonly used plant part followed by fruit, root, seed, bark and flower (Fig. 3).



Figs 1-3: 1. Different life forms of medicinal plants. 2. Application mode of plants. 3. Parts used for the preparation of ethnomedicines

The Factor of informant consensus model was used to determine the use diversity of medicinal plants and to identify the ethnopharmacologically important plant species (Heinrich *et al.*, 1998). Table 2 shows that the Fic values varied from 0.956 to 0.938. The highest Fic value (0.956) was obtained in case of respiratory disorders. The second highest fic value (0.955) was found in case of cardiovascular diseases followed by diabetes, gastrointestinal disorders, diarrhea and dysentery, anthelmintic, dermatological disease, muscle and skeletal disorders, kidney disease, dental, gynecological disorder, jaundice and sexual disorder. The most cited species for respiratory category are *Ocimum sanctum* L., *Nigella sativa* L. *Moringa oleifera* Lamk. and *Jasticia adhatoda* L. In case of Cardiovascular diseases the most cited plant species are *Terminalia arjuna* (Roxb. ex D.C.) Wight & Arn., *Tamarindus indica* L., *Allium sativum* L. Fic is comparatively low for sexual disorders indicating that there is low consensus on the treatment of this ailment in the study area.

**Table 2. Consensus of agreement on the uses of medicinal plants among informants**

No.	Category of disease	Most cited plants	Nur	Ntaxa	Fic
1	Dermatology (hair fall, skin rash, pox, acne, allergy)	<i>Azadirachta indica</i> A. Juss.	176	17	0.908
2	Gastrointestinal disorders (gastritis, constipation, stomachache)	<i>Carica papaya</i> L.	380	25	0.936
3	Diabetes	<i>Coccinia grandis</i> (L.) Voigt	194	13	0.937
4	Cardiovascular disease (pressure reduce, chest pain, blood purifier)	<i>Terminalia arjuna</i> (Roxb. ex D.C.) Wight & Arn.	627	29	0.955
5	Respiratory disorder (Asthma, Cough, fever)	<i>Ocimum sanctum</i> L.	401	19	0.956
6	Muscle and skeletal disorders (cuts and wound, body pain, rheumatism)	<i>Cynodon dactylon</i> (L.) Pers.	254	25	0.905
7	Jaundice	<i>Centella asiatica</i> L.	32	11	0.677
8	Dental (toothache, cavity)	<i>Glycosmis</i> <i>Pentaphylla</i> (Retz.) A. D.C.	59	7	0.896
9	Diarrhoea and Dysentery	<i>Punica granatum</i> L.	512	36	0.932
10	Gynecological disorder	<i>Hibiscus rosa-sinensis</i> L.	43	07	0.857
11	Anthelmintic disease	<i>Azadirachta indica</i> (A.) Juss.	79	07	0.923
12	Sexual disorder	<i>Mentha arvensis</i> L.	14	07	0.538
13.	Kidney disease	<i>Kalanchoe pinnata</i> (Lam.) Pers	22	03	0.904
14.	Others (weakness, memory boosting, epilepsy, anemia, headache, distaste)	<i>Nigella sativa</i> L.	120	22	0.823

Fidelity level (FL) was calculated to identify medicinally important plant species of the study area. The higher FL value of a species indicates the prevalence of a specific disease in an area and the utilization of plant species by the inhabitants to treat it (Bibi *et al.*, 2014; Srithi *et al.*, 2009). *Aerva sanguinolenta* (L.) Blume, *Neolamarckia cadamba* (Roxb.) Bosser, *Tamarindus indica* L., *Momordica charantia* L., *Cocos nucifera* L. *Jasticia adhatoda* L., *Ocimum sanctum* L, *Leucus aspera* (Willd.) Link. showed 100% Fidelity level (FL) values against cut injury, dysentery, high blood pressure, diabetes, toothache and cold respectively. (Table 3).

