INFORMANT CONSENSUS FACTORS AND ANTIBACTERIAL ACTIVITY OF ETHNOMEDICINAL PLANTS OF BRAHMANBARIA, BANGLADESH

A

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By

Tahmina Haque

Registration no. 167/2014-2015

Dedicated

To My Beloved Family members
and
Respected Teachers

Declaration

*I hereby declare that the work presented in this thesis entitled "**Informant consensus factors and antibacterial activity of ethnomedicinal plants of Brahmanbaria, Bangladesh**" is the result of my own investigation. I further declare that this thesis has not been submitted in any previous application for the award of any other academic degree in any University. All sources of information have been specifically acknowledged by referring to the authors.*

December, 2019

(Tahmina Haque)
Author

Certificate

This is to certify that the research work presented in this dissertation entitled "**Informant consensus factors and antibacterial activity of ethnomedicinal plants of Brahmanbaria, Bangladesh**" is the outcome of the original work carried out by Tahmina Haque in the Plant Taxonomy, Ethnobotany, Conservation Biology and Herbal Medicine Laboratory and Microbiology Laboratory, Department of Botany, University of Dhaka under our supervision.

This is further certified that the style and contents of this dissertation is approved for submission in fulfillment of the requirements for the degree of Doctor of Philosophy in Botany (Plant Taxonomy and Ethnobotany).

(Prof. Dr. Mohammad Zashim Uddin)
Supervisor
Department of Botany
University of Dhaka
Dhaka-1000, Bangladesh

(Prof. Dr. Md. Abul Hassan)
Co-Supervisor
Department of Botany
University of Dhaka
Dhaka-1000, Bangladesh

(Prof. Dr. Mihir Lal Saha)
Co-Supervisor
Department of Botany
University of Dhaka
Dhaka-1000, Bangladesh

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Abstract

In spite of the constantly increasing need for new antibacterial agents, antibiotic drug discovery and development seem to have greatly decelerated in recent years. Presented with the significant problem of advancing antibacterial resistance, the global scientific community has attempted to find alternative solutions. One of the most promising ones is to find new sources of antibiotic agents from ethnomedicinal plants those used by local people since first for the treatment diseases caused by bacteria. The present research focuses the consensus of local people of Brahmanbaria district in the use of ethnomedicinal plants to treat different ailments in their daily life and to evaluate the antibacterial properties of most cited ethnomedicinal plant species. Ethnomedicinal data were collected in between June 2015 to June 2017 from 467 local people using mainly key informant's interviews and also followed by plant interviews, field interviews, checklist interviews, group discussions and market surveys. In order to identify the most important ethnomedicinal plants in the study area, Factor of informant consensus (F_{ic}), Fidelity level (Fl), Citation frequency (Cf), Relative frequency of citation (RFC) and Use values (UV) of medicinal plants have been calculated. Plant species with high Cf, RCF, UV, F_{ic} and Fl values can be subjected to further ethno-pharmacology studies to find active compounds for the new drug candidates. To validate the knowledge of local people for the treatment of bacterial diseases, most cited ethno-medicinal plant species have been subjected to determine antibacterial activity. After collection of plant samples, aqueous and ethanol extractions of leaves were made. Both the aqueous and ethanol extracts of leaves were screened for antibacterial activity through disc diffusion assays against eight clinical strains belonging to gram-positive *Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus cereus* bacteria and gram-negative *Escherichia coli*, *Pseudomonas aeruginosa, Salmonella paratyphi*, *Shigella dysenteriae* and *Shigella boydii* bacteria. The extracts showed antibacterial activity further tested for Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) which were determined through serial dilution assays and serial dilution plate method respectively.

In the present study, a total of 247 ethnomedicinal plants under 89 families have been recorded. These plants have been used to treat 73 ailments through 485 formularies. Among 247 ethnomedicinal plants species, four species viz. *Achyranthes bidentata*, *Kalanchoe serrata*, *Echinopsis peruviana* and *Lippia alba* are recorded as new ethnomedicinal plant for Bangladesh. Among the 485 formularies, 96 formularies using 77 species appear to be new for Bangladesh. The highest number of medicinal plants species were found to be Fabaceae, Euphorbiaceae and Asteraceae family. Among formularies 77% have been administered orally and rest 23% used externally. Out of 247 ethnomedicinal plants, 184

species were found to grow wild and 59 species were cultivated. The major modes of remedy preparations were making juice (47%) followed by decoction (16%), paste (13%), tablet (6%), fruit (4%), cooked (4%), powder (4%), plaster (4%), gurgling and brush (3%), Chewed (1%), and others 5% including; tied up with respective organ, oil, and rubbing. The most commonly used ethnomedicinal plants based on use values (UV) were found to be *Centella asiatica*, *Litsea glutinosa, Coccinea grandis*, *Ocimum sanctum*, *Azadirachta indica*, *Cynodon dactylon*, *Cissus quandrangularis*, *Leucas lavandulaefolia*, *Acyranthes aspera*, *Mimosa pudica* and *Kalanchoe pinnata*. Among the ailment categories high informant consensus factor (F*ic*) was found in case of diarrhoea and dysentery followed by respiratory tract disorder, diabetes, gynecological, dermatological, sexual problem, gastrointestinal, musculoskeletal, helmenthiasis, mental disorder, cardiovascular, fever and pain, dental problem, jaundice and others. Most cited species for the treatment of such ailment categories are *Centella asiatica*, *Litsea glutinosa*, *Scoparia dulcis*, *Dalbergia sissoo, Clerodendrum viscosum, Kalanchoe pinnata*, *Ocimum sanctum*, *Abroma augusta*, *Alternanthera sessilis*, *Aloe vera*, *Cissus quandrangularis*, *Azadirachta indica*, *Achyranthes aspera*, *Coccinia grandis*, *Andrographis paniculata*, *Ananas sativus*, *Hyptis sauveolens*, *Terminalia arjuna*, *Eclipta alba*, *Asparagus racemosus*, *Kalanchoe serrata*, *Commelina benghalensis*, *Holarrhena antidysenterica* and *Echinopsis peruviana.* From the most cited plant species, 20 plant species were showed 100% Fidelity level (Fl) values. These are *Adhatoda zeylanica*, *Ananas sativus*, *Aerva sanguinolenta*, *Butea monosperma*, *Calotropis procera*, *Catharanthus roseus*, *Dalbergia sissoo*, *Echinopsis peruviana*, *Ficus racemosa*, *Holarrhena antidysenterica, Jatropha gossypifolia*, *Kalanchoe serrata*, *Mikania cordata*, *Momordica indica*, *Paederia foetida*, *Syzygium cumini*, *Thevetia peruviana*, *Scoparia dulcis*, *Vitex nigundo* and *Zingiber officinale.* Maximum F_{ic} value was found in case of diarrhoea and dysentery category. This disease category was treated by 51 ethnomedicinal plant species by the local people of Brahmanbaria district. Among 51 ethnomedicinal plant species, most cited species were *Litsea glutinosa*, *Scoparia dulcis*, *Dalbergia sissoo*, *Clerodendrum viscosum*, *Holarrhena antidysenterica*, *Phyllanthus reticulatus*, *Paederia foetida* and *Stephania japonica.* The results of antibacterial activity revealed that maximum plant extracts (85%) were potentially effective in suppressing microbial growth of pathogenic bacteria with variable potency. *Litsea glutinosa* was the most effective plant species retarding microbial growth of five tested pathogenic bacteria followed by *Dalbergia sissoo*, *Scoparia dulcis*, *Holarrhena antidysenterica*, *Clerodendrum viscosum*, *Paederia foetida* and *Phyllanthus reticulatus*. The tested plant *Stephania japonica* did not show any activity in retarding microbial growth. Maximum zone of inhibition was found for aqueous leaf extract from *Litsea glutinosa* against *E. coli* (21.6 ± 0.33mm) at 10mg per disc with MIC value 4mg/ml and MBC value 16mg/ml. The Second highest zone of inhibition was found for leaf extract of *Dalbergia sissoo* with a MIC value 4mg/ml and MBC value 32mg/ml. Among the eight tested ethnomedicinal plant

species, five species showed more antibacterial activity than others on which maximum local people rely to treat bacterial diseases as recorded during data collection. Therefore, the results validate the traditional use of ethnomedicinal plant species for the treatment diseases caused by bacteria in Brahmanbaria district. The present research was the first attempt in Bangladesh to established link between field data and scientific evaluation in the laboratory. Based on current findings, conclusion can be drawn that *Litsea glutinosa*, *Dalbergia sissoo*, *Scoparia dulcis, Holarrhena antidysenterica* and *Clerodendrum viscosum* could be the potential source of new antibacterial agents. Further long term studies are needed to isolate, evaluate, characterize and screen out pure compounds to mitigate bacterial diseases.

Abbreviations

The following abbreviation have been used for throughout the text

µg	Microgram
et al	and others
etc	et cetra
Fig.	Figure
g	Gram
h	Hour
L	Liter
mg	Milligram
ml	Milliliter
min	Minute
mm	Millimeter
µl	Microliter
nm	Nanometer
^{0}C	Degree Centigrade
OD	Optical Density
p^H	Negative logarithm of hydrogen ion concentration
sp.	Species

Chapter-1
Introduction

1. Introduction

Ethnomedicinal studies are significant for the discovery of new crude drugs from reported indigenous medicinal plants. 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). The practice of ethnomedicine is a complex multi-disciplinary system constituting the use of plants, spirituality and the natural environment and has been the source of healing for people for millennia (Lowe *et al*. 2000). According to WHO (2001), 80% of the world population uses natural remedies and traditional medicines for their primary healthcare. Ethnomedicinal uses of plants are one of the most successful criteria used by the pharmaceutical Chemistry in finding new therapeutic agents for the various fields of biomedicine (Cox & Balick 1994). Some outstanding medicinal drugs which have been developed from the ethnomedicinal uses of plants include: vinblastine and vincristine from *Catharanthus roseus* (the periwinkle) used for treating acute lymphoma, acute leukaemias *etc*, reserpine from *Rauwolfia serpentina* (Indian snake root) used for treating hypertension, aspirin from *Salix purpurea* (willow) used for treating inflammation, pain and thrombosis and quinine from *Cinchona pubescens* (cinchona) used for treating malaria.

In addition, of the top 150 proprietary drugs used in the United States of America (USA), 57% contain at least one major active compound currently or once derived from plants (Grifo and Rosenthal 1997). Man has used plant drugs for health care delivery over centuries; diseases remedies from plants sources for mankind are as old as human history and still in use till date. It is estimated that about 75% of useful bioactive plant derive pharmaceuticals used globally are discovered by systemic investigation. (Tomoko *et al*. 2002). Medicinal plants are an important source of bioactive compounds and 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient (Dhar *et al*. 1973). About 85% of world population uses herbal medicines for prevention and treatment of diseases, and the demand is increasing in developed and developing countries (Abramov 1996). Some 25% of drugs contain compounds obtained from higher plants. Moreover, the investigation of herbal drugs from plants to treat AIDS, cancer, and malaria, chronic complaints such as rheumatism, arthritis and asthma have been reported (Farnsworth 1994).

Herbal remedies are enjoying widespread popularity throughout the world (Abera *et al.* 2014). It has been reported that human beings were aware of the medicinal properties of plants even around 5,000 years ago. Since then, even after the introduction of modern or allopathic medicine, medicinal plants have played a vital role in the traditional medicinal systems of many countries, as well as being the sources of many modern drugs (Lowe 2000). Indeed, it has been reported that a number of important allopathic drugs like

aspirin; atropine, ephedrine, digoxin, morphine, quinine, reserpine, artemisinin and tubocurarine have been discovered through close observations of traditional medicinal practices of indigenous peoples. Thus such ethnomedicinal knowledge reflects knowledge acquired and accumulated over centuries and even possibly millennia. Scientists as well as general human beings can gain a considerable amount of information from adequate documentation of ethnomedicinal practices. Adequate documentation can not only indicate the possible therapeutic values of any given plant species, but also provide scientists with a general background on the basis of which they can study the plant species for isolation of bioactive constituents.

Bangladesh has a huge resource of medicinal plants and legacy about their uses. Such resources need to be documented and evaluated scientifically. It is believed to have over 5000 floral species of which anywhere between 500 species are considered by various experts to be medicinal plants (Ahmed *et al.* 2009). In fact, a survey report concluded that 39% of rural community members have knowledge about medicinal plants and 13% treat simple ailments with herbs (Khan and Chowdhury 2002). The medicinal plant sector in Bangladesh is recognized as a priority domain of intervention by many stakeholders. The sector is worth US$14 million with local supply comprised of 70% by volume and 40% by value (Dixie *et al*. 2003) with an estimate of around 12,000 tons of dried medicinal plants collected from rural and other naturally grown areas (Ahmed *et al.* 2009). Ahmed also reported the existence of about 500 herbal industries in Bangladesh of which 20 are reasonably large and consume 80% of the total raw material demands. In conjunction with the increasing demand for traditional medicines in the country, research is being conducted on both the ethno-botanical documentation and pharmacological evaluation of the medicinal plants amongst folk medicinal practitioners of various district of Bangladesh (Rahman *et al*. 2007). Previously ethnomedicinal surveys were conducted amongst folk medicinal practitioners in some parts of Noakhali and Feni (Rahmatullah *et al*. 2011). However, accurate documentation of these plant species through actual field surveys is more or less absent. Adequate documentation of such knowledge, and especially traditional medicinal practices, is important medicinal practitioners or healers through long association with plants around their vicinity have acquired quite extensive knowledge on the medicinal properties of these various plant species. However no such works have included the documentation of ethnomedicinal plants of rural people of Brahmanbaria District. Medicinal plants, their habitats and local knowledge of these plants are in danger because of so many factors such as lack of awareness, habitat loss due to deforestation, river erosion, modern agriculture, urbanization etc. If this situation is continuing, important medicinal plants will be lost before documentation.

WHO estimated that nearly 80% of rural population of world still depends on traditional medicines for their primary health care due to easy availability, low cost, effective in case

of chronic diseases and possible fewer side effects (Abramov 1996). Over the last 5 years, more than 800 ethnobotanical studies have quantitatively analyzed data; nearly 90% of these studies are about medicinal plants (Andrade-Cetto and Heinrich *et al*. 2011). In ethnobotanical studies, consensus analysis provides a measure of reliability for any given claim and providing reliable evidence (Heinrich *et al*. 1998). Consensus analysis also indicates the level of agreement in the use of plants between the plant users for particular ailments (Chassange *et al*. 2016). The proper selection of important medicinal plant species is a prerequisite to begin ethno-pharmacological, phytochemical and toxicological studies because of huge laboratory cost. For this purpose, it is necessary to determine the species that are most used to treat a particular illness. A useful tool to find these species is the informant consensus factor (Heinrich *et al.* 1998). The calculation of the informant consensus factor allowed a more objective selection of the species for the microbiological study in order to validate traditional knowledge (Canales *et al.* 2005). King *et al*. (1996) mentioned that it is possible to obtain at least 50% of success with the medicinal plants collected by this method.

Ethnomedicinal studies through informant consensus analysis were carried out in different countries of the world (Heinrich *et al.* 1998, Firedman *et al.* 1986, Canales *et al*. 2005, Gazzaneo *et al.* 2005, Megersa *et al*. 2013, Prasad *et al.* 2013, Teklehaymanot and Giday 2007, Trotter and Logan 1986, Lulekal *et al*. 2008, Bahmani *et al.* 2014, Abera 2014, Sadeghi *et al.* 2014, Idolo *et al*. 2010, Mussarat *et al.* 2014, Song *et al.* 2014, Dey *et al*. 2014, Bhat *et al*. 2014, Hong *et al.* 2015, Parthiben *et al* 2016, Chassange *et al*. 2016). In Bangladesh, investigation on ethnomedicinal plants is at the initial stage. Most noteworthy published articles are Hassan and Khan 1986, 1996, Mia and Huq 1988, Alam 1992, Alam *et al*. 1996, Ghani 2003,Yusuf *et al.* 2009, Uddin *et al.* 2001, Khan *et al.* 2002, Hassan and Uddin 2002, Uddin and Hassan 2014, Uddin and Roy 2007, Uddin *et al.* 2006, 2008, 2012, 2015, 2016, 2017, Haque *et al*. 2017, Haque and Uddin 2018, Sajib and Uddin 2013a, 2013b, Uddin and Sajib 2015, Uddin *et al.* 2011, 2014, 2015, Uddin *et al.* 2004, Uddin 2006, Khan *et al.* 2015, Rahman and Uddin 1998, Rahman 1999, 2010, Rahman 2014, 2015, Rahman *et al*. 2002, 2003, 2007, 2008, 2010, Rahman and Parvin 2014, Rahman and Karmaker 2015, Uddin *et al*. 2015, Yasmin and Rahman 2017, Faruque and Uddin 2011, 2014, Faruque *et al*. 2018, Islam and Rahman 2018, Khatun and Rahman 2019. All these articles (except few), using conventional ethnobotanical research methods, have been focused either list of medicinal plants with traditional uses or medicinal plants for particular diseases or communities. But such studies were failed in some extend to identify most important medicinal plants those are essential for further ethnopharmacological, phytochemical and toxicological studies. To overcome these drawbacks, quantitative ethnobotanical approach is essential for the selection of potential medicinal plants. These methods allow us to identify most potential, culturally important

and highly cited medicinal plants in Brahmanbaria district. More over the medicinal plants and health care knowledge of the selected district are vulnerable because of many threats *viz*., overpopulation and anthropogenic pressure, over harvesting, climate change and globalization, unwillingness of sharing knowledge etc. If situation is prevailing for the prolong time, the medicinal plants, habitats and traditional health care knowledge of the district will be lost forever before their proper scientific record and documentation. All such works have listed the medicinal plants of particular area or community with their medicinal uses and none of these studies except (Uddin and Hassan 2014, Uddin *et al*. 2015, Haque *et al.* 2017), considered any informant consensus technique or ethno-directed technique (Trotter and Logan 1986) for the analysis of medicinal uses of plants suitable for further study to find new drug sources. Cordell (2000) stated that this method plays a fundamental role in biodiversity prospecting. Since time does not allow us to evaluate all the existing medicinal plants scientifically, the proper selection of important plant species is a prerequisite to begin ethno-pharmacological, phytochemical and toxicological studies because of huge laboratory cost (Canales *et al*. 2005). Ethnopharmacological field studies are indispensable for identifying plants that can be selected for their pharmacological effects and chemical composition. One of the most important used tools to identify plants of particular intercultural relevance and to agree on their use is the informant consensus factors (Andrade-Cetto and Heinrich 2011). For this purpose, it is necessary to determine the species that are most used to treat a particular illness by particular culture using informant consensus technique.

Natural products including their derivatives and analogues still represent a major part of therapeutic alternatives (Anundaya *et al*. 2017). Medicinal plants play a key role in health care with about 80% of the world's populations relying on the use of traditional medicine which is predominantly based on plants (Owolabi *et al*. 2007). Plant derived medicines have made large contributions to human health (El-Astal *et al*. 2005). This is due to the significant healing power of the traditional medicinal systems (Adebolu and Oladimeji 2005). The effectiveness of an antimicrobial agent is a global public good (Karen 2010). Natural products from plant may offer new agents for antimicrobial use. A special feature of higher plants is their capacity to produce a large number of organic chemicals of high structural diversity the so called secondary metabolites (Naqvi *et al*. 1991). About 60 to 90% of populations in the developing countries use plant-derived medicine. Traditionally, crude plant extracts are used as herbal medicine for the treatment of human infectious diseases (Alviano and Alviano 2009, Malini *et al*. 2013). Global prevalence of infectious diseases caused by bacteria is a major public health problem (Zhang *et al*. 2006). The bacterial agents including *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis* and *Proteus vulgaris* cause several human infections (Cheesbrough 1984, Peirano 2008). Recent emergence of antibiotic

resistance and related toxicity issues limit the use of antimicrobial agents (Eggleston *et al*. 2010) and is prompting a revival in research of the antimicrobial role of plants against resistant strains due to comparable safety and efficacy (Alviano and Alviano 2009). The development of antibiotic resistant bacteria stems from a number of factors, including inappropriate use of antibiotics in human and animal health and their prolonged use as growth promoters at sub-clinical doses in poultry and livestock production (Elisha *et al*. 2017). Medicinal plants are expected to be the best source of obtaining a variety of drugs (Dwivedi and Wagay 2014). Ethnobotanical records suggest that plants are the sleeping giants of pharmaceutical industry and provide natural source of antimicrobial drugs that controlling some infectious diseases globally (Hostettmann and Hamburger 1991). The most interesting area of application for medicinal plant extracts is the inhibition of growth and reduction in numbers of the more serious pathogens. Global prevalence of infectious diseases caused by bacteria is a major public health problem. The evolution and spread of antibiotic resistance, as well as the evolution of new strains of disease causing agents, is of great concern today. This prompting a revival in research of the antimicrobial role of plants against resistant strains due to comparable safety and efficacy (Alviano and Alviano 2009).

Selection of important taxa using ethno-directed method is essential because of time does not allow to evaluate all existing medicinal plants scientifically from a particular area (Canales *et al*. 2005). Large number of plants in different location around the world have been extracted and semi-purified to investigate individually their antibacterial activity. The potential of higher plants as source for new drugs is still largely unexplored (Mahesh and Satish 2008). Although hundreds of plant species have been tested for antimicrobial properties but the majority have not yet been adequately evaluated. Ethnomedicinal plants should have to be investigated to better understand their properties, safety and efficiency (Ellof 1998). In Bangladesh, plant based antibacterial activities started at 1986 and few works have been done (Hoque *et al*. 1986, Rahman and Anower 2007, Rahman *et al*. 2008, Yasmin *et al*. 2009, Molla *et al*. 2010, Chowdhury *et al*. 2013, Ismail *et al*. 2013, Haque *et al*. 2014, Mostafa *et al*. 2014, Hossain *et al*. 2014, Islam *et al*. 2014, Tahia *et al*. 2017). None of these works were carried out antibacterial activity of ethnomedicinal plants by consensus analysis in a particular area. The proper selection of important ethnomedicinal plant species is a prerequisite to begin ethno-pharmacological, phytochemical and toxicological studies because of huge laboratory cost (Canales *et al*. 2005).

Literature survey revealed that no ethnobotany works so far been found on Brahmanbaria district. The district has long history of traditional knowledge and culture of medicinal use of plants. Presently such knowledge is eroding due to globalization of modern culture. Considering the above mentioned, the present study will be designed to document the ethnomedicinal uses of plants of Brahmabaria district, to find out the culturally important

medicinal plants for conservation, cultivation and utilization for future drug discovery program to cure illnesses of possible bacterial origin. More over the medicinal plants and health care knowledge of the district are vulnerable because of many threats *viz*., overpopulation and anthropogenic pressure, over harvesting, climate change and globalization, unwillingness of sharing knowledge etc.If situation is prevailing for the prolong time, the medicinal plants, habitats and traditional health care knowledge of the district will be lost forever before proper scientific record and documentation.In order to save the ethnomedicinal plants and their healthcare knowledge, Brahmanbaria district was selected. Therefore the present study was undertaken in addition to ethnomedicinal studies, also to carry out antibacterial activity of selected ethnomedicinal plant species selected through consensus analysis from Brahmanbaria district.

1.2. Aims and Objectives

- To record, integrate; document all the scattered distribution of traditional knowledge of ethnomedicinal plants.
- To determine ethnomedicinally potential and culturally important and most cited ethnomedicinal plant species.
- To select important ethnomedicinal plants of Brahmanbaria for antibacterial activity using informant consensus factor (F_{ic}), Fidelity level (Fl) and Citation frequency (Cf), Relative frequency of citation (RFC) and Use value (UV).
- To find out new etnomedicinal plants with their uses.
- To determine antibacterial activity using extracts from important ethnomedicinal plants.
- To determine the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) against selected bacterial strains.
- To determine the citotoxicity of important ethnomedicinal plants.
- To validate the knowledge of ethnomedicinal plants used by the people of Brahmanbaria scientifically.
- To find out the threats to ethnomedicinal plants in the natural habitats using preference ranking method.
- To suggest the measures for the conservation of potential medicinal plants of the district.

1.3. Background

1.3.1. Ethnomedicinal plant

Ethnomedicine is a study or comparison of the traditional medicine based on bioactive compounds in plants and animals and practiced by various ethnic groups, especially those with little access to western medicines, e.g., indigenous peoples. Often these traditions constitute significant interactions with insects as well, in Africa or around the globe. The word ethnomedicine is sometimes used as a synonym for traditional medicine (Meyer-Rochow 2017, Acharya *et al.* 2008).

Ethnomedical research is interdisciplinary; in its study of traditional medicines, it applies the methods of ethnobotany and medical anthropology. Often, the medicine traditions it studies are preserved only by oral tradition. .

Scientific ethnomedical studies constitute either anthropological research or drug discovery research. Anthropological studies examine the cultural perception and context of a traditional medicine. The purpose of drug discovery research is to identify and develop a marketable pharmaceutical product.

Ethnomedicine refers to the study of traditional medical practice which is concerned with the cultural interpretation of health, diseases and illness and also addresses the healthcare seeking process and healing practices (Kripper 2003). The practice of ethnomedicine is a complex multi-disciplinary system constituting the use of plants, spirituality and the natural environment and has been the source of healing for people for millennia (Lowe *et al*. 2000).

Research interest and activities in the area of ethnomedicine have increased tremendously in the last decade. Since the inception of the discipline, scientific research in ethnomedicine has made important contribution to the understanding of traditional subsistence, medical knowledge and practice. The explosion of the ethnomedicine literature has been stimulated by an increased awareness of the consequences of the forced displacement and/or acculturation of indigenous people, the recognition of indigenous health concepts as a means of maintaining ethnic identities, the search for new medical treatments and technologies.

1.3.2. Historical Background for the Medicinal plant as the source of drugs

Human beings have been utilizing plants for basic preventive and curative health care since time immemorial**.** As many as 35,000 – 70,000 species of plant have been used at one time or another for medicinal purposes (Farnsworth & Soejarto 1991). The oldest written evidence of medicinal plants' usage for preparation of drugs has been found on a Sumerian clay slab from Nagpur, approximately 5000 years old. It comprised 12 recipes

for drug preparation referring to over 250 various plants, some of them had alkaloid such as poppy, henbane, and mandrake. However, from those records, it is apparent that most of the early people, such as the Assyrians, Babylonians, Egyptians and ancient Hebrews, were familiar with the properties and use of many medicinal plants (Ghani 2003).

The practice of medicine using medicinal plants flourished most during the Greek civilization, when historical personalities like Hippocrates (born 460 BC) and Theophrastus (born 370 BC) practiced herbal medicine. The *materia medica* by Hippocrates listed around 400 medicinal plants and later the encyclopaedic work of Discordies, '*De materia medica'* (published in 78 AD), which featured about 600 medicinal plants, have been regarded as the forerunners of all modern pharmacopeias and authoritative texts on botanical medicine. In the Middle Ages, the great Greek Pharmacist physician, Galen (131-200 AD), wrote about 500 volumes describing hundreds of recipes and formulations containing a large number of medicinal plants. He was the first person to describe the procedures and methods of preparing therapeutic recipes, including the ingredients of both plant and animal origins. This doctrine, expatiated by Galen, has been the basis of allopathic and homeopathic systems of medicine practiced today (Stojanoski 1999).

The Chinese book on roots and grasses "Pen T'Sao," written by Emperor Shen Nung circa 2500 BC, treats 365 drugs (dried parts of medicinal plants), many of which are used even nowadays such as the following: Rhei rhisoma, camphor, Theae folium, Podophyllum, the great yellow gentian, ginseng, jimson weed, cinnamon bark, and ephedra (Kelly 2009).

The Indian holy books Vedas mention treatment with plants, which are abundant in that country. Numerous spice plants used even today originate from India: nutmeg, pepper, clove, etc. (Tucakov 1971). The Ebers Papyrus, written circa 1550 BC, represents a collection of 800 proscriptions referring to 700 plant species and drugs used for therapy such as pomegranate, castor oil plant, aloe, senna, garlic, onion, fig, willow, coriander, juniper, common centaury, etc.(Glesinger 1954). According to data from the Bible and the holy Jewish book the Talmud, during various rituals accompanying a treatment, aromatic plants were utilized such as myrtle and incense (Dimitrova 1999).

In Homer's epics The Iliad and The Odysseys, created circa 800 BC, 63 plant species from the Minoan, Mycenaean, and Egyptian Assyrian pharmacotherapy were referred to. As regards the plants from the genus Artemisia, which were believed to restore strength and protect health, their name was derived from the Greek word artemis, meaning "healthy" (Toplak 2005). Theophrastas (371-287 BC) founded botanical science with his books "De Causis Plantarium"— Plant Etiology and "De Historia Plantarium"—Plant History. In the books, he generated a classification of more than 500 medicinal plants known at that time (Pelagic 1970). In his work "De re medica" the renowned medical writer Celsus (25 BC–

50 AD) quoted approximately 250 medicinal plants such as aloe, henbane, flax, poppy, pepper, cinnamon, the star gentian, cardamom, false hellebore, etc.(Tucakov 1948).

In ancient history, the most prominent writer on plant drugs was Dioscorides, "the father of pharmacognosy," who, as a military physician and pharmacognosist of Nero's Army, studied medicinal plants wherever he travelled with the Roman Army. Circa 77 AD he wrote the work "De Materia Medica." This classical work of ancient history, translated many times, offers plenty of data on the medicinal plants constituting the basic materia medica until the late Middle Ages and the Renaissance (Thorwald 1991). Charles the Great (742 AD–814), the founder of the reputed medical school in Salerno, in his "Capitularies" ordered which medicinal plants were to be grown on the state-owned lands. Around 100 different plants were quoted, which have been used till present days such as sage, sea onion, iris, mint, common centaury, poppy, marsh mallow, etc. (Celakoski 1997).

Marco Polo's journeys (1254-1324) in tropical Asia, China, and Persia, the discovery of America (1492), and Vasco De Gama's journeys to India (1498), resulted in many medicinal plants being brought into Europe (Nikolovski 1961).

Paracelsus (1493-1541) was one of the proponents of chemically prepared drugs out of raw plants and mineral substances; nonetheless, he was a firm believer that the collection of those substances ought to be astrologically determined. He continuously emphasized his belief in observation, and simultaneously supported the "Signatura doctrinae"—the signature doctrine (Tucakov 1990). In 18th century, in his work Species Plantarium (1753), Linnaeus (1707-1788) provided a brief description and classification of the species described until then. The species were described and named without taking into consideration whether some of them had previously been described somewhere (Jancic 2002). Early 19th century was a turning point in the knowledge and use of medicinal plants. The discovery, substantiation, and isolation of alkaloids from poppy (1806), ipecacuanha (1817), strychnos (1817), quinine (1820), pomegranate (1878), and other plants, then the isolation of glycosides, marked the beginning of scientific pharmacy. With the upgrading of the chemical methods, other active substances from medicinal plants were also discovered such as tannins, saponosides, etheric oils, vitamins, hormones etc. (Dervendzi 1992).

In late 19th and early 20th centuries, there was a great danger of elimination of medicinal plants from therapy. Many authors wrote that drugs obtained from them had many shortcomings due to the destructive action of enzymes, which cause fundamental changes during the process of medicinal plants drying, i.e. medicinal plants' healing action depends on the mode of drying. (Lukic 1985). Since time immemorial people have tried to find medications to alleviate pain and cure different illnesses. In every period, every

successive century from the development of humankind and advanced civilizations, the healing properties of certain medicinal plants were identified, noted, and conveyed to the successive generations. The benefits of one society were passed on to another, which upgraded the old properties, discovered new ones, till present days (Petrovska 2012).

1.3.3 Market of medicinal plant

Studies have been carried out globally to verify efficacy of medicinal plant and some of the findings have led to the production of plant-based medicines. Among the 422,000 species of plants in the world 12.5% are reported to have a medicinal value (Rao *et al*. 2004). The global market value of medicinal plant products exceeds $100 billion per annum (Sofowora *et al*. 2013). The largest global markets for medicinal plants are China, France, Germany, Italy, Japan, Spain, the UK and the US, while Japan has the highest per capita consumption of botanical medicines in the world. In the US and Europe, the trade has typically been growing at an average of 10 % per annum, partly because of the popularity of alternative treatments and partly because there is increasing official recognition of the benefits of traditional medical systems involving herbal preparations. China's total output of medicinal plants from both cultivated and wild- harvested sources is 1.6 million tons (Kuipers 1997). The botanical medicine market in Japan in 1996 was estimated at US$2.4 billion with a rapid sales growth in recent years as Japanese doctors increasingly incorporate TCM as a complement to western medicine. Europe is a major world trader in medicinal plants. At least 2,000 medicinal plants species are traded, of which two thirds (1,200-1,300 species) are native to the continent (Lange and Schippmann 1997). The latter viewed it more precisely as the increasing demand and considerably large volume of global trade (with an annual 15% market growth and around $ 60 billion turnover in the year 2000) has already built a distinct market niche for medicinal plants, not only in the healthcare market but also in the food and cosmetics markets. Therefore this study terms it as an herbal medicine market. In Bangladesh, this herbal medicine market mainly consists of the *Ayurvedic, Unani* and Homeopathic systems.

Apart from these, medicinal plants are also used by local medicine practitioners in folk medicine, and for self- treatment purposes. As in the folk and self-treatment systems, commoditization or a formal market system is virtually nonexistent; this study excludes them from the final analysis Among the available literature on medicinal plants of Bangladesh, were the first to estimate that the annual use of medicinal plants amounted to more than a thousand metric tons when considering only the traditional medicines manufacturing units (*Unani* and *Auyrved* factories). However, with the annual market growth rate compounding 10-17% invariably a sectoral study by Dixie *et al*. (2003) gave the latest annual turnover figure as 17,500 MT (metric ton) of medicinal plants and plant-derived semi processed materials used in *Unani*, *Ayurvedic,* Homeopath and Self-treatment medications. Based on the reports by the Bangladesh Scientific Research Council

(BCSIR), Bangladesh Forest Research Institute (BFRI), *Bangladesh Homeopathic Unani Ayurvedic Federation*, and from the sectoral overview report of SEDF, and considering the growth rates, it is estimated that in terms of value the size of herbal medicines market in Bangladesh is Tk. 3,600 Million (US $ 52.95) in 2005 where the *Unani* enjoys majority share amounting to Tk. 1800 m (US$ 26.48 m), *Ayurvedic* 1200 million (US$ 17.43 m), and Homeopath 600 m (US$ 8.76 m).

1.3.4. Medicinal plants and the Bangladesh economy

Commercial cultivation of medicinal plants is gaining momentum in Bangladesh due to the potential market for these plants both at home and abroad. Considering the market potential and the shortfall from natural sources it is argued that commercial cultivation could provide a good alternative and enduring livelihood for local communities as well as protecting the natural resource base of medicinal plants. However, there is very limited information on medicinal plants, especially their socio-economic attributes, policy imperatives and research issues in the context of Bangladesh (Khan and Rashid 2006). It is estimated that some 12,500 tons of dried medicinal plant material produced in Bangladesh is sold. These products are worth some Tk 255 million ($4.5 million) to the rural economy and around Tk.330M ($5.8M) at the factory rate/wholesale. The 5,000 tons of imported medicinal plants cost around Tk 480 million ($8 million).It is believed that there are around 350 inter-district *beparis* who are serviced by 6,000 to 10,000 local collectors, pikers and growers. In total there are said to be around 200 Unani and 200 Ayuverdic registered factories, plus some 70 homeopathic factories. Collectively they will employ 2,000 to 4,000 people. In addition, there are said to be 5,000 qualified and 80,000 unqualified herbal practitioners in the country (Dixie *et al.* 2003).

1.3.5. Informant Consensus Factor

The factor of informant consensus is particularly useful to select the categories of diseases for which the species are traditionally used. One of the most widely used tools is the factor of informant consensus (Fic). Its current form, proposed by Heinrich *et al*. (1998), was based on a similar but not identical definition first introduced by Trotter and Logan (1986). Fic values range from 0.00 to 1.00. High Fic values are obtained when only one or a few plant species are reported to be used by a high proportion of informants to treat a particular category, whereas low Fic values indicate that informants disagree over which plant to use. As a result of this analysis, it was possible to identify species of particular importance within a culture (intercultural) and to compare different cultures. Over the last 5 years this tool was used at least in 70 publications mainly to analyze the use of plant species in different ethnographic backgrounds; recent examples include Jacob and Shenbargaraman (2011) in Mexico; Oliveira *et al.* (2010) in Brazil; Teklehaymanot and Giday (2009) in Ethiopia. The main use of Fic is to select disease categories where

there is consensus on the use of plants among the informants and to identify species with particular importance in a culture.

1.3.6. Antibacterial activities

An antimicrobial is a substance that kills or inhibits the growth of microorganism, such as bacteria, fungi, nematode. Many plants, due to some chemical constituents they possess, show mild to remarkable activities against some bacteria are known as "antibacterial activities". Medicinal plants represent a rich source of antimicrobial agents and of many potent and powerful drugs. The antimicrobial potency of the test agents are measured by their activity to prevent the growth of the microorganisms surrounding the discs which gives clear zone of inhibition. After incubation, the antimicrobial activities of the test materials were determined by measuring the diameter of the zones of inhibition in millimeter with a transparent scale.

1.4. Literature review: Relevant research in Bangladesh

In Bangladesh, Ethnobotany although has arisen as a very recent subject, a few working teams have been established. In the University of Dhaka a working team has been working under the leadership of Professor M. A. Hassan, where as in the University of Chittagong another working team has been developed under the leadership of Professor M. Atiqur Rahman and Professor Sheikh Bokhtear Uddin. Besides there two teams there are experts working on the ethno botany at BFRI and BCSIR Chittagong and also at Bangladesh National Herbarium, Dhaka. At the moment ethnobotanical research has gathered momentum in Bangladesh. In the meantime a good number of papers have already been published. Hassan and Khan (1986) are the pioneer contributors on the ethnobotanical studies in Bangladesh. Hassan and Khan (1986) recorded ethnobotanical uses of plants for healing fractured bones. They made a list of 9 plant species, used by local village kabiraj, 10 districts of Bangladesh. Haque *et al.* (1986) demonstrated experimentally the antibacterial activity of five species of *Persicaria* (*Polygonum*). Latter on only a few works have been accomplished from Bangladesh up to date Hassan and Khan (1986, 1996), Hassan (1988), Mia and Huq (1988), Alam (1992), Alam *et al*. (1996), Uddin *et al.* (2001), Hassan and Uddin (2002).

Mia and Huq (1988), studied a preliminary ethnobotanical survey in the Jointapur, Tamabil and Jaflong (Jointapur Upazilla), of Sylhet district. They documented 63 plant species for different uses. Preliminary ethnobotanical survey on Sandwip Island was also compiled and findings were published by Mia and Rahman, 1990. A book in Bengali on herbal medicine by Hassan (1988) is also available. Alam (1992) described the medical ethno botany of the Marma tribe in Bangladesh. Alam *et al.* (1996) reported 96 plant species and 143 folk formularies against 53 common human diseases from Bangladesh. BFRI,

UNESCO and ICIMOD Jointly arranged a sub-regional training workshop on applied ethno botany (Proceedings of the sub regional training workshop on applied ethnobotany) in Bangladesh, at BFRI, Chittagong (December 17-22, 1997). The whole documents of this training workshop on applied ethnobotany was published, named Applied Ethnobotany (Banik *et al.* 1998).

Khan *et al.* (2002) described the result of ethnobotanical survey in Rema-Kalenga wildlife sanctuary (Habiganj) in Bangladesh. They documented 84 plant species are used for medicine, 9 as the ingredients for indigenous alcohol, 10 in religious festivals, 22 as ornamentals, 31 as vegetables, 27 as edible fruits and 16 as pesticides materials by the ethnic group of Kalenga (mainly Deb-berma/Tripuri). Partha and Hossain (2002) described how nature and environment conserved by ethno conservational practices of 14 ethnic communities of Bangladesh. Partha and Hossain (2003) documented 53 plant species used by Chakma ethnic communities of Ghagra areas of Bangladesh.

Professor Md. Zashim Uddin from Dhaka University has been working for ethnomedicinal plants from Bangladesh focusing medicinal formularies and quantitative analysis of medicinal plant species. Uddin *et al.* (2001) described the ethnomedical plants of Kalenga forest range (Habiganj, Bangladesh) for Malaria, Jaundice, diarrhea and dysentery. Among eight ethnic communities (Deb-Barma/Tippera, Urang, Kharia, Santal, Goala, Munda, Kurmi and Bunargi) of this reserved forest area, they have preferred Deb-Barma/ Tippera (the largest ethnic community in this area), for their investigation. A total of 27 plant species were recorded by them. Out of these 27 species listed, 7 were recorded to be useful in malaria, and Jaundice, while 11 in diarrhoea and dysentery. Ethnobotanical survey in Rema-Kalenga wildlife sanctuary (Habigonj) in Bangladesh were done Khan *et al*. (2002). They recorded 84 plant species are used for medicine, 9 as ingredients for indigenous alcohol, 10 in religious festivals, 22 as ornamentals, 31 as vegetables, 27 as edible fruits and 16 as pesticidal materials.

Uddin *et al*. (2004) described 183 plants used by ethnic peoples. Major threats to medicinal plants Identified and some recommendation for sustainable use and conservation of those plants given. Uddin *et al*. (2006) has revealed a total of 86 species used as medicinal plants by the Santal community of Phulbariupazila indinajpur district. Santal names, part/s used as medicine and diseases to be treated with each plant have been presented. Uddin *et al*. (2012) studied the use of medicinal plants for primary health care by the local people in and around the Lawachara National Park. A total of 56 plant species under 30 families with 70 formularies (treatment mode) have been documented. Uddin *et al.* (2014) 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. Uddin *et al.* (2014), Investigation and documentation of the status of medicinal plants and associated knowledge was conducted in Rangamati district of Bangladesh. 50 medicinal plant species in 49 genera fewer than 34 families were recorded which are used to treat 28 different ailments. Uddin *et al.* (2015) were conducted an ethnomedicinal survey at feni district in Bangladesh and recorded 115 medicinal plant species belongs to 55 families with 216 formularies to treat 69 ailments. Such data indicated that the study area has plenty of medicinal plants with their diversity of health care uses.Uddin *et al*. (2017) conducted the Consensus of the people's healthcare knowledge of ethnomedicinal plants in and around Lawachara national park. A total of 124 medicinal plant species with 245 formularies to treat 53 ailments were recorded. Uddin *et al*. (2019) recorded 41 ethnomedicinal plants for prevention of cardiovascular disease in Bangladesh.

Haque *et al*. 2017, carried out ethnobotanical survey using mainly key informant's interview and also followed by group discussion, field interviews and plant interviews for the treatment of diabetes in Brahmmanbaria district of Bangladesh. The study has been resulted in recording of total 39 medicinal plant species under 29 families. Haque and Uddin 2018, conducted ethnomedicinal survey focuses plant species used in beauty care and cosmetics from Dhaka resulted in recording of total 43 plants under 32 families under 40 genera.

Rahman *et al.* (2003) described indigenous knowledge of herbal medicine in Bangladesh 2: diarrhoea, dysentery, indigestion and stomach pains. Rahman *et al*. (2007) described Medicinal plants used by *Chakma* tribe in Hill Tracts districts of Bangladesh. Rahman (2010) documented Indigenous knowledge of herbal medicine in Bangladesh 3: Treatment of skin diseases by tribal communities of the Hill Tracts districts. Rahmatullah *et al*. (2010) carried out a survey in six districts of Bangladesh. A total of 32 medicinal plants distributed into 23 families were obtained in their survey. Chowdhury *et al.* (2011) documented ethnobotanical uses of plants at two hilly area of Sylhet in Bangladesh. The study identified 26 species belonging 18 families that are being used in traditional health care.

Uddin *et al.* (2011) carried out an ethnobotanical uses of plants were examined at two hilly area of sylhet in Bangladesh. The study identified 26 species belonging 18 families that are being used in traditional health care. Uddin *et al.* (2013) carried out an ethnobotanical survey on the utilization of medicinal plants by Rakhaing community. Total 82 plant species in 77 genera under 51 families with their short botanical description, local (Rakhaing)

names, medicinal use, mode of preparation and application have been documented. Uddin *et al*. (2014) recorded 50 medicinal plants from chakma community of Bandarban district. Sajib and Uddin (2015), an ethnomedicinal survey of the rural community, mainly Chakma from Hathazari, Bangladesh, was conducted. A total of 75 plant species consisting of 67 genera categorized under 44 families were documented for the treatment of 35 ailments. Uddin *et al*. (2015), carried out an ethnomedicinal survey used by the Lushai community from Bandarban district in Bangladesh. Result of this survey includes 53 ethnomedicinal plants of 49 genera belonging to 34 families is featured in popular antidysentery and antidiarrhoeal activities. Among which 37 plant species were used for diarrhoea, 40 for dysentery, and 24 for both diarrhoea and dysentery. Uddin *et al.* 2018 ducumented 82 ethnomedicinal plant species from the Rakhaing community of coxs bazar district.

Faruque and Uddin (2014) recorded 43 medicinal plants of tripura community of Hathhazari in Chittagong. Faruque and Uddin (2014) recorded 66 medicinal species from marma community of Bandarban district, Bangladesh. Faruque *et al*. 2018 recorded 159 ethnomedicinal plant species from the traditional healers of three indigenous communities of Bandarban districts of Bangladesh. Uddin *et al*. 2004 studied the preliminary ethnomedicinal plant survey in Khagrachari district, Bangladesh. Uddin (2006) recorded traditional plants of the chittagong Hill tracts. Uddin *et al*. (2016) published a book named Ethnomedicinal plants of Bangladesh. Salahuddin *et al.* (2015) recorded 10 ethnomedicinal plants from Narshingdhi districts of Bangladesh. Rahman (2013) has been carried out ethno-medicinal investigation into ethnic communities of 12 Upazillas under six districts in the northern region of Bangladesh. A total of 24 species under 13 genera of the family Cucurbitaceae collected and recorded for their use in various ailments. Rahman and Parvin (2014) has studied the medicinal plants of Fabaceae family at Rajshahi district. Rahman (2014) studied carried out ethno-gynoecological study of traditional medicinal plants. Rahman (2015) has been carried out ethnobotanical survey of antidiabetic medicinal plants used by the santal tribe of Joypurhat district. Islam and Rahman (2018) studied folk medicinal plant of santal tribal practitioners against Dirrhoea and Dysentery in tangore upazila of Rajshahi district recording recorded 20 plant species. Khatun and Rahman (2019) carried out an ethnobotanical investigation on traditional medicinal plants used by Santal tribal people of Nawabganj upazila of Dinajpur district, Bangladesh which documented 105 plant species. Kabir *et al*. (2014) carried out a survey of medicinal plants used by the Deb barma clan of the Tripura tribe of Moulvibazar district, Bangladesh. The clan had a total of 135 people distributed into 20 households and had only one traditional healer. The healer used a total of 44 medicinal plants distributed into 34 families for treatment of various ailments like pain, coughs, cold, gastrointestinal disorders, cuts and wounds, diabetes, malaria, heart disorders, and paralysis. Ocvirk *et al.* (2013) conducted an ethnobotanical survey in urban areas of Dhaka, Bangladeh. In total

37 medicinal plants belonging to 25 families were reported as being used for the treatment of diabetes in Bangladesh. The most frequently mentioned plants were *Coccinia indica*, *Azadirachta indica*, *Trigonella foenum-graecum*, *Syzygium cumini*, *Terminalia chebula*, *Ficus racemosa*, *Momordica charantia*, *Swietenia mahagoni*. Khan *et al*. (2015) carried out an ethnomedicinal survey of various communities residing in Garo hills of Durgapur, Bangladesh. A total of 71 plants from 46 families and 64 genera were documented during our survey. Gastrointestinal disorders represented the major ailment category with the use of 36 plant species followed by dermatological problems (25 species). The informant consensus factor ranged from 0.90 to 0.99, with an average value of 0.96.

1.5. Relevant research in Ethnomedicinal plants and Informant consensus factor

Informant consensus term originally developed by Trotter and Logan (1986) and applied by Heinrich *et al*. (1998). Informant consensus factor (Fic) was used to identify plants of particular intercultural relevance and to agree on their use. It was originally used to analyze three populations with culturally different backgrounds in Mexico. To use Fic, it is necessary to classify illnesses into broad disease categories (several diseases based on the organ systems in one category). The original categories used by Heinrich *et al*. (1998) include conditions common to all five ethnic groups in Mexico: (1) gastrointestinal, (2) dermatological (mostly infections and subsequent inflammatory reactions), (3) respiratory, and (4) gynecological and andrological. They also compared illnesses deemed to be specific to one or two cultures such as "poisonous animal bites and stings" (Maya); ophthalmological illnesses (Maya and Zapotecs); and culture-bound syndromes (Nahua and Zapotecs). After that research Fic field has been widely accomplished in several countries around the world.