**Table 3. Fidelity level (Fl) values of frequently cited plant species and their major uses.**

Scientific name	Ailments	Ip	Iu	FL (100)
<i>Aerva sanguinolenta</i> (L.) Blume	Cut injury	25	25	100
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Dysentery	17	17	100
<i>Tamarindus indica</i> L.	Pressure reduce	96	96	100
<i>Calotropis gigantea</i> (L.) Dryand	Body pain	19	49	38.77
<i>Cucumis sativus</i> L.	Cardiovascular disease	17	18	94.5
<i>Momordica charantia</i> L.	Diabetes	20	20	100
<i>Cocos nucifera</i> L.	Toothache	17	17	100
<i>Syzygium cumini</i> (L.) Skeels	Diabetes	51	86	59.30
<i>Terminalia arjuna</i> (Roxb. ex D.C.) Wight & Arn.,	Cardiovascular disease	140	205	68.29
<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	Dysentery	55	70	78.57
<i>Ananas comosus</i> (L.) Merr.	Anthelmintic diseases	09	11	81.9
<i>Ocimum sanctum</i> L.	Cough	125	125	100
<i>Cuscuta reflexa</i> Roxb.	Skin disease	16	24	66.70
<i>Azadirachta indica</i> (A.) Juss.	Skin disease	51	126	40.4
<i>Curcuma longa</i> L.	Skin disease	9	11	81.90
<i>Leucus aspera</i> (Willd.) Link.	Cough	29	29	100
<i>Colocasia esculanta</i> L.	Cut injury	30	38	78.90
<i>Allium sativum</i> L.	Cardiovascular disease	49	67	73.10
<i>Kalanchoe pinnata</i> (Lam.) Pers	Kidney disease	11	13	84.60
<i>Calotropis gigantea</i> (L.) Dryand	Cardiovascular disease	28	49	57.10
<i>Musa paradisiaca</i> L.	Diarrhea	19	24	79.10
<i>Jasticia adhatoda</i> L	Cough	34	34	100
<i>Hibiscus rosa-sinensis</i> L.	Gynae	13	34	38.23

Citation frequency (Cf) of different plant species are shown in the Table 4. *Terminalia arjuna* (Roxb. ex D.C.) Wight & Arn. showed highest Cf value (74.86%) which indicated that such species is very popular plant species in the study area to treat heart diseases. *Ocimum sanctum* L., *Tamarindus indica* L., *Carica papaya* L., *Cynodon dactylon* (L.) Pers., *Punica granatum* L., *Coccinia grandis* (L.) Voigt were also the most cited plant species in the study area. These species are considered as important medicinal plants in our country.

In the present study maximum number of plant species belonged to Rutaceae, Lamiaceae, Fabaceae, Apocynaceae, Asteraceae, Cucurbitaceae. Juice is the most commonly cited mode of medicine preparation by the followed by paste, crushed, decoction, chewed and powdered. The same results were reported in other study performed by Uddin *et al.* (2017). Maximum informants preferred oral consumption of medicines rather than external application. This result is similar with other studies from Bangladesh (Faruque *et al.*, 2018; Uddin *et al.*, 2015). Highest FIC value (0.956) was found for respiratory disease category (cough, cold, fever). The most cited species used to treat such ailment are *Ocimum sanctum* L. *Jasticia adhatoda* L. which were also reported by Uddin *et al.*, (2017) and Sajib and Uddin (2013, 2015). Cardiovascular disease showed second

highest fic value (0.955) and the most cited species for this category is *Terminalia arjuna* (Roxb. ex DC) Wight & Arn. which were also used for the same purpose as reported by Uddin *et al.* (2012) and Uddin and Hassan (2014). The third highest Fic value (0.937) was found for Diabetes and the most cited species for this category is *Coccinia grandis* (L.)Voigt which is similar with the report of Uddin *et al.* (2015). *Coccinea grandis* is also used for blood purifying, skin disease, jaundice, kidney disease, body ache and dysentery which were reported in different studies (Jahan *et al.*, 2013; Rahmatullah *et al.*, 2010; Dinsesh *et al.*, 2013; Rahmatullah *et al.*, 2009).

**Table 4. Citation frequency of some selected medicinal plants.**

Scientific name	Local name	Ailments	Citation	Citation frequency (CF%)
<i>Ocimum sanctum</i> L.,	Tulshi	Cough	125	66.80
<i>Tamarindus indica</i> L.	Tetul	Pressure reduce	96	51.33
<i>Syzygium cumini</i> (L.) Skeels	Jam	Diabetes	51	27.28
<i>Cynodon dactylon</i> (L.) Pers	Durba	Cut injury	67	35.82
<i>Nigella sativa</i> L.	kalijira	Cough	59	31.55
<i>Coccinia grandis</i> (L.) Voigt	kuchila	Diabetes	65	34.75
<i>Azadirachta indica</i> A. Juss.	Neem	Skin disease	51	27.28
<i>Carica papaya</i> L.	Pepe	Gastritis	84	44.91
<i>Glycosmis pentaphylla</i> (Retz.) A. D.C.	Motkila	Toothache	29	15.50
<i>Terminalia arjuna</i> (Roxb. ex D.C.) Wight & Arn.	Arjun	Cardiovascular disease	140	74.86
<i>Citrus limon</i> (L.) Burm.	Lebu	Pressure reduce	42	22.45
<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	Chapaitta/Menda	Dysentery	55	29.41
<i>Colocasia esculanta</i> L.	Kochu	Cut injury	30	16.04
<i>Mangifera indica</i> L.	Aam	Gastritis	35	18.71