Another study was reported from the village of Zapotitlán de las Salinas is situated in the Valley of Tehuacán-Cuicatlán, Puebla, Mexico. Plant species used by the local inhabitants to treat gastrointestinal diseases were identified using ethnobotanical, ethnographic and taxonomic methods. Out of 119 interviews, 44 plant species were registered, of which the following are the most frequently used. From these plants, hexane, chloroform and ethanol extracts were prepared in order to assess their antibacterial activity against 14 bacterial strains causing the most common gastrointestinal diseases in Mexican population. All hexane extracts showed antibacterial activity against Gram-positive and Gram-negative bacteria. There is a correlation between the frequency of mention (of plant use) and the antibacterial activity. In conclusion, the knowledge of plants most frequently used for gastrointestinal infections in Zapotitlán de las Salinas is supported by scientific rationale (Hernandez *et al*. 2003). In Mexico, another study carried out by Canales *et al*. (2005) where 46 species of medicinal plants have been recorded. Among them 16 species were selected based upon informant consensus factor for the antibacterial test where 75% of the plants presented antibacterial activity.

Ethnomedicinal survey in Uttara Kannada district of Karnataka, India revealed uses of 106 plants in traditional practices for curing various types of wounds. The statistical analysis confirmed high degree of sharing the knowledge amongst 44 key informants. The different types of wounds treated by traditional healers are classified into 15 categories and the highest informant consensus factor scored is for the burns (0.66). Information about the largest number of remedies was obtained from the Havyaka Brahmin ethnic community which has strong Sanskrit background (Bhat *et al.* 2012). In Western Ghat of south India, a consensus of use of medicinal plants have been carried out which reported a total of 95 species belonging to 50 families used for medicinal and general health purposes. The consensus analysis revealed a high level of agreement among the informants usage of a particular plant at a local scale. The average consensus index value of an informant was FIC > 0.71, and over 0.80 for some ailments such as respiratory and jaundice. Their research sheds some light on a traditional culture that believes that a healthy lifestyle is founded on a healthy environment and we suggest that traditional aboriginal knowledge such as that of the Malasars may serve toward a global lifestyle of health and environmental sustainability (Raghupathy *et al.* 2008). There are 54 meidicinal plant species have been recorded from Tamil nadu of India for the treatment of 12 ailments category. Highest informant consensus value found for the treatment of urological category (Parthiban *et al*. 2016).

An ethnobotanical survey of medicinal plants was carried out in Iran by Bahmani *et al.* (2014). There were 30 medicinal plants from 17 families for the treatment of diabetes. The family with most plants was Lamiaceae (20%). Leaves (20%) are often used and its form is decoction (70%). It was also found that *Citrullus colocynthis* has the most frequency of use among traditional healers. Conclusions: Furthermore, based on current findings many of the mentioned plants have potential active ingredients to influence diabetes. Another report found in Iran which was recorded eighty ethnomedicinal plant species for the treatment of gynecological problems. Result of informant consensus factor showed that menstrual problems (0.87) and vaginal infection (0.74) were the most common problems of women in the studied area. The use value and informant consensus factor validated that the relative importance of plant species and shared knowledge of herbal therapies between Baluch womenfolk of this area is still rich (Sadeghia and Mahmood 2014). In Northeast Cambodia, 214 medicinal plant species have been used by the bunong people in order to treat 51 different ailments. Most of the species reported for the treatment of the 11 most frequent ailments have already been proven to be efficient and safe (Chassagne *et al*. 2016). In Pakistan, 70 plant species recorded where highest Fic values (0.80) were obtained each for gastrointestinal and kidney problems followed by respiratory infections (0.72) and Skin infections (0.73). The results showed high dependency of local inhabitants on medicinal plants in meeting their primary health care needs (Mussarat *et*

al. 2014). Another study from Pakistan reported total of 102 plant species belonging to 47 families were reported for the medicinal purposes. Asteraceae was found to be dominant family in terms of species in the area with 11 species. Highest ICF value (1) was recorded for antidote category. 100% fidelity level was found for four plant species i.e. *Achillea welhemsii, Caralluma tuberculata, Citrullus colocynthis, and Seripidium quettense*. The highest use value was reported for the *Acroptilon repens* (0.5) while highest RFC value was calculated for *Berberis balochistanica* and *Citrullus colocynthis* (0.18) (Bibi *et al*. 2014).

An ethnobotanical study of medicinal plants was carried out in the west region of Algeria and the results have identified 39 medicinal plants. This work showed that the leaves and seeds are the most used parts and most of the remedies are prepared as is brewing. In terms of the treated diseases, digestive disorders rank first with a rate of (42.5%), followed by skin diseases (17.5%), rheumatism (10.0%) Face care (5.0%). They could be a database for future research in a phyto-botany and Pharmacognosy studies (Hammadi *et al*. 2015). In Ethiopia, 135 ethnomedicinal plants were recorded where Highest ICF values found from gastrointestinal, parasitic and dermatological disease categories (Each 0.7) (Lulekal *et al*. 2013). Another study from Ethiopia reported 126 medicinal plants for their healthcare treatment (Megersa *et al*. 2013). An ethnobotanical survey carried out in Ethiopia which reported 120 medicinal plants used in traditional health care practices. Among them 108 species were used for treatment for the human disease (Bekalo *et al*. 2009). In southeast Ethiopia 49 ethnomedicinal plants were used to treat various human ailments (Abera 2014). A total of 173 medicinal plants were collected and identified that were distributed across 77 families and 156 genera from Northern Ethiopia to the treatment of many of the described diseases. The informant consensus factor (ICF) was calculated. The highest values were obtained for febrile illness and tonsillitis (0.866) followed by abdominal pain, diarrhea, tapeworm, amoeba and gastritis (0.645), and wound, skin rash, cutaneous leishmaniasis, ringworm, irritation, and skin rash (0.458) (Kidane *et al*. 2018). In Southwester Ethiopia, sixty seven ethnomedicinal plants used by the traditional healers to manage 51 different ailments. High degree of consensus was observed to treat medicinal plants for tumor, rabies and insect bites (Yineger *et al*. 2008).

In Brazil, an ethnobotanical survey conducted where information were collected from local people concerning the use of medicinal plant species from Atlantic forest area. In this study 125 medicinal plants reported for the treatment of mostly blood related disease, disease related with respiratory and digestive disorder (Gazzaneo *et al*. 2005).

A total of 190 plant species in 61 families and 152 genera were reported from Uganda in the treatment of various health conditions. Leaves (68 %) were the most frequently used parts in preparing herbal remedies. Decoctions (29 %) and oral route (53 %) of administration were commonly used method of herbal medicine preparation and

administration respectively. Fifty-eight health conditions grouped in 25 categories were treated using medicinal plants. Informant consensus agreement was highest for blood system disorders (0.9) that included anaemia, hypertension and blood cleansing indicating homogeneity of informant's knowledge about remedies used (Togume *et al*. 2016). In China, An ethnobotanical data were collected and the result showed that a total of 368 medicinal plant species were investigated and documented together with their medicinal uses by the Maonans (Hong *et al.* 2015).

In Korea, 200 species were belonging to 168 genera and 87 families were utilized traditionally in 1682 ethnomedicinal practices. The ICF values in the ailments categories were muscular- skeletal disorder (0.98), the ranking followed with remarks from informants related to concerns of pain (0.97), respiratory system disorders (0.97), liver complaints (0.97), and cuts and wounds (0.96). The lowest degree of consensus was birth-related disorders (Song *et al*. 2014).

In Madagascar, a total of 253 medicinal plant species belonging to 198 genera and 75 families were invented. *Leonotis nepetifolia* (Fl= 96%) and *Strychnos henningsii* (Fl=92%) are plant species claimed by high percentage of informants to treat the digestive system disorder (Randrianarivony *et al*. 2017)

1.6. Relevant research in antibacterial activity of ethnomedicinal plants

Research on antibacterial activity of medicinal plants have been in progress in different location of the world. In South Texas of America, antibacterial properties of commom herbal remedies were analyzed. The result revealed that ten plants consistently inhibited bacterial growth of *Staphylococcus aureus*. The result concluded that some of the herbal remedies used in folk medicine are potentially effective antibacterial agents against *S aureus* (Romero *et al.* 2005).

Antibacterial activity of some Brazilian medicinal plants was carried out by Lima *et al*. (2006). 25 plants of Brazilian traditional medicine were assayed with respect to their antibacterial activities against *E. coli* and *S. aureus*. Among 49 extracts studied, 14 presented antibacterial activity.

Antibacterial activity of traditional medicinal plants used by Haudenosaunee peoples of New York State reported four plant species exhibited antimicrobial properties as expected (*Achillea millefolium, Ipomoea pandurata, Hieracium pilosella* and *Solidago canadensis*), with particularly strong effectiveness against *S. typhimurium*. In addition, extractions from two of the introduced species (*Hesperis matronalis* and *Rosa multiflora*) were effective against this pathogen (Frey and Meyers 2010).

Bisi-Johnson *et al*. 2017 reported antibacterial activity of crude extracts of some South African medicinal plants against multidrug resistant etiological agents of diarrhoea. Most of

the tested organisms were sensitive to the crude acetone extracts with minimum inhibitory concentration (MIC) values ranging from 0.018–2.5 mg/mℓ. Extracts of *A. striata, C. uncinulata, E. autumnalis* and *P. guajava* were more active against enteropathogens. *S. aureus* and *Sh. flexneri* were the most sensitive isolates to the crude extracts but of significance is the antibacterial activity of *A. arborescens* and *P. guajava* against a confirmed extended spectrum betalactamase positive *S. enterica* serovar Typhimurium.

Antibacterial activity of medicinal plants have been conducted throughout the world but those research were not carried out by selecting ethnomedicinal plants through consensus analysis. Only fewer works has been done and it was first introduced by Hernandez *et al*. (2003). They registered 44 plant species and from these plants, hexane, chloroform and ethanol extracts were prepared in order to assess their antibacterial activity against 14 bacterial strains causing the most common gastrointestinal diseases in Mexican population. All hexane extracts showed antibacterial activity against Gram-positive and Gram-negative bacteria. There is a correlation between the frequency of mention (of plant use) and the antibacterial activity. In conclusion, the knowledge of plants most frequently used for gastrointestinal infections in Zapotitlán de las Salinas is supported by scientific rationale.

Canales *et al*. (2005) carried out antibacterial activity of medicinal plants in Mexico and 46 species were reported. Among them 16 species were selected for further antibacterial test where 75% plants were showed antibacterial activity.

In Bangladesh, first paper on the antibacterial activities of plant materials was published by Hoque *et al*. (1986). Since then works on the antibacterial and antimicrobial activities of plant materials are on gradual increase (Hoque *et al*. 1989; Islam *et al*. 2008; Hasan *et al*. 2009; Rahman *et al.* 2009; Molla 2010, Hassan *et al.* 2011, Oly *et al.* 2011, Mostofa et al. 2014, Hossain *et al.* 2014, Haque *et al*. 2014, Begum *et al.* 2015).

Molla *et al.* (2010) reported antibacterial activity of seven bitter medicinal plant of Bangladesh. All the extracts have notable antimicrobial activities against the test organisms. The extract of the plants had MIC values ranging from 32 to 128 mg/ml.The results revealed that the ethanolic extracts of the plants under present investigation have notable antimicrobial activities.

Oly *et al.* (2011), carried out antimicrobial Activity of *Clerodendrum viscosum* (Verbenaceae) and the result of the potential of *C. viscosum* will be creative for developing a broad spectrum antimicrobial formulation.

Mostofa *et al*. (2014) conducted the antibacterial activity of the hexane, methanol, and water extracts of *Tamarindus indica, Azadirachta indica, Cucumis sativus, Eucalyptus camaldulensis, Switenia mahagoni,* and *Psidium guajava* extensively used in traditional

medicine were investigated. The results of this study support the traditional uses of these medicinal plants as antibacterial agents.

Hossain *et al.* (2014) coducted antibacterial Activities of the Methanolic Extract of Bangladeshi Black Tea against Various Human Pathogens and the result showed that extract of Bangladeshi black tea demonstrated potential antibacterial activity in a dose dependent manner against all of the tested bacteria and exhibited highest activity against two common enteric pathogens, *Shigella boydii* and *Vibrio cholerae* with MIC and MBC of 200 µg/ml and 1 mg/ml respectively. Their results indicate that black tea extract can be used as therapeutic to control these deadly pathogens. Haque *el al*. (2014) reported the propagation, antibacterial activity and phytochemistry of *Litsea glutinosa*. Both the ethanolic and water soluble extracts of the leaves and bark showed against *Escherichia coli, Enterobacter intermedium, Salmonella sp., Staphylococcus aureus and Staphylococcus epidermis.* Begum *et al*. (2015) conducted potential In-Vivo Evaluation of Analgesic Investigation of *Mangifera indica* and antimicrobial Activity of *Areca catechu.* The result showed that the crude extracts of Carbon tetrachloride of *Areca catechu*, Methanol & Pet ether were screened for antimicrobial activity against gram positive and gram negative bacteria and fungi using disk diffusion method. The results obtained were compared with that of standard drug kanamycin. The Carbon tetrachloride extract showed mild sensitivity to several gram positive, gram negative bacteria & Fungi (zone of inhibition 9-10 mm).

Chapter 2
Materials and Methods

2.1. Description of the study area

2.1.1: Topography: Brahmanbaria is a district in east-central Bangladesh lies between 23°57′10″ and 23.9528° N latitude and between 91.07′00″ and 91.1167° E longitudes (Plat1-1). It is a part of the Chottogram Division. It was part of greater Comilla District until 1984. It has a total area of 1927.11 km². Brahmanbaria is bounded by Kishoreganj District and Habiganj District on the north, Comilla District on the south, Habiganj District and Tripura State, India on the east and Meghna River, Kishoreganj, Narsingdi District and Narayanganj District on the west. The district divided into nine upazilas including Akhaura, Sorail, Nabinagar, Nasirnagar, Brahmanbaria sadar, Bancharampur, Bijoynagar, Kosba and Ashuganj.

2.1.2: Population: Total population of Brahmmanbaria is 2,840,498 & density 1,500/ km^2 (Bangladesh population and housing census 2011).Literacy and educational institutions average literacy 26.6%; male 32.7% and female 20.3%. Main occupations Agriculture 44.79%, agricultural laborer 15.82%, wage laborer 3.13%, commerce 12.26%, service 6.8%, fishing 2.02% and transport 1.85%, weaving 2.39% and others 10.94%.

Table 2.1. Informations of nine upazilas (Source Bangladesh Population Census 2001, Bangladesh Bureau of Statistics).

Others Information of District								
Name of upazila	**Area (sq km)**	**Municipality**	**Union**	**Mouza**	**Village**	**Population**	**Density (per sq km)**	**Literacy rate (%)**
Akhaura	99.28	1	5	107	113	130319	1313	50.0
Ashuganj	67.59	-	7	30	38	145828	2158	46.2
Kasba	209.76	1	10	160	222	271231	1293	43.5
Nabinagar	353.66	1	20	155	196	420383	1189	37.9
Nasirnagar	311.66	-	13	100	129	255668	820	27.8
Banchharampur	217.38	-	13	76	118	278240	1280	35.0
Brahmanbaria Sadar	440.55	1	21	320	375	625484	1420	44.3
Sarail	227.22	-	9	76	140	271101	1193	32.9

2.1.3: Geography: The geography of the district is characterized by low-lying land with small hills and hillocks of red soil. The annual highest average temperature is 34.3°C and lowest 12.7°C. Total annual rainfall is 2551 mm. The main rivers of the district are the Meghna River, the Titas River, Buri and Haora. (Musa and Muhammad 1998).

2.1.4: Climate: Brahmanbaria has a tropical wet and dry climate. During summer it is extremely hot. August is the hottest month and January is the coldest. Floods are a major concern for people in Brahmanbaria, as the city has suffered from flooding for four times in a decade. Tornados and the monsoon Kaalboishakhi jhor hit almost every year.

Table 2.2. Climate data for Brahmanbaria district ("Brahmanbaria, Bangladesh Travel Weather Averages (World weather)". *World weather online*. Retrieved 3 October 2015).

Climate data for Brahmanbaria													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average high °C (°F)	25 (77)	28 (82)	32 (90)	33 (91)	33 (91)	32 (90)	32 (90)	32 (90)	32 (90)	31 (88)	29 (84)	27 (81)	31 (87)
Daily mean °C (°F)	18 (64)	22 (72)	26 (79)	28 (82)	28 (82)	29 (84)	29 (84)	29 (84)	28 (82)	27 (81)	22 (72)	22 (72)	25 (77)
Average low °C (°F)	10 (50)	14 (57)	19 (66)	22 (72)	23 (73)	25 (77)	25 (77)	25 (77)	24 (75)	23 (73)	17 (63)	17 (63)	20 (69)
Average precipitation mm (inches)	14.4 (0.57)	39.8 (1.57)	72.8 (2.87)	168.2 (6.62)					197.6 (7.78)	148.5 (5.85)	30.4 (1.20)	8.9 (0.35)	1,956.3 (77.03)
Average precipitation days (≥ 0.1 mm)	4	5	7								3	1	

(Source: https://en.wikipedia.org/wiki/Brahmanbaria#Geography_and_climate)

2.1.5: Agriculture and Vegetation: Land use Total cultivable land 152280 hectares; fallow land 700 hectares; single crop 28.38%, double crop 53.95% and triple crop land 17.67%; land under irrigation 55.31%. Land control among the peasants 11% are landless, 61% small, 24% intermediate and 4% rich; cultivable land per head 0.07 hectare.Main crops Paddy, jute, wheat, mustard seed, potato, onion, garlic, chilli, pulses, brinjal, kakrol and patal. Kakrol produced in Mukundopur of this district deserves special mention.Extinct or nearly extinct crops Linseed, sesame, tobacco, Chaplaish and Kataktara varieties of paddy, arahar and kaun. Main fruits Mango, jackfruit, black berry, papaya, coconut, guava, olive, lemon, litchi, bilimbi and banana. Fisheries, dairies, poultries Poultry 83, fishery 64, dairy 61, hatchery 43, nursery 17 and artificial breeding center.

Table 2.3. The area statistics of the land use classes of Brahmabaria district (Haque *et al.* 2012)

Land cover	Types Area (ha)	Cover (%)
Only Rabi	12180	6.40
Only Boro	51289	27
Rabi/ Boro	11499	6.10
Only Aman	4383	2.30
Aman/ Rabi	20176	10.60
Aman/ Boro	12639	6.70
Aman/ Rabi/ Boro	17560	9.20
Bare land/ others	6822	3.60
Settlement	21634	11.40
Builtup	1638	0.90
Pond/ Dishes	6276	3.30
Highland	6887	3.60
River/ Canal	17077	9.00
Total Area	190061	100

2.1.6: Communication facilities: Roads: pucca 266 km, semi pucca 86 km and mud road 1629 km; waterways 131 nautical mile; railways 71km. Cottage industries Brahmanbaria district is famous for the production of cotton fabrics. In the nineteenth century Tanjeb, fine quality muslin, used to be produced in Sarail. Hats, made of cane, are being produced at Radhika from the British period. Since Brahmanbaria has a rich tradition of boat race, boats are being made at Champanagar. Other cottage industries include weaving, such bamboo work, cane work, handicraft, goldsmith, blacksmith, wood work, potteries and tailoring. Main hats, bazars and fairs Total number of hats and bazars are 245, most noted of which Ananda Bazar, Asuganj, Chandura, Lalpur, Panishwar, Akhaura, Magra, Banchharampur, Dariar Char, Masimnagar, Kasba, Muslimganj, Gopinathpur, Nabinagar, Bhangura, Shibpur, Phandauk, Nasirnagar and Sarail; fair- 20 most noted of which are Kendua Mela, Shiva Bari Mouza Mela (Akhaura), Chaumohoni Mela (Kasba), Radhanagar Baishaki Mela (Nabinagar) and Baruni Mela of Ghazi and Kalu (Sarail). Mineral resources Natural gas; gas field 3 (Titas Gas, Meghna Gas Field and Saldandi Gas Field). Main exports Jute, paddy, mustard seed, vegetables, cotton fabrics, handicrafts, natural gas and leather (Banglapedia 2013).

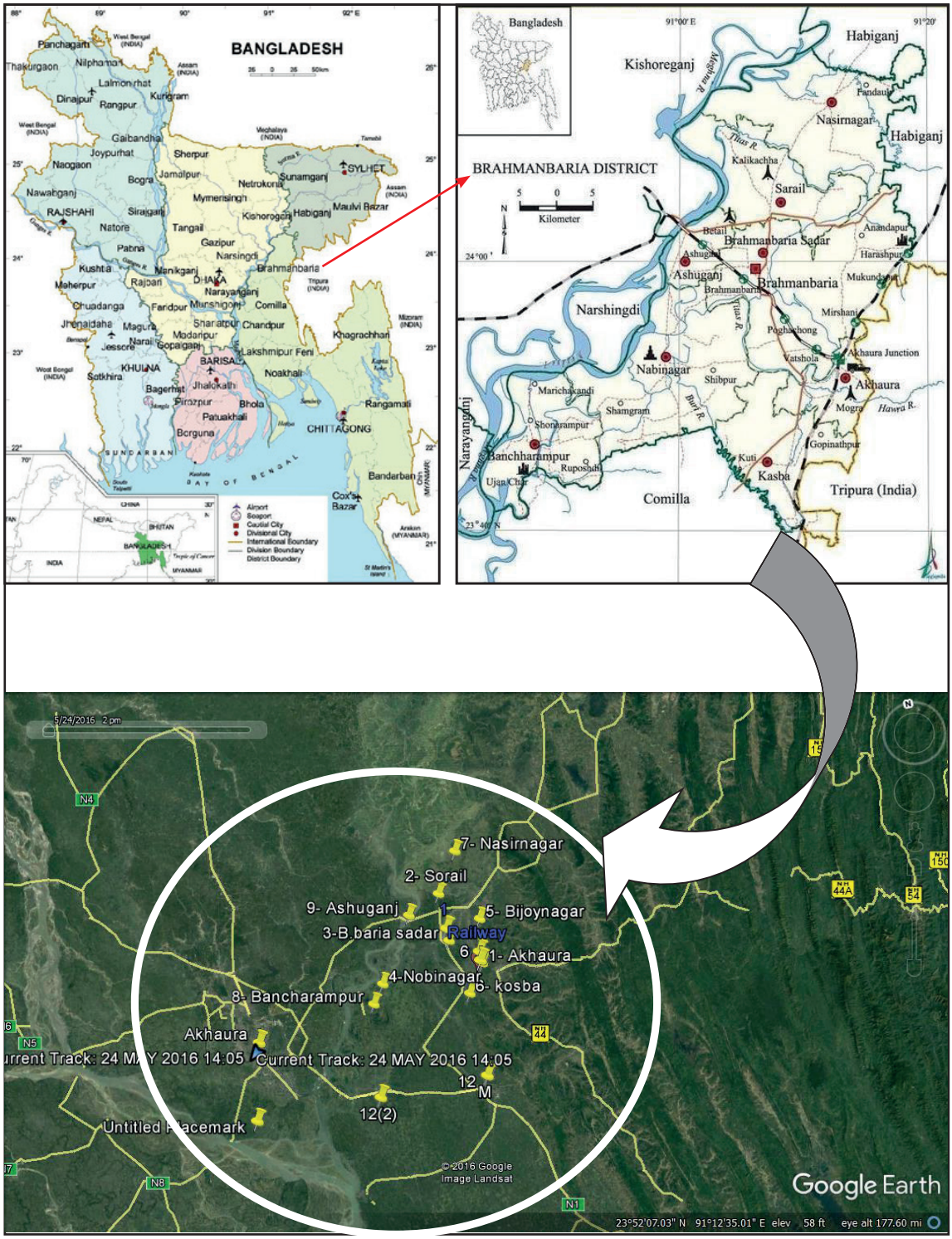


Plate 1. Map of Brahmanbaria district showing nine upazilas and the study areas

2.2. Ethnomedicinal survey

2.2.1. Site and community selection

Pilot field visits were conducted to selects the study sites and information about informants. At the initial stages, Health worker, forest department staff, chairman of the area, local public, teachers and students of the School and colleges were visited to collect information about informants and study area. The study sites were selected based on the prior information gathered from community leaders, knowledgeable elders, health workers, and number of traditional healers in the area (Abera 2014). Twenty one field visits were conducted in 55 villages of 27 unions in between 2015 to 2017 which covers nine upazila of the Brahmmanbaria district. The study sites were selected preferentially based on the pilot field visits and by the recommendation of the key informants (Martin, 1995). Geographical locations were recorded using GPS device (GermineTrex 20). There are no ethnic group living in study region. The name of the locations and date of the field visits are given in table 2.4.

Table 2.4: Field work and number of interviews in different times over the year 2015 to 2017.

Number of field trips	Name of the locations/Unions	Date of data collection	Number of interview
01.	Akaura sadar & adjacent of the railway junction	24.06.2015 -30.06.2015 (7 days)	47
02.	Sorail sadar, Pakhsimul, Shahjadpur	15.07.2015-19.06.2015 (5 days)	36
03.	Brahammanbaria sadar, Ramrail,	24. 08.2015- 27.08.2015 (3 days)	31
04.	DakhsinSingerbil, Brahmmanbaria sadar	27. 09.2015- 28.09.2015 (2 days)	10
05.	Krisnanagar, Kaitala, Barail & adjacent to Meghna river	05.01.2016-07.01.2016 (3 days)	32
06.	Mukondopur, Khatinga	02.02.2016-05.02.2016 (4 days)	37
07.	Kasbasadar	11.03.2016-13.03.2016 (3 days)	18
08	Nasirnagarsadar, Rampur	07.04.2016- 09.04.2016 (3 days)	27
09	Debogram, Mogra,	24.05.2016- 27.05.2016 (4 days)	16
10	Gangasagar, Mogra, Akhaura	28.05.2016- 29.05.2016 (2days)	15
11	Sitanagar& adjacent to Titas river	01.06.2016- 03.06.2016 (3days)	26
12	Aksina, Imambari, Kasba	13.08.2016- 16.08.2016 (4 days)	21

Number of field trips	Name of the locations/Unions	Date of data collection	Number of interview
13	Dakhsin suhilpur	05.09.2016- 06.09.2016 (2 days)	25
14	Durgapur, Asuganjsadar	25.10.2016- 28.10.2016 (4 days)	18
15	Bijoynagar, Champoknagar	08.11.2016- 10.12.2016 (3 days)	16
16	Bishnupur, Bijoynagar	21.12.2016- 23.12.2016 (3 days)	10
17	Simrailkandi, Kuthi bazar, Lashiara	03.02.2017-08.02.2017 (6 days)	32
18	Sorail bazar, Sorail	16.04.2017- 17.04.2017 (2 days)	15
19	Kautali, kazipara,	04.05.2017-06.05.2017 (2 days)	11
20	Puthibazar, Kashba	21.05.2017- 23.05.2017 (2 days)	3
21	Paharikandi, Dakhsin bancharampur	06.05.2017-08.05.2017 (3 days)	15

2.2.2. Data collection

Ethnobotanical study were carried out from June 2015 to June 2017 following the standard guidelines for ethnobotanical survey (Martin 2004, Alexiades 1996, Chambers 1994). To get the information about the medicinal plants used by the local people from Brahmanbaria, interviews of the key informants (Martin 2004; Tremblay 1957) were implemented. For interviews, key informants were selected (Martin 2004) who, because of their elder age, job (kobiraj), family tradition, or personal interests were most likely to have retained ethnobotanical knowledge. A snowball sampling approach (Scherrer *et al*. 2005) was applied, i.e. Further questions were asked to the key informants to indicate additional people experienced in traditional plant use (Idolo *et al.* 2010). So the data of medicinal uses have been recorded through (a) Key informants interview (b) semi-structured interviews, (c) focus group discussion and informal conversations, (d) plant interviews, (e) field interview, (f) checklist interview and (g) Market survey (Alexiades 1996, Chambers 1994, Martin 1995).

(a) **Key informant interview:** Key informants are used primarily as a source of information on a variety of topics, such as kinship and family organization, economic system, political structure, and religious beliefs and practices. In brief, they are interviewed intensively over an extensive period of time for the purpose of providing a relatively complete ethnographical description of the social and cultural patterns of their group (Tremblay 1957).

(b) **Semi-structured interviews:** In semi structured interviews, some questions were determined beforehand and others arise during the course of the conversation. Most of the time interviews were conducted with a single person to express their personal viewpoints, discuss disagreements in the community and speak freely without being interrupted by others (Martin 1995).

(c) **Group interview:** In group interviews the ethno botanist conducts interviews with several informants at a time (Alexiades 1996). Group discussion was conducted among the local people in the local tea shop, educational institution and health institute.

(d) **Field interview:** This is also referred to as a 'bagging interview' (Alcorn 1984). The field interview consists of walking in one or more vegetation zones with an informant, collecting and taking notes on plants and their uses. The plants are shown to the researcher by the informants who described its use. The advantages of the field interviews include the facts that informants get to see the plants in their natural state, thus minimizing the risk of misidentification, and that the context of the interview itself can lead to the discovery and discussion of new important questions. In field interview technique, the informants accompany with the author and data has been collected in the field (Martin 2004).

(e) **Plant interview:** In a variation of the field interview technique, plants can be collected in the field, brought back to the village, and presented to informants (Alcorn 1984). Data about the plant uses can then be obtained. This method is known as the 'Plant Interview' technique. In plant interview, plants collected in the field and shown to the informants about their uses.

(f) **Market survey:** Many cities and town markets have sections where medicinal plants, fruits and other plant products are sold. Direct observations and surveys of both merchants and buyers can be used to obtain a broad range of qualitative and quantitative data concerning cultural, social and economic aspects of plant product selection, use and commercialization (Martin 1992, Alexiades 1996). Market survey carried out at different local market places including kuthibazar, sorail hut, kosba border bazaar, Brahmanbaria sadar.

(g) **Checklist interview:** Informants may also be presented with a checklist of plant names and asked for their uses. This may be an interesting alternative method for well-known plants, but it is open to introducing errors due to frequent variations in taxonomic systems used by different groups. The information obtained was cross- checked with the other informants (Hong *et al.* 2015).

Every informant was interviewed once. Local assistant often helps to understand dialect and traditions. The questionnaire contained no strict questions and informants were allowed to speak spontaneously in their local language and without pressure (Martin 1995). Gender, age, profession, education, and any other information concerning their background were recorded for each informant.

Home side cultivated land

Roadside plantation

Aquatic vegetation

Kantogir dikhi

Railway area

Titas River

Plate 2. Some images of study area

A: Kazipara in Brahmanbaria sadar,

B- Simrail in Kosba,

C- Gangasagar in Akhaura

D- Suhilpur in Sorail.

Plate 3. Key informant interviews

A- housewife

B- Health workers

C- Kobiraj

D- Knowledgeable elder.

Plate 4. Group discussion with local people

A- housewife

B- Health workers

Plate 5. Plant interview; A- Collected Sample identified by traditional healer, B- Traditional healer medicinal plant species.

Plate 6. Field interview Location: A-B: Kosba border area, C -Debogram, Akhaura, D- Akhsina, Kosba.

Plate 7. Market survey: A- Medicinal plant seedlings and plant parts sold at Kuthi bazar of Kosba with reciting magical word by kobiraj, B- Medicinal plant seedlings were sold at Brahmanbaria sadar, C- Seeds and plant parts of medicinal plant in Akhaura station bazar, D- Plant parts were sold at Sorail bazar.

Plate 8: A, B. Brahmanbaria forest Office, C. Akhaura boarder area

The informants were native-born or had been living in the study area for a long time. A digital voice recorder was used during interview and photographs of all recorded medicinal plants have been captured from study area. Face to face interviews were conducted for resolving and registering demographic characteristics of respondents. During the field survey, information on uses of plants to treat human, parts used, modes of preparation and administration have been collected. The conservation status of medicinal plants also recorded.

Information was carefully recorded during an interview with an informant as well the knowledge of vegetation categorization was asked and recorded. Field observations were performed with the help of local guides on the morphological features and habitats of each medicinal plant species in the field. Discussions were conducted on threats to medicinal plants, conservation of the medicinal plants and transferability of knowledge in the community.

2.3. Collection of Botanical samples

Field visits were made during flowering and fruiting season for plant specimen collection from June 2015 to June 2017 which covers all seasons for plant specimen collection. For each medicinal plant species, specimens either with flowers or fruits were collected following the methods of Hyland (1972) and Alexiades (1996). The vernacular names have been recorded with the help of local people. The botanical samples, having ethnobotanical importance and cited by the informants were collected along with necessary information. Voucher specimens of cited medicinal plants were collected and their local identity was reconfirmed by other informants. The information such as the local name, habit, wild/ cultivated, availability of medicinal plants, need of conservation and efforts made by inhabitants, and traditional medicinal uses of plants were recorded. Photographs of each specimen also taken from study area.

2.4. Botanical identification of voucher specimen

Voucher specimens for each medicinal plant have been collected and processed using standard herbarium techniques (Hyland 1972, Alexiades 1996). Maximum plant species were identified by the experts in both field and laboratory. The specimens were identified consulting 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, 2009e. In case of confusion in identity some specimens were compared with both the identified specimens at Dhaka University Salar Khan herbarium and Bangladesh national Herbarium. Voucher specimens have been deposited at Dhaka University Salar Khan Herbarium, Department of Botany, University of Dhaka.

Collection of sample

Brought into laboratory

Identification of sample

Blotting

Plate 9. Collection and identification of plant sample

2.5. Data analysis

Data was organized and analyzed using Microsoft Excel software. Ethnobotanical data has been gathered in computer and has been analysed using biostatistician formulae. Microsoft Excel software (2010) is used to identify proportions like plant families, habit, parts, frequency of citation and popularly used plants. The habits of the plants were categorized into four groups, that is, herbs, shrubs, trees and climbers using available literature. The status of recorded plants was divided into three groups of wild, cultivated, and both wild and cultivated. The parts used by the healers were categorized into 11 groups that is flower, fruit, leaves, whole plant, seeds, bark, root, rhizome, latex, bulb and twig.

2.5.1. Ailment category

Ailments recorded in field survey have been arranged in major ailment categories (Hall & Guyton 2011, Canales *et al.* 2005). Human ailments treated by the local people were divided into 15 categories such as Cardiovascular, diarrhoea and dysentery, gastrointestinal, respiratory tract disorder, dermatological, diabetics, fever and pain, mental disorder, Helminthiasis, jaundice, musculoskeletal, gynecological, sexual problem, dental problem and others.

2.5.2. Factor of informant consensus (*F*ic)

Factor of Informant Consensus (*F*ic) for different ailment categories were calculated for testing homogeneity or consistency of the informant's knowledge about a particular remedy for a particular ailment. It was calculated according to the formula of Heinrich *et al.* as follows (Heinrich *et al.* 1998, Trotter and Logan 1986).

$$F\text{ic} = N_{ur} - N_t / N_{ur} - 1$$

Where N_{ur} is the number of use reports in each category, N_t is the number of species in each category. The relative importances of a species were evaluated by the proportion of respondents who cited it. The *F*ic provided a range of 0-1, where high values (close to 1) are obtained when only one or a few plant species are reported to be used by a high proportion of informants to treat a particular ailment. High *F*ic thus means that there is a narrow well- defined group of species used to cure a particular ailment category and/ or that information is exchanged between informants. On the other hand, low *F*ic values (close to zero) indicate that informants disagree over which plant to use due to random choosing or lack of exchange of information about use among informants.

2.5.3. Use-value (UV)

The Use value (UV), a quantitative method that demonstrates the relative importance of species known locally, was calculated according to the following formula; UV= ΣUis/

ns: (Phillips and Gentry 1993, Albuquerque *et al*. 2006). Where UV is the Use value of a species; ΣUis is the sum of the total number of use citations by all informants for a given species; and ns is the total number of informants. The main objective of UV calculation is to find out the degree of ethnomedicinal use for a particular plant species. High UV value indicates the broad acceptance of that particular plant species for a particular therapeutic use.

2.5.4. Frequency of citation of medicinal plants (Cf) and Relative frequency of citation (RFC)

Calculation of citation frequency is a way to determine the most useful plants. Citation frequency values are useful to determine most common medicinal plants in study area. Cf values of medicinal plants were estimated using the formula: (number of people interviewed citing species/ total number of people interviewed) × 100 (Randrianarivony *et al.* 2017).

The RFC index was evaluated by dividing the number of informants who mentioned the use of the species (Cf) by the total number of informants participating in the survey (N). The RFC index ranges from "0" when nobody referred to a plant as useful to "1" when all informants referred to a plant as useful. RFC = Cf/N (Tardío and Pardo-De-Santayana 2008).

2.5.5. Fidelity level (FL)

The FL value is useful for identifying the informants most preferred species in use for treating certain ailments (Friedman *et al*. 1986). 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. Plant species with high fidelity level is important to local people to treat ailments. It is noted that the number of mentions for a given plant by all of the informants for a specific disease was considered for this factor (Randrianarivony *et al.* 2017).

2.6 Antibacterial activity

2.6.1 Collection of plant material

Fresh leaves were collected from the study area in January 2018. The leaves were taken in the taxonomy laboratory, University of Dhaka, washed thoroughly 2-3 times with running water, dried in the open air separately for 10 days at room temperature to minimize chemical changes by microbial attack after collection.

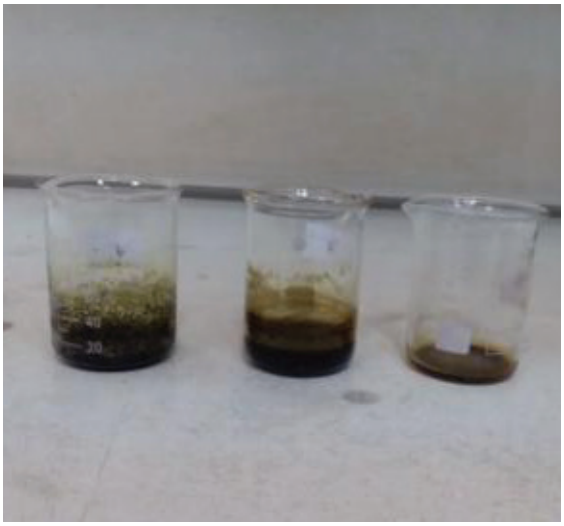
Collected plant part

Grinding

Weighting

Soaked in solvent

Filtering



Dried to form crude extract

Plate 10. Photograph of extracts preparation.

2.6.2 Preparation of aqueous extract

Forty grams of selected fresh leaf materials was macerated with 100 ml of sterile distilled water in a grinding machine (Jaipen prince mixed grinder) for about 10-15 min. The macerate was filtered successively through sterilized cotton and whatman No. 1 filter paper and sterilized at 121 ^{O}C for 15 minute. The extracts were preserved aseptically at 4 ^{O}C for further use (Gupta *et al.* 1996).

2.6.3 Preparation of ethanol extract

The leaves were ground to a fine powder using a grinding machine (Jaipen prince mixed grinder) The powder was stored in tightly closed glass containers in the dark at room temperature (Elisha *et al.* 2017). Forty grams dried powder was soaked in 100 ml of sterilized 70% ethanol for 24hrs in a clean, sterile reagent bottle and shaken vigorously to allow for proper extraction. It was filtered successively through sterile cotton and Whatman filter paper (No. 1). The solvent in the extracts was completely removed by using a rotary evaporator to obtain a semi-solid mass and the yield was calculated based on the weight of the dried plants (Pratiwi and Elin 2016). The extracts were kept in a sterile glass container and stored below 4^{O}C temperature until required.

2.6.4 Test Organisms

There were eight test organisms used for antibacterial activity test. Among them *Pseudomonas aeroginosa* (DMCH-1), *Escherichia coli* (DMCH-5), *Staphylococcus aureus* (DMCH-18), *Bacillus cereus* (S- 01), *Bacillus subtilis* (S-02), *Salmonella paratyphi* (S-03), *Shigella dysenterae* (S-05) were obtained from the Laboratory of Microbiology, Department of Microbiology, Dhaka Medical College were used for antibacterial test. *Bacillus cereus* (S- 01), *Bacillus subtilis* (S-02), *Salmonella paratyphi* (S-03) and *Shigella dysenterae* (S-05) were obtained from the Laboratory of Pharmaceutical Chemistry, University of Dhaka. Stock cultures were maintained on Mueller Hinton agar medium in a refrigerator at 4^{0}C in the Laboratory of Microbiology, Department of Botany, University of Dhaka.

Table 2.5. Description of the test Bacteria.

	Test bacteria with sample ID	Description
Gram positive	*Bacillus cereus*, S- 01	Rod-shaped, facultative anaerobic, motile bacterium commonly found in soil and food. Some strains are harmful to humans and cause food borne illness.
	Bacillus subtilis, S- 02	This is a rod-shaped and catalase-positive aerobic bacterium found in soil and the gastrointestinal tract of ruminants and humans.
	Staphylococcus aureus DMCH-18	A potential pathogen cause boils, food poisoning, skin infections, nausea, vomiting, diarrhea.

	Test bacteria with sample ID	Description
Gram negative	*Salmonella paratyphi*, S-03	**Paratyphoid** is caused by the bacterium, growing in the intestines and blood of human body. They are usually spread by eating or drinking food or water contaminated with the feces of an infected person.
	Escherichia coli, DMCH-5	Found in the lower intestine of warm blooded organism
	Shigella dysenteriae, S-05	Shigellae are rod-shaped, nonspore-forming, facultatively anaerobic, nonmotile bacteria can cause **shigellosis** (bacillary dysentery), spread by contaminated water and food, causes minor dysentery because of its Shiga toxin (Herold, 2004). Contamination is often caused by bacteria on unwashed hands during food preparation, or soiled hands reaching the mouth.
	Shigella boydii (S-08)	This is a nonmotile, non sporeforming, rod-shaped bacterium which can cause dysentery in humans through fecal-oral contamination.
	Pseudomonus aeruginosa, DMCH-1	This is a rod-shaped, multidrug resistant pathogen that can cause disease including humans typically infects the airway, urinary tract, burns, and wounds, and also causes other blood infections.

2.6.4.1. Taxonomic enumeration of test bacteria

Sample (DMCH-1): *Pseudomonas aeruginosa* (Schroeter) Migula (1900)

Synonym: *Bacterum aeruginossum* Schroeter (1872)

Description: Gram negative bacteria, vegetative cells short rods, about 1.5-1.0×1.5-5.0 µm, non-spore former, motile with a single sheathed polar flagellum, aerobic. Optimum temperature for growth 37°C, can also grow in higher temperature. Alkaline peptone water is normally used for selective enrichment.

Significance: The organism is associated with wounds, burns and urinary tract infections. Some strains are pathogenic to plants. Polluted water bodies with high organic matter content support overgrowth of the bacteria.

Sample (DMCH-5): *Escherichia coli* (Migula) Castellani and Chalmers (1919)

Synonym: *Bacillus coli* Migula (189).

Description: Gram- negative bacteria, cells straight rods, nonmotile, facultative anaerobic. Colonies on the nutrient agar plate are grey and shiny, colony edge entire. Rough and smooth. Glucose utilized with the production of acid but no gas. Colonies do not produce any pigment. Optimum temperature for growth is 37°C, can grow at 45°C.

Significance: *Escherichia coli* that are isolated from stool samples of patients suffering from diarrhoea have been identified as the causative agents of diarrhoea. The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) has carried out extensive

research on these different diarrhoea genic *E. coli* over the past few years. The mechanism by which these organism produce diarrhoea has also been worked out, in many cases with the generation of new information.

Sample (DMCH-18): *Staphylococcus aureus* Rosenbach (1884)

Description: Grampositive bacteria, nonmotile, aerobic to facultative aerobic. Vegetative cells cocci, occur in pair or irregular clusters, individual cells 0.8-1.0 µm, non-acid fast, non spore former. Colony on the nutrient agar plate circular, smooth, flat, opaque to orange in colour. **Significance:** The organism is a potential pathogen causing a wide range of infections and intoxication. It may cause boils, abscesses, meningities, pyemia, oesteomyelities, suppuration of wounds and food poisoning.

Sample (S-1): *Bacillus cereus* Frankland and Frankland (1887).

Synonym: *Bacillus mycoides* Filigge (1886), *Bacillus anthracoids* Trevisian (1889), *Bacillus pseudoanthacis* Wahrlich (1890).

Description: Grampositive bacteria, highly motile, aerobic. Vegetative cells rods with blunt ends, cells usually occur in long tangled chains, individual cells 1.0-1.2× 3.0-5.2 µm, non-acid fast. Endospore ellipsoidal, central, sporangia thin walled, not swollen. Colony on the nutrient agar plate large, rough, flat, irregular, opaque to whitish. Growth on the nutrient agar slant opaque, whitish, spreading, non-adherent. Growth in the nutrient broth uniformly turbid with ring and pellicle formation.

Significance: The organism can produce extracellular products, such as haemolysin, asolubletoxin which is lethal to mice. Very high load of the bacteria in food products may cause food poisoning (Hoque *et al.* 1986). Poly-a-hydroxybutyrate (PHB) accumulation in the form of intracellular granules has also been reported.

Sample (S-3): *Salmonella paratyphi*

Description*: Salmonella paratyphi* is a rod shaped Gram negative bacteria. Non spore-forming, predominantly motile bacteria, with cell diameters between about 0.7 and 1.5 µm , lengths from 2 to 5 µm, and peritrichous flagella (all around the cell body). They are also facultative anaerobes.

Significance: Strains of *Salmonella paratyphi* cause illnesses such as typhoid fever, paratyphoid fever, and food poisoning. Many infections are due to ingestion of contaminated food. *Salmonella* serotypes can be divided into two main groups typhoidal and nontyphoidal *Salmonella*. Nontyphoidal serotypes are more common, and usually cause self-limiting gastrointestinal disease.

2.7. Antibacterial Activities

The antibacterial activities of the plant extracts were carried out by determining the zone of inhibition using Kirby Bauer disc diffusion method (Bauer *et al*. 1966).

2.7.1 Preparation of the test plates

The test organism were inoculated in test tube containing 10 ml of Muller Hinton broth medium and incubated at 37^0 for 24 h and were referred to as seeded broth. One ml of seeded broth medium was poured into the sterilized petridish. Then 15 ml of molten Muller Hinton medium poured into that petridish. The plates were gently pushed back and forth, north-south, north-southwest and northwest-east to mix the bacteria with the medium and allow the medium to set.

2.7.2 Preparation of the disc

The extracts were made solution at a concentration of 400mg/ml for both aqueous and ethanol extract. Sterile discs of 8 mm in diameter (ADVANTEC, Disc for antibiotic Assay; Toyo Roshi Kaisha, Ltd. Japan) were impregnated with 25µl of each of the above extract solution and the discs were dried for 10 minutes in a sterile petridish. Separate petridish was used for each case extract viz. leaf extract with distilled water and ethanol. So the final doses per disc are 10mg of aqueous and ethanol extracts. Disc impregnated with ethanol was used as negative control. Ciprofloxacin 30µg/disk were used as positive control.

2.7.3 Diffusion and Incubation

After the plates were labelled, the discs were placed on the surface of the agar along with a commercial antibiotic (Positive control) and a solvent control disc (ethanol) were placed on the inoculated agar plates using sterile forceps. These plates were then kept at 4^oC for 4 hours to allow maximum diffusion of samples.

The plates were then incubated at 37^oC for 24 hours. The test materials having antimicrobial activity inhibited the growth of the microorganisms and a clear, distinct zone of inhibition was visualized surrounding the disc. The antimicrobial activity of the test agents was determined by measuring the diameter of zone of inhibition in millimeter. The experiment was carried out several times and the average zone of inhibition was calculated.

2.7.4 Minimum Inhibitory Concentration (MIC)

The minimum inhibitory concentration (**MIC**) is the lowest concentration of the plant extract which prevents visible growth of a bacterium or bacteria. Serial dilution technique was used to determine MIC of the extracts against bacterial strains. One ml of bacterial suspension diluting the cell 10 times (adding 9 ml Broth). Adding 50 µl cell suspension in each seven sterile test tube containing 10ml broth, 1mg/ml, 2mg/ml, 4mg/ml, 8mg/ml,

16mg/ml and 32mg/ml of the plant extract serially added in each 6th test tube except 7th test tube. Incubated seven test tubes at 37°C for 4-5 hours (in Shaker Incubator). Than MIC was recorded by visual observation. The experiment was carried out in triplicate.

2.7.5 Minimum Bacterial Concentration (MBC)

Minimum Bacterial Concentration was determined following the serial dilution plate method (Kang *et al.* 2011). Spreading 5µl inoculated media from each test tube that was used for minimum inhibitory concentration test. Petri dishes were incubated kept at 37°C for 8 hours to count the number of colonies. The lowest concentration that revealed no visible bacterial growth after sub-culturing was taken as MBC. Positive and negative cultures were also prepared. Observed the survival rate in different plant extract concentration and determined the MBC. The experiment was carried out in duplicate. The growth of organisms was observed as turbidity determined by a spectrophotometer at 600 nm.

2.8 Cytotoxic effect analysis

Cytotoxic activity of five plant extracts has been examined from the service provided by the Centre for advanced research in sciences, University of Dhaka (CARS). 10 mg crude plant extracts have been dissolved in 1ml of 20% Dimethyl sulfoxide (DMSO)to make a concentration of 10mg/ml.

2.8.1 Cytotoxic activity of plant sample

The cytotoxicity of the DMSO extracts against Vero cell line. HeLa, a human cervical carcinoma cell line was maintained in DMEM (Dulbecco's Modified Eagles' medium) containing 1% penicillin- streptomycin (1:1) and 0.2% gentamycin and 10% fetal bovine serum (FBS). Cells (3.0×10^{4}/ 200µl) were seeded onto 48 well plates and incubated at 37°C+5% CO_2. Next day, 25µl sample (filtered) was added each well for plant extract sample. Cytotoxicity was examined under an inverted light microscope after 48h of incubation. Duplicate wells were used for each sample.