A number of medicinal uses are found to be new after comparison with previous studies (Uddin *et al.*, 2006, 2015, 2017; Sajib and Uddin, 2013, 2015; Nahar *et al.*, 2016; Yasmin and Rahman, 2017; Khatun and Rahman, 2018; Sohel *et al.*, 2016). *Leucus aspera* (Willd.) Link. was reported to treat cough, *Amaranthus tricolor* L. to treat anaemia, *Punica granatum* L. to treat child diarrhea, *Datura metel* L. to treat dogbite and *Fioria vitifolia* L. was reported to treat hair fall problem.

From the present survey, some threats to medicinal plants have been observed. Lack of awareness among local people and roadside plantation of exotic species are the major threats in the study area. *Acacia auriculiformis* (A.) Cunn. ex Benth, *Switenia mahagoni* (L.) Jacq., *Eucalyptus camadulensis* Dehnh. *Samanea saman* (Jacq.) Merr. and *Dalbergia sissoo* Roxb. are some commonly used exotic plants for roadside plantation. According to local people, these species might possess threats to native ecosystem as no birds sit in these trees and no fish can survive in nearby ponds. To protect valuable medicinal plant species in the present study area, a number of measures should be undertaken. Among the measures, nurseries should be developed for propagating important and threatened medicinal plants. Distribution map of medicinal plants can be made. *Ex situ* conservation strategies should be applied for the important and threatened plants of the study area. Different governmental and non-governmental organizations should



undertake appropriate measures for listing and conserving important medicinal plants of Raipura Upazila.

### Conclusion

The study area has a variety of medicinal plants (87 species) and diversity of health care uses (69 ailments with 114 formularies). Respiratory disorders attained highest Fic value followed by cardiovascular disease. In this survey *Cynodon dactylon* (L.) Pers, *Tamarindus indica* L., *Momordica charantia* L., *Cocos nucifera* L., *Jasticia adhatoda* L., *Ocimum sanctum* L. and *Leucus aspera* (Willd.) Link. scored 100% FI values. According to the Fic, FL and Cf values, the most important medicinal plant species in the study area are *Ocimum sanctum* L., *Cynodon dactylon* (L.) Pers., *Curcuma longa* L., *Centella asiatica* L., *Carica papaya* L., *Coccinia grandis* (L.) Voigt, *Aerva sanguinolenta* (L.) Blume, *Jasticia adhatoda* L., *Leucus aspera* (Willd.) Link., *Litsea glutinosa* (Lour.) C. B. Rob., *Mangifera indica* L., *Terminalia arjuna* (Roxb. ex D.C.) Wight & Arn., *Tamarindus indica* L., *Punica granatum* L., *Mikania cordata* (Burm. f.) Robinson, *Moringa oleifera* Lamk., *Syzgium cumini* L. and *Momordica charantia* L. The present analysis proved their popularity as important medicinal plants among the local people of Raipura Upazila. Therefore, such plant species can undergo further selection process for future phytochemical studies and also be recommended for drug development. The study also revealed that the medicinal plants and traditional knowledge in Raipura Upazila are in threatened condition due to different disturbances and some suggestions have been recommended for conservation.

### Acknowledgement

The authors acknowledged the Ministry of National Science and Technology for financial support for the research. The authors also remember the contribution of informants in the data collection process during field works in Raipura Upazila.

### References

- Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., Khondker, M., Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman A.K.A. and Haque, E.U. (Eds.) 2008a. Encyclopedia of flora and fauna of Bangladesh, Vol. **6**. Angiosperms: Dicotyledons (Acanthaceae-Asteraceae). Asiatic Society of Bangladesh, Dhaka, pp. 1-408.
- Ahmed, Z.U., Hassan, M.A., Begum, Z.N.T., Khondker, M., Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman, A.K.A. and Haque, E.U. (Eds.) 2008b. Encyclopedia of flora and fauna of Bangladesh, Vol. **12**. Angiosperms: Monocotyledons (Orchidaceae-Zingiberaceae). Asiat. Soc. Bangladesh, Dhaka, pp. 1-552.
- Ahmed, Z.U., Hassan, M.A., Begum, Z.N.T., Khondker, M., Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman, A.K.A. and Haque, E.U. 2009b (Eds.). Encyclopedia of flora and fauna of Bangladesh, Vol. **7**. Angiosperms: Dicotyledons (Balsaminaceae-Euphorbiaceae). Asiat. Soc. Bangladesh, Dhaka, pp. 1-546.
- Ahmed, Z.U., Hassan, M.A., Begum, Z.N.T., Khondker, M., Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman, A.K.A. and Haque, E.U. (Eds.) 2009c. Encyclopedia of flora and fauna of Bangladesh, Vol. **8**. Angiosperms: Dicotyledons (Fabaceae- Lythraceae). Asiat. Soc. Bangladesh, Dhaka, pp. 1-478.
- Ahmed, Z.U., Hassan, M.A., Begum, Z.N.T., Khondker, M., Kabir, S.M.H., Ahmad, M., and Ahmed, A.T.A. (Eds.) 2009d. Encyclopedia of flora and fauna of Bangladesh, Vol. **9**. Angiosperms: Dicotyledons (Magnoliaceae-Punicaceae). Asiat. Soc. Bangladesh, Dhaka, pp. 1-488.
- Ahmed, Z.U., Hassan, M.A., Begum, Z.N.T., Khondker, M., Kabir, S.M.H., Ahmad, M. and Ahmed, A.T.A. (Eds.) 2009e. Encyclopedia of flora and fauna of Bangladesh, Vol. **10**. Angiosperms: Dicotyledons (Ranunculaceae-Zygophyllaceae). Asiat. Soc. Bangladesh, Dhaka, pp. 1-580.

- Alam, M.K., Choudhury, J. and Hassan, M.A. 1996. Some folk formularies from Bangladesh, *Bangladesh J. Life Sci.* **8**(1): 49-63.
- Alexiades, M.N. (ed.). 1996. *Selected Guidelines for Ethnobotanical Research: A Field Manual*. The New York Botanical Garden, New York. 305pp.
- Bibi, T., Ahmad, M., Tareen, R.B., Tareen, N.M., Jabeen, R. and Rehman, S. 2014. Ethnobotany of Medicinal Plants in District Mastung of Balochistan Province-Pakistan. *J. Ethnopharmacol.* **157**: 79-89.
- Breevot, P. 1998. The booming of US botanical market: A new overview of herbal gram **44**: 33-46.
- Dinesh, V., Bembrekar, S.K. and Sharma, P.P. 2013. Herbal formulations used in treatment of kidney stone by native folklore of Nizamabad District, Andhra Pradesh, India. *Bioscience Discovery* **4**(2): 250-253.
- Faruque, M.O., Uddin, S.B., Barlow, J.W., Hu, S., Dong, S., Cai, Q., Li, X. and Hu, X. 2018. Quantitative Ethnobotany of Medicinal Plants Used by Indigenous Communities in the Bandarban District of Bangladesh. *Front. Pharmacol.* **9**: 40.