2.9 Statistical analysis

The experimental results were expressed as mean ± standard deviation (SD) of three replicates. Where applicable, the data were subjected to one-way analysis of variance (ANOVA). P values less than 0.001 were considered statistically significant. To determine the possible statistical correlation, using two-way ANOVA method of statistical analysis for the data obtained from the research work. Microsoft Excel 2010 statistical package was used for all analyses (JMP software, version 4.0.0).

2.10. Preference ranking method

Preference ranking method was used to rank the threats responsible for the depletion of ethnomedicinal plants in the study area (Martin 1995). Each variable was ranked by 12

selected key informants. All informants were oriented on each variable and asked to mark the highest value (10) for most preferred and the lowest value (1) for the least preferred on choosing the threats responsible for the degradation of ethnomedicinal plants, their uses and knowledge in the study area. Finally, the values were summed up; ranked and illustrated using tables.

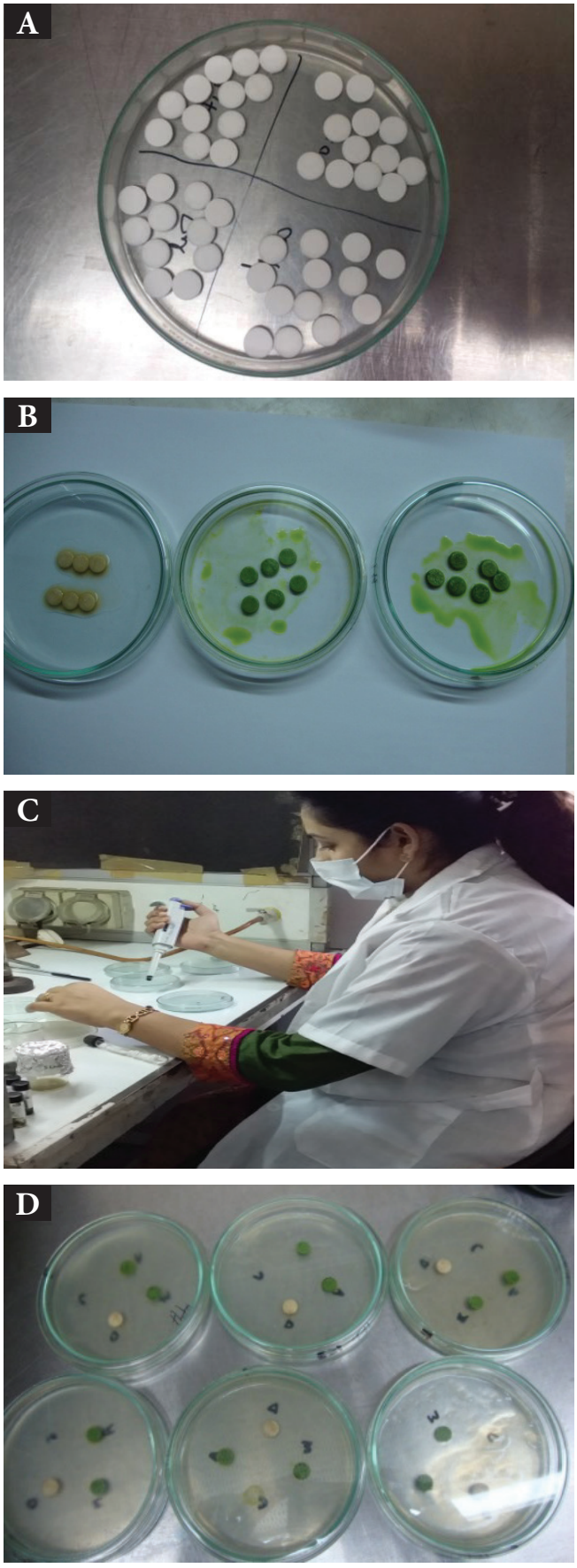


Plate 11. A. Disc for Antibiotic activity, B. Disc impregnated with plant extracts, C, D. Disc placed on Mueller Hinton Agar medium

Chapter 3

Results

3.1. Results

3.1.1 Informant's socio- demographic characteristics

A reconnaissance survey of the study area was carriedout from June 2015 to June 2017 and recorded the ethnomedicinal uses of plants in the study area from the local people. A total of 467 (264 males and 203 females) informants were interviewed in the study area. These included several elderly people who had formerly worked as local traditional healer (kobiraj), farmers, shopkeepers, primary school teacher, and housewife. Face to face interviews were conducted for resolving and registering demographic characteristics of respondents. Demographic data of the informants are presented at Table 3.1.

Table 3.1. Demographic characteristics of the informants included in the survey (Total informants = 467).

Characteristics	Description	Frequency
Age	≤ 30	46 (9.9%)
	31-40	70 (15%)
	41-50	96 (20.6%)
	51-60	142 (30.6%)
	61-70	74 (15.7%)
	≥ 71	38 (8%)
Gender	Male	264 (56.46%)
	Female	203 (43.31%)
Religion	Hindu	154 (32.97%)
	Muslim	313 (67.02%)
Occupation	Kobiraj/Hakim	127 (27.15%)
	Village medicine man	3(6.68%)
	Farmer	74 (15.73%)
	Housewife	93(20%)
	Business	38 (8.18)
	Health worker and teacher	54 (11.42%)
	Others	45 (9.48%)
Educational level	Illiterate	137 (29.52%)
	Primary	97 (22.9%)
	Secondary	92 (20.82%)
	Intermediate	78 (17.81%)
	Graduate	46 (11.91%)

Among the informants age groups of 51–60 is very high compared to other groups and most of them are Muslim (66.88%). Just 9.78% of informants were below 30 years old. Education levels of the informants were from illiterate up to B. Sc. Degree. The most of the informants acquired the ethnomedicinal knowledge from their forefathers or other elder person and also practicing out of interest. People in remote areas mostly used plant based medicine, due to economic condition, unavailability of modern health facilities including synthetic drug and health services. Local people also prefer medicinal plants for the treatment of their primary health care rather than synthetic medicine even where modern medical system is available because they believe that natural drug from medicinal plants are safe.

3.1.2. Ethnomedicinal plants

In the present study, a total of 247 plant species under 210 genera from 89 families used by local people have been recorded. These plants have been used to treat 73 ailments through 485 formularies. Among the medicinal plants, 206 species belonged to dicotyledones, 36 species are monocots, two species are pteridophyta and one species each of fungi and gymnosperm. The record of 247 ethnomedicinal plant species in the Brahmanbaria district is the indication of huge diversity of medicinal plants and their uses. The present results are the first historical documentation for Brahmanbaria district which will be served as baseline information for further ethnomedicinal study. Ethnomedicinal survey in Brahmanbaria district revealed that local people used medicinal plants comprehensively in their regular health care system. For each species scientific name, local name, family, habit, part (s) used, treatment mood, citation frequency and relative citation frequency are provided in the Table 3.2.

The table 3.2 showed that one medicinal plant species used in the treatment of more than one ailments. On the other hand one ailments treated by many medicinal species. In case of culturally important species, one ailment has only one medicinal plant to treat. This is the cultural bounded species. Most cited species for the treatment of particular ailment is the most potential species to find new active chemical.

Table 3.2: Ethnomedicinal data of medicinal plants and their uses in the study area (S= Shurb, C= Climber, H= Herb, T= Tree)

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
1	*Abelmoschus esculentus* (L.) Moench, TH-215	Vendi	Malvaceae	S	Diabetes	Fruit	Boiled with salt and eaten occassionally	0.437636761	0.000937124
2	*Abroma augusta* (L.) L. f, TH-34	Ulotkombol	Sterculiaceae	S	Abortificant	Leaf	Soaked in water over night than taken internally in the morning	5.032822757	0.010776922
					Cold & Cough	Leaf	Juice taken internally	0.218818381	0.000468562
					Diabetes	Leaf	Soaked in water over night than taken internally in the morning	0.437636761	0.000937124
					Impotence	Stem	Juice taken internally until cure	6.126914661	0.013119732
					Jaundice	Stem	Soaked in water & one glassful taken everyday	0.218818381	0.000468562
					Urine infection	Stem	Juice taken internally until cure	6.126914661	0.013119732
					Blood dysentery	Stem	Soaked in water over night than taken internally in the morning	0.437636761	0.000937124
3	*Abrus precatorius* L., TH-139	Kuch	Fabaceae	C	Cough	Leaf	Dried leaf taken internally with betel leaf	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
4	*Abutilon hirtum* (Lamk.) sweet., TH-230	Sida	Malvaceae	S	Fever	Leaves	Paste taken internally	0.656455142	0.001405686
5	*Acacia catechu* (L. F.) Willd, TH-216	khoier	Fabaceae	tree	Aphrodiasic	bark	Dried powder taken internally	0.437636761	0.000937124
6	*Acacia nilotica* L., TH-248	Babla	Mimosaceae	T	Diarrhoea	Bark	Decoction taken internally twice daily	1.531728665	0.003279933
7	*Acalypha indica* L., TH-106	Muktojhuri	Euphorbiaceae	H	Scabies	Leaf	Paste applied externally	1.094091904	0.002342809
8	*Achyranthes aspera* L., TH-87	Ufuthlenga	Amaranthaceae	H	Chest pain	Seed	One spoonful powder Taken internally	10.06564551	0.021553845
					Evil eye	Root	Tied it into a tabiz at Saturday or Tuesday	1.531728665	0.003279933
					Itching	Seed	Paste applied externally	1.312910284	0.002811371
					Jaundice	Seed	Used around neck as ornaments until disease is cured	0.437636761	0.000937124
					Jaundice	Leaf	Soaked into water which is taken internally	0.656455142	0.001405686
					Pain	Root	Tied fresh root around west for several days	0.218818381	0.000468562
					Toothache	Root	Chewed	0.437636761	0.000937124
					Pils	Leaf	Tablets made from leaf which taken two twice daily	0.218818381	0.000468562

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Impotence	Root	Paste is prepared by mixing 7 root of ufuthlenga, one banana and cow milk which is taken internally for 3 days in the morning and evening	2.188183807	0.004685618
9	*Achyranthes bidentata*, TH-217	Ultautrengsa	Amaranthaceae	H	Jaundice	Leaf	Juice taken internally	2.625820569	0.005622742
10	*Acampe praemorsa (Roxb.) Blatt., TH-235*	Porgacha	Orchidaceae	H	Impotence	Leaf	Juice taken internally with boiled rice water	3.501094092	0.007496989
11	*Adhatoda zeylanica* Medikus, TH-27	Bashok	Acanthaceae	T	Cold & Cough	Leaf	Two table spoonful juice taken inernally with or without houney	15.75492341	0.033736453
12	*Aegle marmelos* (L.) Corr., TH-25	Bel	Rutaceae	T	Appetizer	Fruit	Burned and taken internally for one or two times a day	3.06345733	0.006559866
					Diabetes	Fruit	Juice taken internally	5.470459519	0.011714046
					Dysentery	Fruit	Juice taken internally	3.719912473	0.007965551
					Eye complain	Stem	Tied young stem around the Head	0.656455142	0.001405686
13	*Aerva sanguinolenta* (L.) Blume, TH-58	Rongila	Amaranthaceae	H	Cut injury	Leaf	Paste applied externally on affected area	10.72210066	0.02295953
14	*Agaricus bisporus* L., TH-218	Mashroom	Agaricaceae (F)	H	Diabetes	Fruit-body	Fried & eaten	0.218818381	0.000468562
15	*Ageratum conyzoides* L.TH-154	kurka	Asteraceae	H	Jaundice	Leaf	Dried leaf mixed with water than taken internally	4.814004376	0.010308361

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
16	*Albizzia lebbeck* (L.) Benth, TH-249	Sirish koroi	Mimosaceae	T	Inflammation	bark	One or two table spoon powder mixed with one glass of water which taken internally	0.656455142	0.001405686
17	*Allium cepa* L, TH-202	Peaz	Liliaceae	H	Cold	Bulb	Juice Taken internally	0.656455142	0.001405686
		peaz	Liliaceae	H	Bald/ Hairfall	Bulb	Juice is applied on Head for 3-7 days	0.437636761	0.000937124
18	*Allium sativum* L, TH-117	Rosun	Liliaceae	H	Abdominal pain	Bulb	Paste taken internally with boiled rice	0.656455142	0.001405686
					Cold	Bulb	Juice taken internally	0.656455142	0.001405686
					Ringworm	Bulb	Taken internally	1.094091904	0.002342809
					Blood purify	Bulb	3 (koa) bulb is taken with rice everyday	0.218818381	0.000468562
19	*Alocasia cucullata* (Lour.) G. Don, TH-65	Bish kochu	Araceae	H	Pain	Stem	Boiled & taken internally	1.094091904	0.002342809
20	*Alocasia macrorrhizos* (L.) G. Don, TH-66	Mankochu/ fenkochu	Araceae	H	Cough	Root	Tied externally around neck	0.437636761	0.000937124
21	*Aloe vera* (L.) Burm, TH-39	Gitikanchon	Aloaceae	H	Acne	Leaf	Mucillage applied on externally untill cure	0.437636761	0.000937124
					Impotence	Wp	One glass of juice taken everyday	22.10065646	0.047324746
					Leucorrhoea	Leaf	one glass of juice taken everyday	6.783369803	0.014525417

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
22	*Alpinia conchigera* Griff, TH-233	Bonalach	Zingiberaceae	H	Cold & Cough	Root	Grinded & mixed with water which is taken internally	0.218818381	0.000468562
					Weight loss	Fruit	Grinded & mixed with water which is taken internally	0.218818381	0.000468562
23	*Alstonia scholaris* L. R. Br.TH-234	chatim	Apocyanaceae	T	Pain	Bark	Paste applied externally	1.969365427	0.004217057
24	*Alternanthera sessilis* (L.) R. Br. Ex Roem. & Schult, TH-121	Golhisa	Amaranthaceae	H	Burning Chest pain	Root	Juice taken internally	1.312910284	0.002811371
					Eye complain	Wp	Juice applied externally on eye two times daily	0.218818381	0.000468562
					Fever	Root	Tied around the hand	7.658643326	0.016399665
					Pain	Wp	Juice taken internally every morning	0.437636761	0.000937124
					Pain	Leaf	Juice taken internally for 7 days	0.875273523	0.001874247
25	*Amaranthus spinosus* L, TH-126	Kantanoitta	Amaranthaceae	H	Toothache	Stem	Boiled with water which is used for gurgling	0.437636761	0.000937124
					Diarrhoea	Stem & Leaf	Decoction taken internally	0.437636761	0.000937124
26	*Amaranthus tricolor* L, TH-102	Lal shakh	Amaranthaceae	H	Blood purify	Leaf	Fried & eaten	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
27	*Amorphophallus paeoniifolius* (Dennst.) Nicolson, TH-275	Ol kochu	Araceae	H	Diarrhoea	Tuber	Decoction taken internally	0.656455142	0.001405686
28	*Anacardium occidentale* L, TH-73	kajubadam	Anacardiaceae	T	Skin disease	Leaf	Paste applied externally	0.218818381	0.000468562
29	*Ananas sativus* (Lindl.) Schult. f, TH-50	Anarosh	Brumiliaceae	H	Anthelmintics	Twig	Mixed with same proportion of termeric & sawrnalata and taken internally	8.096280088	0.017336788
30	*Andrographis paniculata* (Burm. f.) Wall. *ex* Nees, TH-45	Chirota	Acantheceae	H	Anthelmintics	Root	Dried & grinded to form powder & mixed with water which is taken internally	0.437636761	0.000937124
					Diabetes	Leaf	Grinding & mixed with water than taken internally every morning	6.783369803	0.014525417
					Dysentery	Leaf	Juice taken internally	3.282275711	0.007028428
					Fever	Stem	Soaked in water over night than taken internally in morning in the empty stomach	3.501094092	0.007496989
					Fever & pain	Stem	Soaked in one glass of water overnight than taken internally in the morning	7.002188184	0.014993979
					Impotence	Leaf	Crust with water & taken orally in morning	0.218818381	0.000468562

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Liver complain	Stem	Soaked for 12 hours & taken internally twice a day until cured	1.969365427	0.004217057
					Liver disease	Leaf	Juice taken internally 2 times daily	0.656455142	0.001405686
					Skin disease	Leaf	Juice taken internally	0.437636761	0.000937124
31	*Annona reticulata* L, TH-143	Ata	Annonaceae	T	Skin disease	Leaf	Paste applied externally	0.437636761	0.000937124
32	*Antigonon leptopus* Hook. et Arn.TH-247	Anantamul	Polygonaceae	C	Dirrhoea	Root	Decoction is taken internally	0.218818381	0.000468562
33	*Areca catechu* L, TH-15	Supari	Arecaceae	T	Toothache	Root	Fried & eaten	0.875273523	0.001874247
34	*Artabotrys hexapetalus* (L.f.) Bhandari, TH-246	Kathalichapa	Annonaceae	C	Vomiting	Leaves	Decoction taken internally	0.218818381	0.000468562
35	*Artocarpus heterophyllus* Lamk, TH-306	Kathal	Moraceae	T	Toothache	Leaf	Boiled with water which is used for gurgling	0.437636761	0.000937124
36	*Artocarpus lakoocha* Roxb, TH-283	Dewa	M	T	Acne	Stem/ Leave	Decoction is taken internally	0.218818381	0.000468562
37	*Asclepias carassavica* L, TH-250	Bankapas	Asclepiadaceae	H	Chest pain	Wp	Extract taken internally with one table spoonful of water	0.437636761	0.000937124
38	*Asparagus racemosus* willd., TH-43	Chattayn bio	Liliaceae	C	High blood Pressure	Root	Juice taken internally	0.656455142	0.001405686
					Impotence	Wp	Grinded & mixed with water than taken internally	8.315098468	0.01780535

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Mental disorder	Root	Grinded to form powder & mixed with water which is taken internally	7.658643326	0.016399665
39	*Averrhoa bilimbi* L, TH-54	Bilimbi	Averrhoaceae	T	Diabetes	Fruit	Cooked to make picle and taken internally	3.282275711	0.007028428
40	*Averrhoa carambola* L, TH-95	Kamranga	Averrhoaceae	T	Anthelmintics	Fruit	Taken internally	3.501094092	0.007496989
					Cold & cough	Fruit	Burned young fruit taken internally	0.656455142	0.001405686
					Cough	Fruit	Juice taken internally	9.846827133	0.021085283
					Dysentery	Leaf	Juice taken internally	2.188183807	0.004685618
					Fever	Leaf	Juice taken internally	0.437636761	0.000937124
41	*Azadirachta indica* A. Juss, TH-04	Neem	Meliaceae	T	Skin Allergy	Leaf	Bathing with boiled water	26.91466083	0.057633107
					Chicken pox	Leaf	Paste applied externally 3 times on affected area	0.656455142	0.001405686
					Diabetes	Leaf	Small tablet made from leaf Paste & taken internally in morning & evening	5.251641138	0.011245484
					insect bite	Leaf	Blended with termeric & one spoonful mixture taken internally once each day for seven days	3.501094092	0.007496989

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Toothache	Stem	Brush teeth with juice	2.84463895	0.006091304
42	*Bacopa monnieri* (L.), TH-261	Brammi	Scrophulariaceae	H	Brain tonic	Leaf	Juice taken internally	2.84463895	0.006091304
43	*Barringtonia acutangula* (L.) Gartn, TH -305	Hijol gach	Lecythidaceae	T	Gastric	Leaf	Juice taken internally	2.625820569	0.005622742
44	*Bursera serrata* Colebr., TH-242	Maijfol	Burseraceae	T	Stop bleeding	Fruit	Powder mix with water & taken internally until disease is cured	0.875273523	0.001874247
45	*Basella alba* L, TH-114	Puilata	Basellaceae	C	Constipation	Twig	Cooked with oil and salt, taken internally	0.656455142	0.001405686
		Puilata	Basellaceae	C	Insomnea	Leaf	Decoction taken before sleep	0.656455142	0.001405686
46	*Blumea lacera* (Burm. f.) DC. Wight, TH-86	Shealmotra	Asteraceae	T	Jaundice	Root	Juice taken internally	4.595185996	0.009839799
47	*Boerhaavia diffusa* L, TH-14	Punarnabba	Nyctaginaceae	S	Digesion	Leaf	Boiled leaf taken internally	5.032822757	0.010776922
48	*Bombax ceiba* L, TH-40	Tula gach	Bombacaceae	T	Diabetes	Bark	Grinded & mixed with water than taken internally	0.656455142	0.001405686
					Headache	Bark	Paste applied externally on head	3.501094092	0.007496989
					Impotence	Root	Taken internally	1.094091904	0.002342809
					Leucorrhoea	Root	Grinded & mixed with water than taken internally	3.938730853	0.008434113

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
49	*Borassus flabellifer* L, TH-119	Taal	Arecaceae	T	Cold & Cough	Stem	juice of young stem taken internally one time daily	0.437636761	0.000937124
50	*Brassica nigra* (L.) Koch, TH-263	Sarisha	Brassicaceae	H	Stomachic	Seed	Seeds oil is rubbed on the lower abdomen	1.094091904	0.002342809
					Cold and cough	Leaves	Cooked and taken with boiled rice	1.094091904	0.002342809
51	*Butea monosperma* (Lamk.) Taub, TH-304	Polash	Fabaceae	T	Urine infection	Leaf/ flower	Decoction taken three times daily until disease is cured	6.564551422	0.014056855
52	*Cajanus cajan* (L.) Millsp, TH-162	Arol	Fabaceae	S	Jaundice	Leaf	Juice taken internally	0.875273523	0.001874247
		Arol	Fabaceae	S	Body pain	Leaf	Fried & eaten	4.595185996	0.009839799
53	*Calotropis procera* (Ait.) R. Br.TH-41	Akon	Asclepiadaceae	S	Rheumatic pain	Leaf	Rubbing with warmed leaf	7.221006565	0.015462541
54	*Camellia sinensis* (L.) O. Kuntze, TH-266	Chapata	Theaceae	S	Cold	Leaf	Boiled with water & mixed with honey which is taken internally at morning	0.656455142	0.001405686
55	*Canna indica* L., TH-282	kolaboti	Cannaceae	H	Fever	Root	Decoction taken internally	1.094091904	0.002342809
56	*Carica papaya* L, TH-18	Pepe	Caricaceae	S	Abortificant	Fruit	Juice taken internally	3.06345733	0.006559866
					Diabetes	Fruit	Taken internally	3.938730853	0.008434113
					Ringworm	Latex	Applied externally for 3 days	1.094091904	0.002342809
57	*Carissa carandas* L, TH-235	Koromcha	Apocyanaceae	T	Diabetes	Fruit	Taken internally	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
58	*Cassia fistula* L, TH-200	Sonajaron gach	Caesalpiniaceae	T	Leucchoea	Leaf	Decoction taken internally	1.094091904	0.002342809
					Rheumatic pain	Fruit	Dried to made tablet &taken internally two times daily	0.437636761	0.000937124
59	*Catharanthus roseus* L. G. Don, TH-12	noyontara	Apocyanaceae	S	Diabetes	Leaf	Decoction taken internally	4.157549234	0.008902675
60	*Celosia cristata* L.r, TH-278	Morogful	Amaranthaceae	H	Diarrhoea	Leave	Juice is prepared by mixing salt and sugar and taken internally everyday until disease is cured	0.656455142	0.001405686
61	*Centella asiatica* (L) Urban, TH-02	Tunimankoni	Apiaceae	H	Dysentery	Wp	Juice or paste taken internally until cure	52.73522976	0.112923404
					Memory loss	Leave	Mixture is prepared by blending one spooneful juice of *Centella asiatica*, 1/2 glass of cow milk and one spoon of honey which is taken internally for 15 days in the morning and evening	0.437636761	0.000937124
					Diabetes	Leaf	Blended with zinger & internally taken until cure	1.969365427	0.004217057
					Stomache	Leaf	Paste taken with Boiled rice	3.06345733	0.006559866
					Eye complain	Leaf	Two drops of decoction applied externally on eye	1.312910284	0.002811371