- Friedman, J., Yaniv, Z., Dafni, A. and Palewitch, D. 1986. A preliminary classification of healing potential plants, based on a rational analysis of an ethno pharmacological field survey among Bedouins in the Negev Desert, Israel. *J. ethnopharmacol.* **16**: 275-287.
- Hassan, M.A. and Khan, M.S. 1986. Ethnobotanical record of Bangladesh-1: Plants used for healing fractured bones. *J. Asiatic Soc. Bangladesh. Sci.* **12**(1&2): 33-39.
- Hassan, M.A. and Khan, M.S. 1996. Ethnobotanical record of Bangladesh-2. Plants used for healing cuts and wounds. *Bangladesh J. Plant Taxon.* **3**(2): 49-52.
- Heinrich, M., Ankli, A., Frei, B., Weimann, C. 1998. Medicinal plants in Mexico: healers consensus and cultural importance. *Social Sci. Med.* **47**: 1859-1871.
- Hooker, J.D. 1872-1897. *Flora of British India Vol. 1-7. First Indian Reprint 1973* Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
- Hyland, B.P.M. 1972. A technique for collecting botanical specimens in rain forest. *Flora Malesiana Bulletin* **26**: 2038-2040.
- Islam, R. 2006. "Role of plant medicine in health care and improving nutritional standard in rural area of Bangladesh" in *National Seminar on Diversity of Medicinal Plants and Their Sustainable Utilization in Health Care and Improving Nutritional Standard in Rural Areas (Kolkata)*, pp. 1-30.
- Jahan, N., Khan, A., Hasan, M.N., Hossain, M.U., Das, U., Sultana, S. and Rahmatullah, M. 2013. Ethnomedicinal plants of fifteen clans of the Garo tribal community of Madhupur in Tangail district, Bangladesh. *Am-Eur J Sustain Agr.* **7**: 188-95.
- Khatun, M.M. and Rahman, A.H.M.M. 2018. Medicinal Plants Used by the Local People at the Village Pania under Baghmara Upazila of Rajshahi District, Bangladesh. *Discovery*, **54** (266): 60-71.
- Kona, S. and Rahman, A.H.M.M. 2016. Inventory of Medicinal Plants at Mahadebpur Upazila of Naogaon District, Bangladesh. *Appl. Ecol. Environ. Sci.* **4**(3): 75-83.
- Mahwasane, S.T. 2013. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. *South African J. Bot.* **88**: 69-75.
- Mia, M.M.K. and Huq, A.M. 1988. A preliminary ethno-botanical survey in the Jointiapur, Tamabil and Jafflong area, Sylhet, Bangladesh. *Nat. Herba. Bull.* **3**: 1-10.
- Nahar, J., Kona, S., Rani, R., Rahman, A.H.M.M. and Islam, A.K.M.R. 2016. Indigenous Medicinal Plants Used by the Local People at Sadar Upazila of Naogaon District, Bangladesh. *Inter. J. Adv. Res.* **4**(6): 1100-1113.
- Offiah, N.V., Makama, S., Elisha, I.L., Makoshi, M.S., Gotep, J.G., Dawurung, C.J., Oladipo, O.O., Lohlum, A.S. and Shamaki, D. 2011. Ethnobotanical survey of medicinal plants used in the treatment of animal diarrhoea in Plateau State, Nigeria. *BMC Veterinary Research.* **7**: 36.
- Prain, D. 1903. *Bengal Plants 1-2: 1-1013. First Indian Reprint 1963*, Bishen Singh Mahendra Pal Singh Dehra Dun.