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
62	*Cestrum nocturnum* L.TH-155	Hasnahena	Solanaceae	S	Vomitting	Flower	Inhale the smell of flower	0.218818381	0.000468562
63	*Chenopodium album* L, TH-237	baitua shakh	Chenopodiaceae	H	Weakness	leaves	Fried & taken internally taken for children	0.437636761	0.000937124
64	*Chromolaena odorata* (L.) R.M.King & H.Rob, TH-276	Assamlata	Asteraceae	C	Dysentery	Leaf	juice is taken internally	0.218818381	0.000468562
65	*Cinnamomum tamala* Nees & Eberm, TH-44	Tej pata	Louraceae	T	Cold & Fever	Leaf	Juice taken internally	3.501094092	0.007496989
					nail infection	Leaf	Mixture is prepared by blended two leaves of Cinnamomum, betel leaves and masturd oil which is applied on infected area for 6-7 hour	2.407002188	0.00515418
66	*Cinnamomum zeylanicum* Blume, TH-267	Daruchini	Louraceae	T	Aphrodiasiac	Bark	Taken with tea	0.656455142	0.001405686
67	*Cissus quadrangularis* L, TH-62	Arenga	Vitaceae	C	Rheumatic arthrities	Stem	Paste applied externally	0.218818381	0.000468562
					Rheumatic arthrities	Wp	Fried & taken internally for 7 days	11.81619256	0.02530234
68	*Citrus aurantifolia* (Cristm. & Panzer) Swingle	Kangogilebu	Rutaceae	S	Laxative	Fruit	Juice mixed with boiled water & taken internally	1.750547046	0.003748495

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
			Rutaceae	S	Vomitting	Leaf	Juice taken internally	4.157549234	0.008902675
69	*Citrus aurantium* L, TH-180	Tok Komola	Rutaceae	T	Diabetes	Fruit	Juice taken occassionally	1.531728665	0.003279933
70	*Citrus grandis* (L.) Osbeck, TH-57	Jambura	Rutaceae	T	Diabetes	Leaf/ fruit	Juice taken internally	0.656455142	0.001405686
71	*Clerodendrum viscosum* Vent, TH-153	Vat	Verbenaceae	S	Anthelmintic	Leaf	Extract internally taken by children	1.094091904	0.002342809
					Diarrhoea	Leaf	Extract internally taken by children	12.4726477	0.026708025
72	*Clinogyne dichotoma* (Roxb.) Salishb. Ex Benth Th-240	Beithpata	Marantaceae	S	Rheumatic pain	Stem	Tied around west until cure	0.437636761	0.000937124
73	*Clitoria ternetea* L, TH-52	Nilkontho	Fabaceae	H	Cold & Cough	Flower	Juice taken internally as needed	6.783369803	0.014525417
74	*Coccinea cordifolia* (L.) Cogn, TH-03	Telakucha	Cucurbitaceae	C	Appetizer	Leaf	Paste taken with boiled rice	6.783369803	0.014525417
					Diabetes	Leaf	Paste taken internally with boiled rice	26.91466083	0.057633107
					Headache	Leaf	Paste applied on head	1.531728665	0.003279933
					Inflammation	Leaf	Rubbing externally	1.312910284	0.002811371
					Hair fall	Leaf	Decoction applied externally on head	0.656455142	0.001405686
					Asthma	Root	Tabiz is tken	0.218818381	0.000468562

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
75	*Cocos nucifera* L, TH-47	Naroil	Arecaceae	T	Jaundice	Fruit	Juice taken internally	0.875273523	0.001874247
					Rheumatic arthrities	Fruit	Pulp taken internally	1.312910284	0.002811371
					Toothache	Root	Boiled water used for gurgling	0.656455142	0.001405686
76	*Colocasia esculenta* (L.) Schott, TH-65	Kochu	Araceae	H	Brain tonic	Leaf	Cooked & taken internally	0.218818381	0.000468562
77	*Commelina benghalensis* L, TH-122	Jhol kanda/ Dhol pata/ kanchira/ kandoloar	Commilinceae	H	Eye complain	Wp	Grinded & applied externally on eye	0.218818381	0.000468562
					Jaundice	Wp	Juice taken internally	3.501094092	0.007496989
78	*Coriandrum sativum* L, TH-130	Dhania	Apiaceae	H	Abdominal pain	Seed	Soaked over night & taken internally one glassful in empty stomach in morning	3.501094092	0.007496989
					Impotence	Seed	Soaked in water over night & taken in the morning	1.094091904	0.002342809
79	*Crataeva magna* (Lour.) DC, TH-32	Barunpata	Capparaceae	T	Diarrhoea	Leaf	Juice taken internally	0.218818381	0.000468562
					Ear complain	Leaf	Juice taken internally	0.437636761	0.000937124
					Rheumatic pain	Fruit	Paste is dried to form tablet & taken 2 or 3 tablet internally everyday	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Anthelmintics	Leaf	Juice of young leaf internally taken by chewing	4.595185996	0.009839799
					Pain	Leaf	Paste is applied externally	1.312910284	0.002811371
					Fructured bones	Bark	Paste is perared by mixing with zinger extract and salt which applied for 14 days	0.218818381	0.000468562
80	*Crotalaria juncea* L, TH-188	Junjune	Fabaceae	S	Skin Allergy	Leaf	Paste applied externally	0.437636761	0.000937124
81	*Crotalaria pallida* Ait.	Jhunjune	Fabaceae	S	Digesion	Root	Extract taken Internally	0.218818381	0.000468562
82	*Cucumis sativus* L, TH-268	Sasha	Cucurbitaceae	H	Gastric	Fruit	Taken internally	2.407002188	0.00515418
83	*Cucurbita maxima* Duch, TH-303	Mistikumra	Cucurbitaceae	C	Laxative	fruit	Boiled with salt & taken internally	0.437636761	0.000937124
84	*Cuminum cyminum*, TH-302	Zira	Apiaceae	H	Gastric	Seed	Powder mix with water & taken internally	0.437636761	0.000937124
85	*Curcuma longa* L, TH-167	kacha holud	Zingiberaceae	H	Eczema	Rhizome	Paste applied externally on affected area	7.439824945	0.015931103
					Toothache	Flower	Paste applied on teeth	2.188183807	0.004685618
					Vomitting	Rhizome	Juice taken internally	0.875273523	0.001874247
					Pain	Rhizome	Dried poweder mixed with boiled rice water which is taken for 14/21 day	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
86	*Curcuma zedoaria* (Christm.) Rosc, TH-164	Gandhasoti	Zingiberaceae	H	Dirrhoea	Rhizome	Grinded to form powder which is taken internally	1.094091904	0.002342809
					Jaundice	Rhizome	Juice taken internally	0.437636761	0.000937124
87	*Cuscuta reflexa* (Roxb.), TH-48	Akashlat	Cuscutaceae	C	Jaundice	Wp	Tied around neck	0.656455142	0.001405686
					Abdominal pain	Wp	Boiled water taken internally	2.625820569	0.005622742
					Anthelmintics	Wp	Juice taken internally for 14 days	9.190371991	0.019679597
					Aphrodiasic	Wp	Paste applied externally	1.969365427	0.004217057
					Body pain	Wp	Juice taken internally	0.437636761	0.000937124
					Epilepsy	Wp	Juice taken internally	0.437636761	0.000937124
88	*Cyathula prostrata* (L.) Blume, TH-214	dengi	Amaranthaceae	H	Cough	wp	Decoction taken with tulshi	0.218818381	0.000468562
89	*Cynodon dactylon* L. Pers, TH-06	Durba	Poaceae	H	Cut injury	Wp	Paste applied externally on affected area	22.31947484	0.047793308
					Jaundice	Leaf	Juice of young leaf internally taken by chewing	0.437636761	0.000937124
					Teeth infection	Wp	Paste made by mixing with termeric & zinzer which is applied externally	1.312910284	0.002811371
					Toothache	Wp	Paste applied externally	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
90	*Cycus pectinata* Griff	Cycus	Cycadaceae	S	Snakebite	Me-gaspro-phyll	Paste of seed is applied on affected area	0.437636761	0.000937124
91	*Dalbergia sissoo* Miq, TH-104	Sissoo	Fabaceae	T	Dysentery	Leaf	one spoon of juice taken internally two times daily for seven days	11.002188184	0.014993979
92	*Datura metel* L, TH-20	Dutra	Solanaceae	S	Asthma	Leaf	grinded dried leaves which is burned to make smoke which is taken internally	0.656455142	0.001405686
					Dog bite	Leaf	Paste applied on affected area	0.656455142	0.001405686
					Mental disorder	Seed	1 or 2 seed taken internally but excessive may causes death	6.564551422	0.014056855
					Toncilities	Leaf	Decoction taken two times daily	0.437636761	0.000937124
					Reumatic pain	Root	Decoction of root is mixed with juice of the leaves of Calotropis procera which is applied externally for message	0.218818381	0.000468562
93	*Daucus carrota* L, TH-83	Gajor	Apiaceae	H	Liver disease	Fruit	Taken internally	0.218818381	0.000468562
94	*Desmodium triflorum* L. D.C, TH-71	kufilingi	Fabaceae	H	Cataract	Leaf	Crusted leaf externally applied on eye	2.625820569	0.005622742

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
95	*Dillenia indica* L, TH-110	Chalta	Dilleniaceae	T	Diabetes	Fruit	Taken internally	0.437636761	0.000937124
96	*Diospyros malabarica* (Desr) Kostel, TH-284	Deshi gab	Ebenaceae	T	Oral infection	Fruit	Ripe fruit taken internally	0.437636761	0.000937124
97	*Diplazium esculentum*, TH-300	Dheki shak	Athyniaceae	H	Ear infection	Twig	2/3 drops extract applied on the ear	2.84463895	0.006091304
					High blood Pressure	Leaf	Cooked & taken internally	0.437636761	0.000937124
98	*Drynaria quercifolia* (L.) J. Sm, TH-301	Por gacha	Drynariaceae	H	Cold & Fever	Rhizome	Juice taken internally	0.875273523	0.001874247
99	*Echhornia crassipes* (Mart), TH-204	Kochdi	Ponderiaceae	h	fever	petiols	used for bathing	0.437636761	0.000937124
100	*Echinopsis peruviana* (Britton & Rose), TH-134	Hiz gach	Cactaceae	H	Constipation	Aerial part	Decoction taken internally every morning for several days	0.218818381	0.000468562
					Daud	Aerial part	Paste applied externally	0.437636761	0.000937124
					Fever & Cold	Aerial part	Juice is prepared by warmed the leave which taken internally three times daily	8.096280088	0.017336788
101	*Eclipta alba* (L.) Hassk, TH-92	Kemotra	Asteraceae	H	Child affair	Wp	Seven days old child are touched	0.437636761	0.000937124
					Eye complain	Leaf	2/3 drops of juice applied on eye	1.750547046	0.003748495

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Hair die	Wp	Applied externally on hair	1.750547046	0.003748495
					Headache	Leaf	Crusted by hand & applied externally on the eye	1.094091904	0.002342809
					Leucorrhoea	Wp	Juice mixed with termeric than taken internally for 7 days	7.658643326	0.016399665
					Toothache	Root	Mixed with termeric than chewed	0.875273523	0.001874247
					leucorrhoea	Rhizome	Two table spoonful decoction is mixed with cow milk which is taken in an empty stomach for one month	0.218818381	0.000468562
102	*Elaeocarpus robustus* Roxb, TH-98	Jolpai	Elaeocarpaceae	T	Vomitting	Fruit	internally taken by pregnant women	0.218818381	0.000468562
					Diabetes	Leaves	Decoction taken internally	1.531728665	0.003279933
103	*Eleusine indica* (L.) Gaertn, TH-221	Ghash	Poaceae	H	Diabetes	Root	Decoction is taken internally	0.437636761	0.000937124
104	*Enhydra fluctuans* Lour.	Titradangi	Asteraceae	H	Blood purify	Leaf	Cooked & taken internally	0.656455142	0.001405686
					Leucchoea	Wp	Grinded & mixed with cow milk Which is taken internally thrice a day for 3 days	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
105	*Entada scandens* Benth.	Gila	Mimosoiceae		Aphrodiasiac	Seed	one spoonful powder taken internally	0.218818381	0.000468562
106	*Eriochloa procera* (Retz.) C.E. Hubb.	Aryle gash	Poaceae	H	Skin disease	Wp	Decoction taken internally for 2 days	0.437636761	0.000937124
					Toothache	Wp	Mixed with termeric & garlic which is used externally	0.875273523	0.001874247
107	*Eryngium foetidum* L, TH-63	Rashnapata/ Boro Dhania	Apiaceae	H	Appetizer	Wp	Juice taken internally	0.437636761	0.000937124
					Teeth infection	Wp	Juice taken internally	0.656455142	0.001405686
108	*Erythrina indica* Lamk, TH-70	Kulaimander	Fabaceae	T	Burned injury	Root	Paste applied burned area with oil	0.437636761	0.000937124
109	*Euphorbia antiquorum* L, TH-264	Narahiz	Euphorbiaceae	H	Absess	Latex	Applied externally	0.437636761	0.000937124
110	*Euphorbia hirta* L, TH-76	Dudhgch	Euphorbiaceae	H	Dysentery	Wp	Juice taken internally	0.437636761	0.000937124
					Lactation	Wp	Juice taken internally as necessary	1.750547046	0.003748495
111	*Euphorbia tirucalli* L, TH-299	Dudhraj	Euphorbiaceae	T	Cut injury	Latex	Applied externally	0.437636761	0.000937124
112	*Ficus benghalensis* L, TH-166	Botgach	Moraceae	T	Dysentery	Root	Juice taken internally	0.218818381	0.000468562

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Leucorrhoea	Latex	10 drops of latex taken every day with honey for one week	1.094091904	0.002342809
113	*Ficus hispida* L, TH-53	Dumur	Moraceae	T	Diabetes	Fruit	Two raw fruits are taken internally everyday	1.312910284	0.002811371
					Dysentery	Fruit	Unripe fruit is taken internally	0.437636761	0.000937124
					Dandruft	Seed	Burned seed taken internally	0.437636761	0.000937124
114	*Ficus racemosa*, TH-256	Jogdumur	Moraceae	T	Diabetes	Leaf or seed	Decoction taken internally	6.564551422	0.014056855
115	*Frageria Chiloensis* (L) Mill, TH-127	Strawbery	Rosaceae	H	Protect skin	Fruit	Juice taken internally	0.437636761	0.000937124
116	*Gardenia jasminoides* Ellis, TH-178	Gandharaj	Rubiaceae	S	Cut injury	stem	paste applies externally	1.094091904	0.002342809
117	*Glinus oppositifolius* (L.) Aug, TH-298	Gimashakh	Mulloginaceae	H	Fever & pain	Wp	Cooked and eaten with rice	0.218818381	0.000468562
118	*Gloriosa superba* L, TH-287	Ulatchandal	Liliaceae	C	Stomache	Tuber	One spoon of extract taken internally	0.218818381	0.000468562
119	*Glycosmis pentaphylla* (Retz.) A. DC, TH-68	Bonjami/ FotiKgilla/ Gomraila	Rutaceae	T	Anthelmintic	Leaf	Crusted with the twig of pineapple & juice is taken internally trice a day for seven days	4.814004376	0.010308361
					Cut injury	Leaf	Paste applied externally	3.938730853	0.008434113
					Stomachache	Leaf	Juice taken internally	3.06345733	0.006559866

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
120	*Gymnopetalum cochinensis* (Lour.) kurtz, TH-211	Jonglifol	Cucurbitaceae	h	snakebite	fruit	Decoction applied externally	0.437636761	0.000937124
121	*Gynura nepalensis* DC, TH-262	Diabetes pata	Asteraceae	H	Diabetes	Leaf	Soaked in water at night than taken in the morning and evening	3.282275711	0.007028428
122	*Hedyotis corymbosa* (L.) Lamk, TH-89	Khet pakhra	Rubiaceae	H	Fever	Wp	Decoction taken internally 3 times a day for a few days	0.437636761	0.000937124
123	*Heliotropium indicum* L, TH-113	Ayatunda	Boraginaceae	H	Cut injury	Leaf	Decoction applied externally	0.656455142	0.001405686
					Headache	Leaf	Grinded with salt than applied externally on eye	1.094091904	0.002342809
					Scabies	Leaf	Paste applied externally	6.564551422	0.014056855
					Diabetes	Leaf	Juice taken internally	5.689277899	0.012182608
					Jaundice	Leaf	Decoction is mixed with boiled rice and sugar which taken daily until the disease is cured	0.437636761	0.000937124
124	*Hibiscus rosa* sinensis L, TH-163	Roktojaba	Malvaceae	S	Dysentery	Leaf	Mashed & taken with rice	1.094091904	0.002342809
					Dysentery	Flower	Mashed & taken with rice	0.437636761	0.000937124
					Jaundice	Leaf	Juice taken internally	0.437636761	0.000937124
					Leucorrhoea	Flower	Juice taken internally	6.783369803	0.014525417

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Menstruation	Flower	Juice taken internally as necessary	0.656455142	0.001405686
125	*Hibiscus sabdariffa* L, TH-58	Mestapata	Malvaceae	H	Appetizer	Fruit	Boiled with water & salt than taken internally	0.875273523	0.001874247
				H	Laxative	Leaf	Grinded with water to make paste than taken internally with rice	8.315098468	0.01780535
126	*Holarrhena antidysenterica* (L.) Wall. ex Decne, TH-148	Kuruz	Apocyanaceae	T	Dysentery	Leaf	Juice of fresh leaf taken internally in the morning	12.28446389	0.022022407
127	*Hyptis suaveolens* (L.) Poit, TH-38	Tokmai	Lamiaceae	H	Constipation	Seed	Juice taken internally	5.689277899	0.012182608
					Impotence	Seed	Soaked into water & taken internally	10.28446389	0.022022407
128	*Ichnocarpus frutescens* (L.) R. Br, TH-241	dudhilat	Apocyanaceae	S	Ashtma	Root	Decoction taken with honey or sugar	1.531728665	0.003279933
129	*Imperata cylindrica* (L.) P. Beauv, TH-100	Premkata	Poaceae	H	Impotence	Root	Juice taken internally	0.218818381	0.000468562
130	*Ipomoea batatas* (L.) Lamk, TH-107	Mistialu	Convulvulaceae	C	Stomache	Leaf	Paste taken with boiled rice	0.656455142	0.001405686
131	*Ipomoea fistulosa* Mart. ex Choisy, TH-297	Militiry gach	Convulvulaceae	S	Cut injury	Stem	Latex is applied externally on the affected area	3.06345733	0.006559866
					Hum	Leaf	Cooked & taken internally for 2/3 days	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Impotence	Root	Juice taken internally	0.218818381	0.000468562
132	*Ixora nigricans* R.Br. ex Wight & Arn, TH- 280	Rangan	Rubiaceae	S	Bleeding	Leaf	Extract is taken by women to stop excess bleeding during menstruation	0.875273523	0.001874247
133	*Jatropha gossypifolia* L, TH-198	Lal veron	Euphorbiaceae	T	Toothache	Seed	juice taken internally	6.564551422	0.014056855
134	*Justicia gendarussa* Burm. f, TH-176	Jogmardon	Acanthaceae	S	Stomache	Leaf	Juice taken internally	3.719912473	0.007965551
135	*Kaempferia galanga* L, TH-288	Unknown	Zingiberaceae	H	Fevers	leaves	Decoction taken internally	0.875273523	0.001874247
136	*Kalanchoe pinnata* (Lamk.) Pers, TH-09	Pathorkuchi	Crassulaceae	H	Cold	Leaf	Juice taken internally by children for 3 to 6 month	1.312910284	0.002811371
					Dysentery	Leaf	2 leaves chewed with salt every morning until cure	0.656455142	0.001405686
					Gall bladder Stone	Leaf	Juice taken internally 2/3 times daily until cure	12.91028446	0.027645149
					Menustruation	Leaf	Chewed to take the decoction internally	0.875273523	0.001874247
					Skin Allergy	Leaf	Juice applied externally	0.656455142	0.001405686
					Urothral stone	Leaf	Chewed every morning in an empty stomach for 7-21 days	0.656455142	0.001405686
137	*Kalanchoe serrata*, TH-93	Sarnokomol	Crassulaceae	H	Toothache	Leaf	Decoction is applied externally into the mouth	8.315098468	0.01780535

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
138	*Lablab purpureus* (L.) Sweet, TH-125	Choi	Fabaceae	C	Etching	Leaf	Rubbing	0.656455142	0.001405686
					Ringworm	Leaf	Rubbing with salt	0.437636761	0.000937124
					Laxative	Fruit	Mashed & taken with rice	2.407002188	0.00515418
139	*Lactuca sativa* L, TH-56	Lettuce pata	Asteraceae	H	Heart pain	Leaf	Taken internally as salad	0.437636761	0.000937124
140	*Lagenaria vulgaris* Seringe, TH-296	Lau	Cucurbitaceae	C	Cold	Seed	Crusted with water and taken internally twice a day until cure	0.437636761	0.000937124
					Laxative	Fruit	Cooked & taken internally	1.531728665	0.003279933
141	*Lannea coromandelica* (Houtt.) Mers, TH-132	Zigar gach	Anacardiaceae	T	Dysentery	Bark	Extract taken internally for three days	0.218818381	0.000468562
					Labour pain	Stem	Tied around the body	0.656455142	0.001405686
142	*Lantana camara* L, TH-168	Chutra pata	Verbenaceae	S	Abdominal pain	Leaf	Decoction taken internally	0.437636761	0.000937124
143	*Lawsonia inermis* L, TH-33	Mehedi	Lythraceae	S	Dandruft	Leaf	Paste applied externally	3.06345733	0.006559866
					Hair die	Leaf	Paste applied externally	0.437636761	0.000937124
					Urine infection	Leaf	Soaked into water at night & taken internally in the morning for seven days	7.221006565	0.015462541
144	*Leonurus sibiricus* L, TH-132	Roktodron	Lamiaceae	H	Gall bladder Stone	Leaf	Boiled in water & internally taken	1.531728665	0.003279933

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
145	*Leucus lavandulaefolia* Smith, TH-137	Dondokolosh	Lamiaceae	H	Cold	Leaf	Leaves are boiled with banana than mixed with tentul & pipper to make a mixture which is taken every day until cure	0.656455142	0.001405686
					Cold & Cough	Leave & flower	Mixed with honey to form paste which is taken internally two times daily.	20.78774617	0.044513375
					Constipation	Leaf	Juice taken internally	1.969365427	0.004217057
					Headache	Leaf	Paste applied on head	0.437636761	0.000937124
					Scabies	Leaf	Grinding to form powder which is taken internally with water every morning	0.656455142	0.001405686
					Cold & cough	Leaf	Same proportion of termarind and leaves are mixed which is taken in the morning	0.437636761	0.000937124
146	*Lippia alba* (Mill.) Briton et Wilson, TH-138	Motka	Verbenaceae	H	Diarrhoea	Leaves	Juice taken 2/3 times every day until disease is cured	7.221006565	0.015462541
147	*Litchi chinensis* Sonn, TH-81	Lichu	Sapindaceae	T	Impotence	Fruit	Raw fruit taken internally	0.656455142	0.001405686
148	*Litsea glutinosa* (Lour.) Robinson, TH- 08	Menda	Louraceae	T	Bone fractured	Bark	Poultice used	0.656455142	0.001405686
					Chest pain	Bark	Paste applied externally	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Dysentery	Leaf	Mashed with water than one glassful taken internally in morning & evening until cure	42.0131291	0.089963874
					Dysentery	Bark	Grind & mixed in water over night & taken internally at morning	6.126914661	0.013119732
					Impotence	Leaf	Soaked into water at night & juice taken internally in the morning as necessary	3.06345733	0.006559866
					Jaundice	Leaf	Juice taken internally	0.437636761	0.000937124
					Menstruation	Leaf	Juice taken internally	2.625820569	0.005622742
					Diabetes	Leaf	4/5 leaves soaked into water at night and taken internally in the morning	0.218818381	0.000468562
149	*Ludwigia adscendens* (L.) Hara, TH-252	Mulsi	Onagraceae	H	Diuretic	Leaf	Extract taken Internally	0.656455142	0.001405686
150	*Ludwigia prostrata* Roxb, TH-187	Nakful	Onagraceae	H	Diarrhoea	Leaf	Cooked & taken internally	0.218818381	0.000468562
151	*Lycopersicum lycopersicun* (L.) Britton & Brown, TH-128	Tometo	Solanaceae	h	Appetizer	Fruit	Ripe fruit taken as salad	0.437636761	0.000937124
152	*Malpighia coccigera* L., TH-186	Kata mehedi	Malpighiaceae	H	Cut injury	Leaf	Paste applied externally immidiate after injury	1.750547046	0.003748495

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
153	*Mangifera indica* (L.) sw, TH-133	Aam	Anacardiaceae	T	Diarrhoea	Leaf	Chewed young leaves	12.4726477	0.026708025
					Dysentery	Leaf	Grinded & mixed with goat milk than taken internally in empty Stomach	2.84463895	0.006091304
					Edema	Bark	Juice is taken internally	0.437636761	0.000937124
					Gastric	Leaf	Chewed young leaves	0.656455142	0.001405686
					Toothache	Leaf	Brush teeth with young leaves	1.531728665	0.003279933
					Jaundice	Bark	Tablet made from leaf paste which is taken internally until cure	0.218818381	0.000468562
154	*Manihot esculenta* Crantz, TH-285	Cassava	Euphorbiaceae	T	Jaundice	Root	Juice taken internally	0.656455142	0.001405686
155	*Manilkara zapota* (L.) P. Royen, TH-279	Sofeda	Sapotaceae	T	Cold and cough	Leaf	Decoction is taken internally twice daily	0.656455142	0.001405686
156	*Melastoma malabathricum* L, TH-185	jonglitezpata	Melasomataceae	S	Diarrhoea	Leaf	decoction taken internally	0.656455142	0.001405686
157	*Mentha arvensis* L, TH-37	Pudina pata	Lamiaceae	H	Cold & Cough	Wp	Taken internally	0.218818381	0.000468562
					Gastric	Wp	Taken internally	2.625820569	0.005622742

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Leucchoea	Wp	Juice taken internally or eaten as salad	0.437636761	0.000937124
					Diarrhoea	Leave	Juice is prepared by mixing leaves of *Centella asiatica*and taken internally for 3-7 days	2.84463895	0.006091304
158	*Mesua ferrea* L, TH-295	Nageshor	Clusiaceae		Dysentery	Leaves/ Flower	Decoction taken internally in empty stomach until disease is cured	1.750547046	0.003748495
159	*Mikania cordata* (Burm. f.) Robinson, TH-195	Refugelata	Asteraceae	H	Cut injury	Leaf	Paste applied externally	7.877461707	0.016868226
160	*Mimosa glauca* L., TH-248	Sada lajonti	Mimosaceae	H	Fever & pain	Root	Tied in hand	0.437636761	0.000937124
161	*Mimosa pudica* L, TH-35	Lajonti	Mimosaceae	H	Abscess	Leaf	Paste applied externally until cure	2.625820569	0.005622742
					Dirrhoea	Root	Juice taken internally	2.625820569	0.005622742
					Impotence	Leaf	Juice taken internally	6.564551422	0.014056855
					Menusturation	Wp	Tied it with a rope around the west	9.409190372	0.020148159
					Rheumatic arthrities	Root	Tied around west until cure	3.719912473	0.007965551
					Toothache	Root	Chewed & taken juice internally for 3 days	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
162	*Mimusops elengi* L, TH-294	Bokul	Sapotaceae	T	Toothache	Fruit	Soaked water used for gurgeling	0.437636761	0.000937124
163	*Momordica cochinchinensis*, TH-212	kakrol	Cucurbitaceae	c	absess	Seed	Externally used	0.437636761	0.000937124
164	*Momordica indica* L, TH-120	Titkona	Cucurbitaceae	C	Diabetes	Fruit/ leaves	Juice of taken internally	10.06564551	0.021553845
165	*Moringa oleifera* lamk, TH-26	Sajna	Moringaceae	T	Cold	Leaf	Juice taken with sugar	1.094091904	0.002342809
					Diabetes	Fruit	Boiled with salt & taken internally	7.002188184	0.014993979
					Diarrhoea	Leaf	Fried leaf eaten with rice twice a day for 3 days	0.218818381	0.000468562
					High blood pressure	Leaf	Juice taken internally	1.094091904	0.002342809
					Liver disease	Bark	Soaked into water at night which is taken internally in the morning	3.501094092	0.007496989
					Pain	Leaf	Fried leaf eaten with *roshun*	0.656455142	0.001405686
					Scabies	Leaf	Paste applied externally	0.656455142	0.001405686
166	*Mucuna pruriens* (L.) TH-196	Bonno shim	Fabaceae	C	Menstruration	seed	Paste taken internally during menstruration	1.094091904	0.002342809
167	*Murraya paniculata* (L.) Jack, TH-22	Kaminiful	Rutaceae	T	Stomachache	Leaf	Juice taken internally	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Urothral stone	Leaf	Juice taken internally for several days	2.188183807	0.004685618
168	*Musa paradisiaca* L, TH-67	Attya kola	Musaceae	T	Dysentery	Fruit	Crusted raw fruit taken orally with rice until cure	3.719912473	0.007965551
					Dysentery	Wp	Juice of young plant taken internally	0.218818381	0.000468562
					Jaundice	Stem	Juice of young stem taken internally	0.656455142	0.001405686
					Diabetes	Fruit	Taken internally	2.625820569	0.005622742
					Leucorrhoea	Fruit	Soft and yellow part of snail is mixed with the banana which is taken after pregnency	0.218818381	0.000468562
169	*Nelumbo nucifera* Gaertn, TH-203	Padma	Nymphaeaceae	H	Eczema	Flower	Juice taken internally to stop bleeding	0.218818381	0.000468562
170	*Neolamarckia cadamba* Bosser, TH-293	Kodom	Rutaceae	T	Urine infection	Fruit	Taken internally	1.094091904	0.002342809
					Pain	Leaf	Decoction taken internally	1.094091904	0.002342809
171	*Nigella sativa* L, TH-80	Kalojira	Ranunculaceae	H	Ashtma	Seed	Fried & taken internally	3.938730853	0.008434113
					Diabetes	Seed	Juice taken internally	0.656455142	0.001405686
					Rheumatic arthrities	Leaf	Boiled with two cups of water & taken internally in the morning	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
172	*Nyctanthes arbortristis* L, TH-142	Shefaliful	Oleaceae	S	Menstruration	Seed	Juice taken internally	0.875273523	0.001874247
173	*Nymphaea rubra* Roxb. ex Andr, TH-292	Padmakanchan	Nymphaeaceae	H	Pain	Leaf	Decoction of young leaf taken internally	0.875273523	0.001874247
174	*Ocimum sanctum* L, TH-10	Tulsi	Lamiaceae	H	Cold & fever	Leaf	Jabcdefguice taken internally with honey every morning as necessary	22.53829322	0.04826187
					Constipation	Leaf	Crusted with potash alum to make tablet which is taken internally once daily until cure	0.437636761	0.000937124
					Cold & Cough	Leaf	4 leaves chewed everyday until cure	0.437636761	0.000937124
					Diabetes	Leaf	Juice taken internally	0.218818381	0.000468562
					Toothache	Leaf	Mixed with cumin seed to form paste which is applied externally	0.437636761	0.000937124
175	*Oenanthe javanica* (Blume) DC, TH-239	Panidhainna	Apiaceae	H	Jaundice	Leaves	Juice taken internally	1.094091904	0.002342809
176	*Opuntia dillenii* Haw, TH-78	Mansha gach	Cactaceae	H	Pain	Root	Grinding to form powder which is taken internally with water every morning	0.656455142	0.001405686
177	*Oroxylum indicum* (L.) Kurz, TH-190	Kanaidingi	Bignoniaceae	T	Poisoning	Leaf	Pluster is used on affected area	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Fertility	Leaf	Juice taken internally by married women	0.437636761	0.000937124
178	*Oryza sativa* L, TH-271	Dhan	Poaceae	H	Physical Weakness	Seed	Boiled water taken internally with salt	0.437636761	0.000937124
					Fertility	Seed	Same proportion of rice, Leave of *Cynodon dactylon* and little amount of til are blended to made tablet. 6-7 tablets are fried which is taken internally every day after menstruration period for 41 days	0.437636761	0.000937124
179	*Oxalis corniculata* L, TH-189	Amrul	Oxalidaceae	T	Cold & Cough	Fruit	Extract mixed with houney & cumin oil than taken internally in the morning and evening	0.218818381	0.000468562
180	*Paederia foetida* L, TH-30	Padrapata	Rubiaceae	C	Diarrhoea	Leaf	Paste taken internally with rice	8.283369803	0.014525417
					Stomachache	Leaf	Fried leaf eaten	0.656455142	0.001405686
181	*Pandanus foetidus* Roxb. Fl, TH-248	Keumul	Panadanaceae	S	Fracture bone	Root	Mixed with leave of *Azadirachta indica* and *Curcuma longa* to form paste which is applied externally	5.251641138	0.011245484
182	*Paspalum scrobiculatum* L, TH-123	Dhan durba	Poaceae	H	Diarrhoea	Wp	Tied around west until cure	1.969365427	0.004217057

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
183	*Passiflora foetida* (L.) TH-286	Passon flower	Passifloraceae	C	Diabetes	Leaf and root	Boiled in water which is taken internally	0.218818381	0.000468562
184	*Pedilanthus tithymaloides* Poit, TH-147	Koj gach	Euphorbiaceae	S	Cut injury	Stem	Latex is applied externally on the affected area	4.157549234	0.008902675
185	*Peperomia pellucida* (L.) H. B. & K, TH-201	Luchipata	Piperaceae	H	Eczema	Leaf	Juice is taken internally	0.218818381	0.000468562
186	*Phoenix sylvestris* (Roxb.), TH-281	Khejur	Arecaceae	T	Absess	Spine	Decoction is prepared by mixing with extract of *Allium sativum* which is applied externally thrice daily	1.969365427	0.004217057
187	*Phyla nodiflora* (L.) Greene, TH-254	Unknown	Verbenaceae	H	Bronchitis	leaves	Paste taken internally	0.218818381	0.000468562
188	*Phyllanthus acidus* (L.) Skeels, TH-97	Arboroi	Euphorbiaceae	H	Hum	Leaf	Two spoonful juice is prepared by mixing decoction of turmeric which is taken internally until disease is cured	9.846827133	0.021085283
					Constipation	Fruit	Taken internally	1.094091904	0.002342809
					Hum	Leaf	Boiled in water & it is used for bathing of children	0.875273523	0.001874247
					Lactation	Fruit	Taken internally as necessary	4.157549234	0.008902675
					Diabetes	Fruit	Juice taken internally	2.188183807	0.004685618

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
189	*Phyllanthus emblica* L, TH-05	Amloki	Euphorbiaceae	T	Appetizer	Fruit	Crusted dry fruit taken internally	7.658643326	0.016399665
					Dandruft	Fruit	Boiled with water & applied externally	1.531728665	0.003279933
					Mental disorder	Fruit	Juice taken internally	0.218818381	0.000468562
					Toothache	Fruit	Boiled water taken internally	1.094091904	0.002342809
					Diabetes	Fruit	2 or 3 fruits taken every morning	5.689277899	0.012182608
190	*Phyllanthus niruri* L, TH-108	Bhuiamla	Euphorbiaceae	H	Jaundice	Wp	Juice taken internally every morning as necessary	0.656455142	0.001405686
191	*Phyllanthus reticulatus* Poir, TH-61	Sitki	Euphorbiaceae	S	Diarrhoea	Stem & Leaf	One spoon of extract taken internally for child	10.551422	0.024056855
					Eye complain	Twig	Grinded 3 twigs with salt than 3 drop of juice applied on eye at night for 2/3 days	0.437636761	0.000937124
					Toothache	Stem	Bark used for brushing teeth & leaf juice taken internally	1.531728665	0.003279933
192	*Physalis minima* L, TH-287	Photka	Solanaceae	H	Diuretic	Leave	Juice is internally taken by Diabetic patients	0.218818381	0.000468562
193	*Piper betle* L, TH-144	Bonalapan	Piperaceae	H	Toothache	Leaf	Chewed & taken the decoction	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
194	*Piper nigrum* L, TH-167	Golmorich	Piperaceae	C	Cold & Cough	Seed	Taken internally with tea	1.531728665	0.003279933
195	*Piper chaba* Hunter, TH-276	Choi	Piperaceae		Urine infection	Stem	Decoction taken internally	0.437636761	0.000937124
196	*Pistia stratiotes* L, TH-291	Molahena	Araceae	H	Pain	Leaf	Juice taken internally	0.218818381	0.000468562
197	*Pithecellobium dulce* (Roxb.) Benth, TH-231	Moccasarif gach	Mimosaceae	T	Absess	Bark	Paste applied externally	0.437636761	0.000937124
					Diarrhoea	Bark	Boiled in water which is taken twich daily	1.750547046	0.003748495
					Stomachache	Bark	Decoction is taken internally twice daily	5.032822757	0.010776922
198	*Plumbago zeylanica* L, TH-49	Dorer gach	Plumbaginaceae	S	Fever	Stem	Tied around the body for 3 days	6.783369803	0.014525417
					Mental disorder	Root	Tied around the hand of children	0.218818381	0.000468562
199	*Polygonum hydropiper* L, TH-88	Bishkatali	Polygonaceae	H	Dysentery	Leaf	Juice taken internally	0.656455142	0.001405686
					Pain	Leaf	Tablet made from leaf paste which is taken internally until cure	0.437636761	0.000937124
200	*Portulaca oleracea* L, TH-289	Nontashakh	Portulaceae	H	Dysentery	Wp	Decoction is given to children	1.312910284	0.002811371

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
201	*Pothos scandens* L, TH-171	Por gach	Araceae	C	Pain	Wp	Tied around the body	0.875273523	0.001874247
202	*Psidium guajava* L, TH-109	Peara	Myrtaceae	T	Diarrhoea	Leaf	Juice of young leaves taken internally	5.470459519	0.011714046
					Impotence	Fruit	Raw fruit taken internally	1.531728665	0.003279933
					Toothache	Leaf	Young leaves chewed	6.564551422	0.014056855
203	*Punica granatum* L, TH-28	Dalim	Punicaceae	T	Anthelmintic	Leaf	Decoction of young leaf taken internally	3.938730853	0.008434113
					Dysentery	Fruit	Taken internally as necessary	0.437636761	0.000937124
					Impotence	Leaf	Juice taken internally	2.625820569	0.005622742
204	*Rauvolfia serpentina* (L.) Benth. *ex* kurz, TH-103	Sorpogandha	Apocyanaceae	S	High blood pressure	Root	Powder mix with water & taken internally	3.719912473	0.007965551
205	*Ricinus communis* L, TH-21	Keron	Euphorbiaceae	T	Toothache	Stem	Brush teeth with juice	3.282275711	0.007028428
					Vomitting	Stem	Tied around the neck of children	0.656455142	0.001405686
206	*Rosa damascena* Mill, TH-129	Golap	Rosaceae	S	Digesion	Flower	Juice taken internally	0.437636761	0.000937124
207	*Rumex maritimus* L, TH-243	Ban palang	Polygonaceae	H	Aphrodiasiac	Seed	Paste is mixed with water which taken internally	0.437636761	0.000937124
208	*Saccharum officinarum* L, TH-85	Kushar	Poaceae	T	Jaundice	Stem	Juice taken internally	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
209	*Santalum album* L, TH-272	Chandon gach	Santalaceae	T	Gastric	Bark	Grinded to form powder which is taken internally	0.437636761	0.000937124
					Urine infection	Seed, Leaf	Juice taken internally	0.437636761	0.000937124
210	*Saraca asoca* ((Roxb.) d Wild, TH-175	Asok	Fabaceae	T	Blood purify	Bark	Grinded to form powder & mixed with water which taken internally	0.656455142	0.001405686
211	*Schumannianthus dichotomus* (Roxb.) Gagnep, TH-290	Patigach	Marantaceae	h	General weakness	Rhizome	decoction taken occasionally	0.875273523	0.001874247
212	*Scoparia dulcis* L, TH-172	Chinigura gach	Scrophulariaceae	H	Absess	Leaf	Paste applied externally	0.218818381	0.000468562
					Diarrhoea	Root	Juice taken internally	12.03501094	0.025770901
213	*Senna alata* (L.) Roxb, TH-74	Daudmordan	Fabaceae	S	Skin Allergy	Leaf	Bathing with boiled water	2.188183807	0.004685618
214	*Sesamum indicum* L.	Goyal	Pedialiaceae	H	Aphrodiasiac	seed	Oil is used externally	0.437636761	0.000937124
					Antiaging	Seed	100gm taken internally everyday	0.875273523	0.001874247
215	*Sesbania sesban* (L.) Merr, TH-219	Dhaincha	Fabaceae	T	Diabetes	Leaf	Cooked which taken internally	0.875273523	0.001874247
216	*Sida cordifolia* L, TH-208	Barela	Malvaceae	S	Fever	Root	Decoction is taken internally	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
217	*Smilax macrophylla* Roxb. TH-36	Kumarilata	Smilacaceae	C	Gynocological	Twig	Juice taken internally	2.625820569	0.005622742
					Impotence	Wp	crusted and dried under shade to make tablet which taken internally for 15 days	0.437636761	0.000937124
218	*Solanum americanum* Mill, TH-169	Titbegun	Solanaceae	H	Aphrodiasiac	Fruit	Raw fruit taken internally	2.625820569	0.005622742
219	*Solanum sisymbrifolium* Lamk, TH-111	Kata huduira	Solanaceae	H	Abscess	Root	Grinded with citrus & banana than internally taken until cure	7.658643326	0.016399665
					Diarrhoea	Root	Decoction is taken internally	0.218818381	0.000468562
					Jaundice	Root	Juice taken internally in a empty stomach for 7 days	1.094091904	0.002342809
					Rheumatic pain	Root	Tied around the fractured leg or hand for 7 days	0.218818381	0.000468562
220	*Spillanthus calva* DC, TH-173	Sonamukhi	Asteraceae	H	Toothache	Flower	Mashed & applied externally	0.875273523	0.001874247
221	*Spondias pinnata* (L. F.) Kurz, TH-07	Amra	Anacardiaceae	T	Dandruft	Bark	Paste applied externally	2.625820569	0.005622742
					Diabetes	Fruit	Juice taken internally	1.094091904	0.002342809
					Dysentery	Bark	Grinded & mixed with water which is taken internally twice a day for 7 days	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
222	*Stephania japonica* (Thunb.) Miers, TH-60	Muchagandi	Menispermaceae	C	Back pain	Leaf	Grinded & mixed with water which is taken internally	0.656455142	0.001405686
					Ashtma	Leaf	Paste applied on head occasionally until disease is cure	4.157549234	0.008902675
					Cold & Cough	Leaf	Juice of young leaf internally taken by children	0.437636761	0.000937124
					Dermatology	Leaf	Paste applied externally	4.157549234	0.008902675
					Dysentery	Leaf	Grinded & mixed with water which is taken internally twice a day for 7 days	6.337636761	0.010937124
					Leprosy	Stem	Small pices of stem dried and burned than mixed with (*chun*) and small tablet made from mixture which is taken internally for 10-12 days in the morning & also applied externally	0.437636761	0.000937124
223	*Sterculia villosa* Roxb. ex Smith, TH-177	Udal	Sterculiaceae	T	Impotence	Stem	Soaked at night & taken internally twice a day in empty stomach for 7-14 days	0.875273523	0.001874247
224	*Streblus asper* Lour, TH-157	Howra	Moraceae	T	Abscess	Leaf	Decoction applied externally	10.50328228	0.022490968

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Ashtma	Latex	Latex is mixed with milk which internally taken everyday	2.84463895	0.006091304
					Epilepsy	Leaf	Paste applied on head	0.218818381	0.000468562
225	*Swietenia mahagani* Jacq, TH-42	Mehegani	Meliaceae	T	Diabetes	Seed	Dried seed taken internally everyday as necessary	0.437636761	0.000937124
226	*Syzygium cumini* (L.) Skeels, TH-19	Jam	Myrtaceae	T	Diabetes	Seed	one spoonful paste is mixed with one glass of water than taken internally in the morning in a empty stomach	9.409190372	0.020148159
227	*Syzygium jambos* (L.) Alston, TH-161	Golapjam	Myrtaceae	T	Appetizer	Fruit	Taken internally as necessary	2.188183807	0.004685618
228	*Syzygium samarangense* (Blume) Merr. & Perry, TH-160	Lal jamrul	Myrtaceae	T	Diabetes	Fruit	Juice taken internally	4.595185996	0.009839799
229	*Tagetes patula* L, TH-116	Ganda	Asteraceae	H	Cut injury	Leaf	Paste applied externally	1.094091904	0.002342809
230	*Tamarindus indica* L, TH-197	Tentul	Caesalpiniaceae	T	Diabetes	Leaf	Juice taken internally	3.06345733	0.006559866
					Dysentery	Bark	Boiled in water taken internally	2.625820569	0.005622742
					High blood pressure	Leaf	Juice taken internally as necessary	0.875273523	0.001874247

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Urine infection	Bark	Blended with water & one glassful of juice taken every morning in empty stomach until cure	6.783369803	0.014525417
231	*Tectona grandis* L.f, TH-277	Kathgach	Verbenaceae	T	Stomachache	bark	Decoction of young stem bark is mixed with leaf paste of *Centella asiatica* which is taken internally	0.437636761	0.000937124
232	*Terminalia bellirica* (Gaertn.) Roxb, TH-31	Bohera	Combretaceae	T	Heart disease	Bark	Dried bark grinded and mix with water than taken internally in the morning	6.783369803	0.014525417
					Pain	Bark	Soaked into water at night & juice taken internally in the morning as necessary	1.312910284	0.002811371
					Dysentery	Fruit	powder of bark mix with water & taken internally	0.437636761	0.000937124
233	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.TH-01	Aurjun	Combretaceae	T	Diabetes	Bark	Grinded to form powder & 2 spoonful of powder mixed with one glass of water and which taken internally every morning	6.783369803	0.014525417
					Dysentery	Bark	Juice taken internally for 2/3 times a day until cure	0.218818381	0.000468562
					Impotence	Bark	Juice taken internally twice daily	5.032822757	0.010776922

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
					Leukoria	Bark	Dried bark grinded and mix with water than taken internally in the morning	0.656455142	0.001405686
					Heartahce	Fruit	Juice taken internally	0.875273523	0.001874247
					Gastric	Fruit	powder of bark mix with water & taken internally	5.032822757	0.010776922
234	*Terminalia chebula* Retz, TH-13	Haritoki	Combretaceae	T	Constipation	Fruit	Crusted raw fruit mix with water than taken internally as needed	0.218818381	0.000468562
					Diabetes	Fruit	taken internally	7.877461707	0.016868226
					Blood purify	fruit	Soaked into water and taken internally	0.218818381	0.000468562
235	*Thevetia peruviana* (Pers.) K. Schum, TH-115	Kobri ful	Apocyanaceae	T	Cut injury	Stem	Latex applied externally on injured area	14.22319475	0.03045652
					Mental disorder	Seed	Raw seed taken internally	0.218818381	0.000468562
236	*Tinospora crispa* (L.) Hook. F. & Thoms, TH-59	Guloncho	Menispermaceae	C	Diabetes	Stem	Soaked water taken internally	2.625820569	0.005622742
					Absess	Stem	3 twigs are blended with little amount of soil than warmed mixture applied externally for 3-7 days	0.437636761	0.000937124

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
237	*Trewia nudiflora* L, TH-11	Medda	Euphorbiaceae	T	Abscess	Fruit	Burned and applied externally	0.218818381	0.000468562
					Dysentery	Bark	Grinded with bark of mango & mix with water than taken internally	0.437636761	0.000937124
					Pain	Leaf	Juice of young plant taken internally	0.437636761	0.000937124
238	*Trigonella foenum-graecum* L, TH-101	Methi	Fabaceae	H	Gastric	Seed	Fried & taken internally	1.750547046	0.003748495
					Diabetes	Seed	Soaked in one glass of water and taken everyday	0.218818381	0.000468562
239	*Urena lobata* L, TH-205	Jangli gagra	Malvaceae	S	Rheumatic pain	Root	Decoction taken internally	1.312910284	0.002811371
240	*Vernonia patula*, TH-206	Kukshim	Asteraceae	H	Ringworm	Leaf	Extract taken Internally	0.218818381	0.000468562
241	*Vigna unguiculata* (L.) Walp, TH-253	Barbati	Fabaceae	C	Laxative	Fruit	Paste taken internally	0.437636761	0.000937124
242	*Vitex negundo* L, TH-29	Nisinda	Verbenaceae	T	insectiside	Leaf	Burned leaf applied externally	0.437636761	0.000937124
					Pain	Leaf	Paste of 3 leaves taken internally	1.312910284	0.002811371
243	*Wedelia chinensis* (Osbeck) Merr., TH-279	Keshoraj	Asteraceae		Hair die	Leaf	Paste is applied on scalp	0.656455142	0.001405686

Sl. No.	Scientific name	Local name	Family	Habit	Ailments	Parts use	Treatment mode	Frequency of citation (Cf)	Relative Frequency of Citation(RFC)
244	*Xanthium strumarium* L, TH-55	Ghagra	Asteraceae	H	Cut injury	Fruit	Externally used	1.531728665	0.003279933
245	*Zanthoxylum rhetsa* (Roxb.) D. C, TH-210	Bajna	Rutaceae	T	Abscess	Fruit	Oil from matured fruit rubbed at infected area	1.094091904	0.002342809
246	*Zingiber officinale* Rosc, TH-105	Ada	Zingiberaceae	H	Cough	Rhizome	One spoonful juice and honey were mixed than taken internally	6.783369803	0.014525417
247	*Ziziphus mauritiana* Lamk, TH-131	Boroi	Rhamnaceae	T	Abscess	Stem	Pluster is used on affected area for seven days	3.719912473	0.007965551
					Diabetes	Leaf	Boiled water taken internally	0.656455142	0.001405686
					Skin rash	Leaf	Mixed with *aurjun* and *bohera* seed to form paste which is applied externally	0.437636761	0.000937124

3.1.3. Major plant families appeared

Among the 89 families, Fabaceae (18 spp.) was best represented in terms of the number of species, followed by Asteraceae (13 spp.), Euphorbiaceae (13 spp.), Rutaceae (8 spp.), Amaranthaceae (8 spp.), Apocyanaceae, Cucurbitaceae, Poaceae (7 spp.), Araceae, Apiaceae, Malvaceae, Verbenaceae, Mimosoidae and Solanaceae (6 spp); Lamiaceae, Moraceae, Zingiberaceae (5species); Anacardiaceae, Acantheceae, Arecaceae, Combretaceae, Liliaceae, Myrtaceae, Louraceae, Piperaceae, Rubiaceae, Verbenaceae (4 species); Aloaceae, Averrhoaceae, Convulvulaceae, Caesalpiniaceae, Crassulaceae, Meliaceae, Menispermaceae, Caesalpiniaceae, Scrophulariaceae, Sterculiaceae (2 species); The remaining families that were reported included one medicinal plant each (Fig. 3.1).