- Rahman, A.H.M.M. 2013. Traditional Medicinal Plants Used in the Treatment of different Skin diseases of Santals at Abdullapur Village under Akkelpur Upazilla of Joypurhat district, Bangladesh. *Biomedicine and Biotechnology. USA.* **1**(2): 17-20.
- Rahman, A.H.M.M. and Sarker, A.K. 2015. Investigation of Medicinal Plants at Katakhalı Pouroshova of Rajshahi District, Bangladesh and their Conservation Management. *Appl. Ecol. Environ. Sci. USA.* **3**(6): 184-192.
- Rahmatullah, M., Das, A.K., Mollik, M.A.H., Jahan, R., Khan, M., Rahman, T. and Chowdhury, M.H. 2009. An Ethnomedicinal Survey of Dhamrai Sub-district in Dhaka District, Bangladesh; *Am.-Eurasian J. Sustain. Agric.*, **3**(4): 881-888.
- Rahmatullah, M., Momen, M. A., Rahman, M.M., Nasrin D, S. Hossain, Khatun, Z., Jahan, F., Khatun, A. and Jahan, R. 2010. A Randomized Survey of Medicinal plants used by Folk Medicinal Practitioners in Daudkandi sub-district of Comilla district, Bangladesh. *Adv. Nat. Appl. Sci.* **4**(2):99-104.
- Sajib, N.H. and Uddin, S.B. 2013. Medico-Botanical Studies of Sandwip Island in Chittagong, Bangladesh. *Bangladesh J. Plant Taxon.* **20**(1): 39-49.
- Sajib, N.H., and Uddin, S.B. 2015. Ethnomedinal study of plants in Hathazari, Chittagong, Bangladesh. *Pertanika J. Trop. Agric. Sci.* **38**(2): 197-210.
- Siddiqui, K.U., Islam, M.A., Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., Khondker, M., Rahman, M.M., Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman, A.K.A. and Haque, E.U. (Eds.) 2007c. *Encyclopedia of Flora and Fauna of Bangladesh. Angiosperms: Monocotyledons (Agavaceae-Najadaceae).* *Asiat. Soc. Bangladesh* **11**: 1-399.
- Sohel, M.D.D., Kawsar, M.D.H., Sumon, M.D.H.U. and Sultana, T. 2016. Ethnomedicinal Studies of Lalmohan Thana in Bhola District, Bangladesh *Altern Integr Med*, **5**:1.
- Srithi, K., Balslev, H., Wangpakapattanawong, P., Srisanga, P. and Trisonthi, C. 2009. Medicinal plant knowledge and its erosion among the Mien (Yao) in northern Thailand. *J. Ethnopharmacol.* **123**(2): 335-342
- Uddin, M.Z., Khan, M.S. and Hassan, M.A. 2001. Ethno medical plants records of Kalenga forest range (Habiganj), Bangladesh for malaria, jaundice, diarrhea and dysentery. *Bangladesh J. Plant Taxon.* **8**(1): 101-104.
- Uddin, M.Z. and Hassan, M.A. 2004. *Flora of Rema-Kalenga Wildlife Sanctuary.* IUCN Bangladesh Country Office, Dhaka, Bangladesh, vi+120 pp.
- Uddin, S.N., Uddin, M.Z., Hassan, M.A. and Rahman, M.M. 2004. Preliminary ethnomedicinal plant survey in Khagrachari district, Bangladesh. *Bangladesh J. Plant Taxon.* **11**(2): 39-48.
- Uddin, M.Z., Hassan, M.A. and Sultana, M. 2006. Ethnobotanical survey of medicinal plants in Phulbari Upazila of Dinajpur District, Bangladesh. *Bangladesh J. Plant Taxon.* **12**(1): 63-68.
- Uddin, M.Z. and Roy, S. 2007. Collection and Management of Selected Medicinal Plants in Rema Kalenga Wildlife Sanctuary. In: *Making Conservation Work: Linking rural livelihoods and protected area management in Bangladesh* edited by Fox, J. Bushley, B.R., Dutta S. and Quazi, S.A. 2007. Monograph of East-West Center, Hawaii, USA. pp. 66-83.
- Uddin, M.Z., Roy, S., Hassan, M.A. and Rahman, M.M. 2008. Medicobotanical report on the Chakma people of Bangladesh. *Bangladesh J. Plant Taxon.* **15**(1): 67-72.
- Uddin, S.B., Sajib, N.H. and Islam, M.M. 2011. Investigation of Ethnomedicinal Plants of Subarnachar in Noakhali, Bangladesh. *The Chittagong Univ. J. B. Sci.* **6**(1&2): 77-86.
- Uddin, M.Z., Hassan, M.A., Rahman, M.M. and Arefin, M.K. 2012. Ethno-medico-botanical study in Lawachara National Park, Bangladesh. *Bangladesh J. Bot.* **41**(1): 97-104.
- Uddin, S.B. and Faruque, M.O. 2013. Ethnomedicinal Study of the Marma Community of Bandarban District of Bangladesh. *Acad J. of Med. Plants* **1**(8): 141-148.
- Uddin, M.Z. and Hassan, M.A. 2014. Determination of informant consensus factor of ethnomedicinal plants used in kalenga forest, Bangladesh. *Bangladesh J. Plant Taxon.* **21**(1): 83-91.
- Uddin, M.Z., Kibria, M.G. and Hassan, M.A. 2015. Study of ethnomedicinal plants used by the local people of Feni District, Bangladesh. *J. Asiat. Soc. Bangladesh, Sci.* **41**(2): 203-223.

- Uddin, M.Z., Arefin, M.K., Alam, M.F., Kibria, M.G., Podder, S.L. and Hassan, M.A. 2017. Knowledge of ethnomedicinal plants and informant consensus in and around Lawachara National Park. *J. Asiat. Soc. Bangladesh Sci.* **43**(1): 101-123.
- Umair, M., Altaf, M. and Abbasi, M.B. 2017. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab Pakistan. *PLoS ONE.* **12**(6).
- Van Wyk, B.E., Oudtshoorn, B.V. and Gericke, N. 1997. *Medicinal Plants of South Africa.* Johannesburg: Briza.
- Yasmin, F. and Rahman, A.H.M.M. 2017. Ethnomedicinal Plants Used by the Santal Tribal Practitioners at Sadar Upazila of Joypurhat District, Bangladesh. *Indian J. Sci.* **24**(93): 435-453.
- Yusuf, M., Wahab, M.A., Choudhury, J.U. and Begum, J. 2006. Ethno-medico-botanical knowledge from Kaulkhali proper and Betunia of Rangamati district. *Bangladesh J. Plant Taxon.* **13**(1): 55-61.

*(Manuscript received on 07 December 2021; revised on 04 June 2022)*