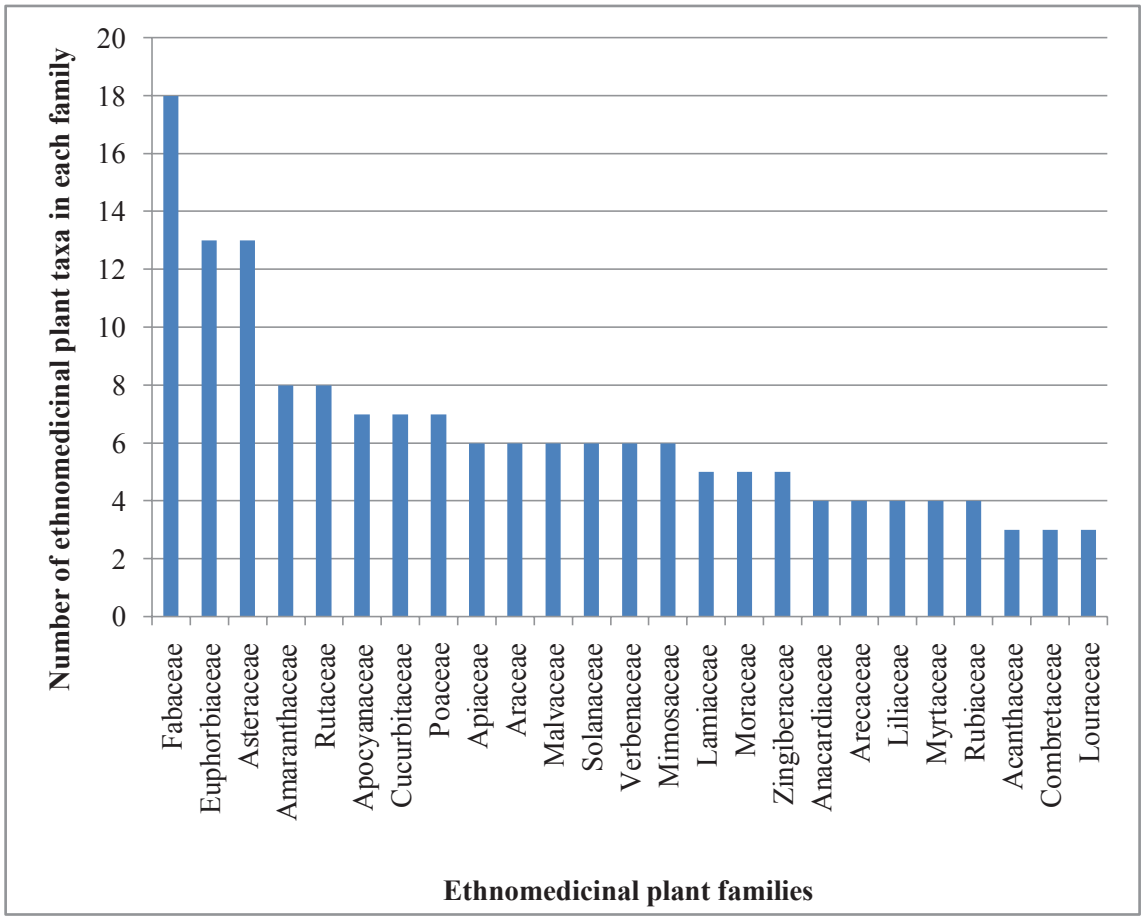


Fig. 3.1. Number of useful ethnomedicinal plant species per family from the study area

3.1.3. Diversity of ethnomedicinal plants as their habit

The collected ethnomedicinal plant species have diverse life forms. The recorded ethnomedicinal plants are classified into four major groups like trees, shrubs, herbs and climbers. Among the medicinal plants, 42% has been represented by herbs, 33% by trees, 14 % by shrubs and 11% by climbers (Fig. 3.2.). It was observed that local healers take herbs more than trees, shrub, and climber to cure different kind of diseases, it may be due

to their easy accessibility, collection, less side effects and abundance in the area. Similar results were reported with analogous studies conducted (Faruque *et al.* 2018, Uddin *et al.* 2017, Khatun *et al.* 2018).

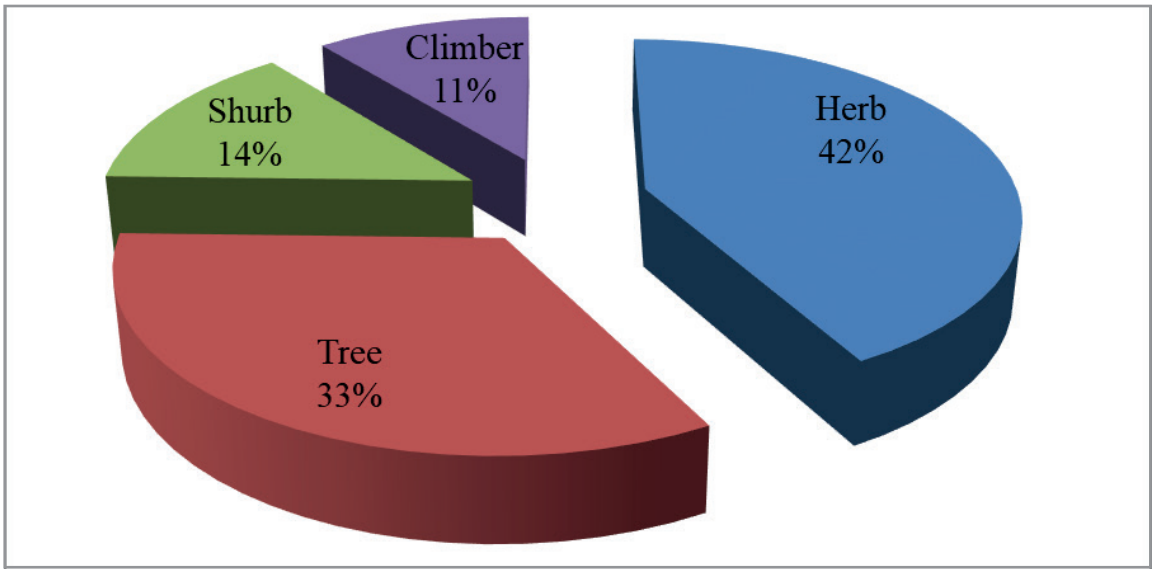


Fig. 3.2. Diversity of habits of medicinal plants

3.1.4. Consensus of plant parts used (CPP%) as a therapeutic agent

Use of plant parts as medicine among the informants shows variations. Plant parts used for the treatment of various ailments were leaves, barks, fruits, flowers, roots, seeds, rhizome, whole plant, and bulbs. Leaves (0.389%) are mostly used part for majority of the medicinal plants, followed by fruits (0.155%), root (0.09%), %), seed (0.09%), stem (0.086%), bark (0.081%), whole plant (0.073%) and flower (0.024%) (Fig. 3.3)

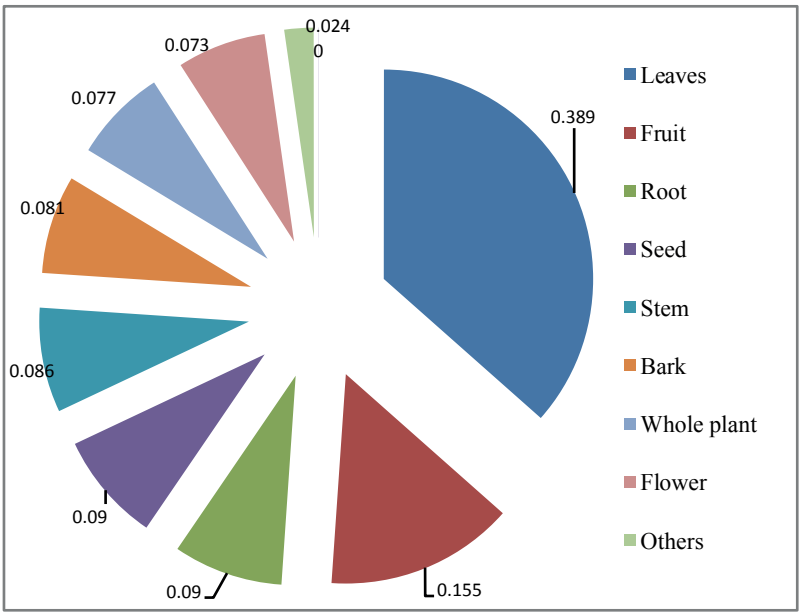


Fig. 3.3. Consensus in the plant parts used in the study area

3.1.5. Mode of application of ethnomedicinal plants

Among the 485 formularies recorded from the study area, 371 (77%) were of oral application and the rest 113 (24%) of external applications (Fig. 3.4). The local people of the study area employ several collection conditions. The high percentage of oral administration of remedies calls for more attention on testing for the safety, mainly toxicological properties of these herbal remedies.

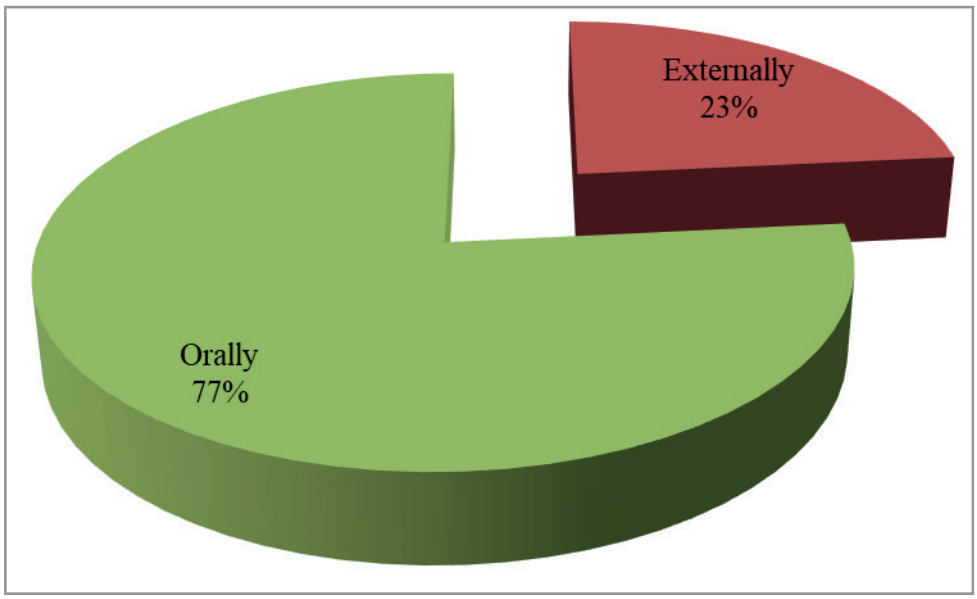


Fig. 3.4. Mode of administration

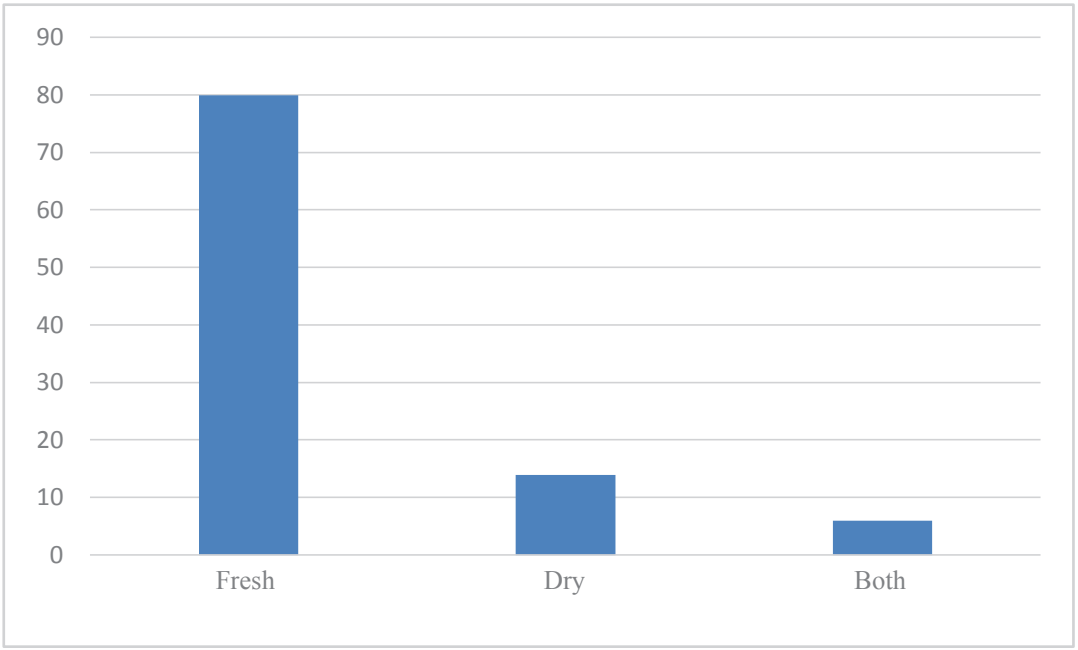


Fig. 3.5. Collection form of ethnomedicinal plants

Fig.3.5 demonstration that the majority (80%) of the remedies were prepared from fresh materials only. Some remedies were prepared from dried materials (14%) exclusively and few were prepared from dried or fresh materials (6%) depending upon their availability of them in the study area.

3.1.6. Knowledge of local people of preparation methods

It has been observed that local people in the study area follow various ways of remedy preparation which depend on type of disease treated. The major modes of remedy preparations were making juice (47%), decoction (16%), paste (13%), tablet (6%), fruit (4%), cooked (4%), powder (4%), plaster (4%), gurgling and brush (3%), Chewed (1%), and others 5% including; tied, tabiz, oil, rubbing etc. (Fig. 3.6).

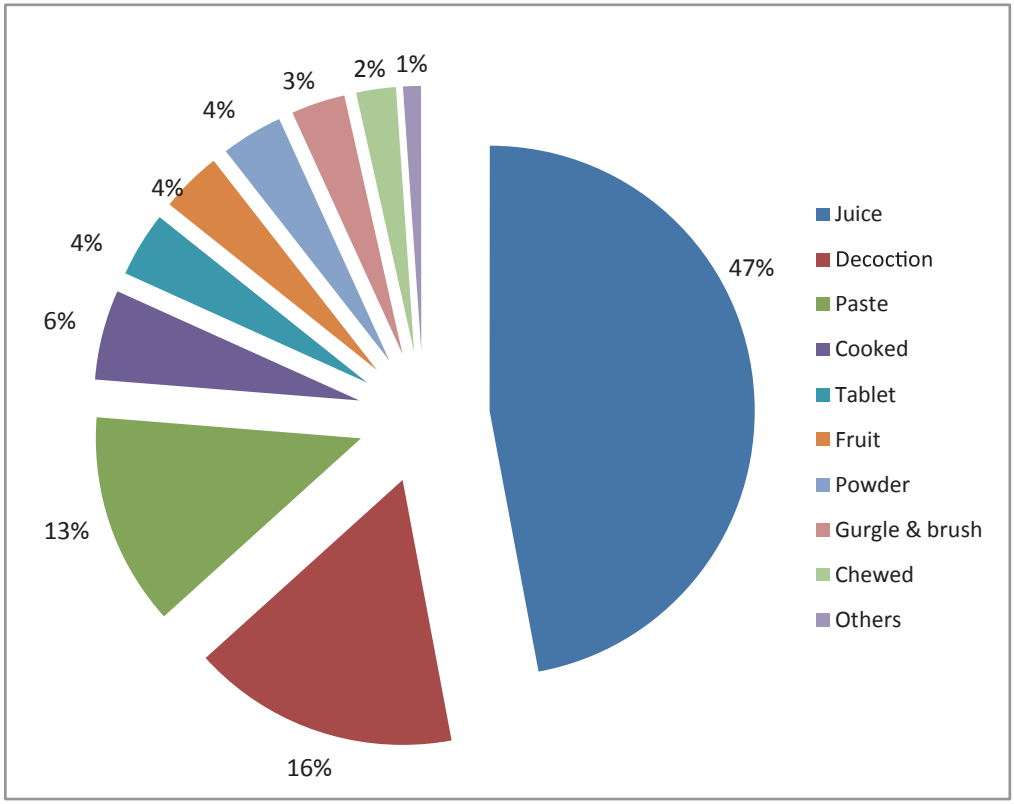


Fig. 3.6. Mode of remedy preparation

Along with herbal ingredients, different additives like boiled water, boiled rice, betel leaf, honey, salt, turmeric, piper, zinger, garlic, sugar, coconut oil, banana, cumin seed, citrus, pineapple, mango, goat milk, cow milk, tamarind, potash alum were often used in preparation of remedies. Plant ingredients were collected by the local people from wild and cultivated or home garden of the habitat in the study area and other ingredients were procured from the commercial sources.

Results show that there was no agreement in measurement or unit used among majority informants. Informants generally used measuring units such as teaspoonful, cup, glass, fingers, etc. but still differed in the doses they administered.

3.1.7. Status of ethnomedicinal plants

Most of the ethnomedicinal plants were collected from wild habitat (76%) followed by cultivated land 24% (Fig. 3.7). Sometimes local people go far away to collect medicinal plant from hilly region and boarder area. Rarely they cultivate or plant ethnomedicinal plant species in their own residential area. Most of the time they collect the plant material in fresh form and taken internally. Highest percentage of medicinal plant obtained from wild habitat indicates the low cultivation practices of medicinal plants in the study area.

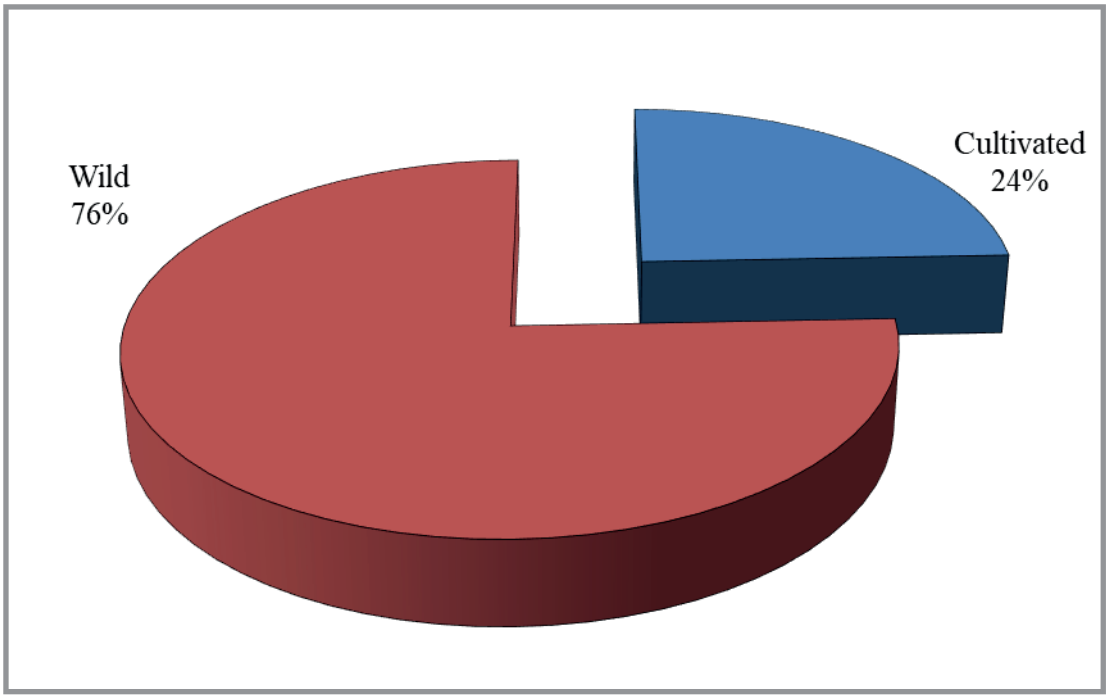


Fig. 3.7. Status of ethnomedicinal plants

3.1.8. Quantitative analysis

3.1.8.1. Frequency of citation (Cf) and Relative Frequency of Citation (RFC)

The most frequently mentioned plants were analyzed regarding the times mentioned by the informant for treatment of different disease category in the study area. To find out the most cited species, Frequency of citation (Cf%) and Relative Frequency of Citation (RFC) were used and top twenty most cited species were presented in Table 3.3.

According the citation frequency highest cited species was *Centella asiatica,* more than 50% of the informants cited the plants for treatment of Dysentery with RFC value (0.11). The second highest cited species *Litsea glutinosa* was attained 42.01% citation frequency which was used by the local people for the treatment of dysentery. *Azadirachta indica* was third highest frequently cited species with 26.9% citation frequency, used for treatment of different diseases mostly cited for treatment of skin disease and diabetes. *Coccinea grandis,*

Ocimum sanctum, *Cynodon dactylon*, *Aloe vera, Leucas lavandulaefolia*, *Adhatoda zeylanica*, *Thevetia peruviana*, *Kalanchoe pinnata*, *Dalbergia sissoo*, *Mangifera indica*, *Clerodendrum viscosum, Scoparia dulcis, Cissus quadrangularis, Aerva sanguinolenta, Holarrhena antidysenterica* and *Hyptis suaveolens* were cited more than 10% of the informants in the study area (Table 3.3).

Relative Frequency of Citation was ranges from 0.1129 to 0.0004 (Table 3.3). Though *Litsea glutinosa*, *Centella asiatica*, *Coccinea grandis*, *Ocimum sanctum, Adhatoda zeylanica*, *Terminalia arjuna*, *Dalbergia sissoo* and *Holarrhena antidysenterica* were attained highest relative frequency of citation but they found in very limited number in the study area. The ethnomedicinal plant species having high RFC values indicated their abundant use and widespread knowledge among the local communities. Traditional healers collected these plant species from the wild habitat and cultivated to their home garden.

Table 3.3: Frequency of citation and Relative Frequency of Citation of top twenty ethnomedicinal plants

Scientific name	Ailments	Citation number	Frequency of citation (Cf%)	Relative Frequency of Citation(RFC)
Centella asiatica (L) Urban,	Dysentery	241	52.73	0.11
Litsea glutinosa (Lour.) Robinson	Dysentery	192	42.01	0.08
Azadirachta indica A. Juss	Skin Allergy	123	26.91	0.05
Coccinea grandis L.	Diabetes	123	26.91	0.05
Ocimum sanctum L.	Cold and fever	103	22.53	0.05
Cynodon dactylon L. Pers.	Cut injury	102	22.31	0.05
Aloe vera (L.) Burm.	Impotence	101	22.10	0.05
Leucas lavandulaefolia Smith.	Cold and Cough	95	20.78	0.04
Adhatoda zeylanica Medikus.	Cold and Cough	72	15.75	0.03
Thevetia peruviana (Pers.) K. Schum	Cut injury	65	14.22	0.03
Kalanchoe pinnata (Lamk.) Pers	Gall bladder Stone	59	12.91	0.02
Clerodendrum viscosum Vent.	Diarrhoea	57	12.47	0.03
Mangifera indica (L.) sw.	Diarrhoea	57	12.47	0.03
Scoparia dulcis L.	Diarrhoea	56	12.03	0.02
Holarrhena antidysenterica (L.) Wall. ex Decne	Dysentery	54	12.2	0.02
Cissus quadrangularis L.	Rheumatic arthritis	54	11.81	0.02
Dalbergia sissoo Miq.	Dysentery	52	11.37	0.02
Aerva sanguinolenta (L.) Blume	Cut injury	49	10.72	0.02
Streblus asper Lour.	Abscess	48	10.50	0.02
Hyptis suaveolens (L.) Poit.	Impotence	47	10.28	0.02

3.1.8.2. The Use value (UV) of ethnomedicinal plants

The UV index allows the identification of a species within a sample without taking into account its use (Category); this is useful in the comparison between species for the whole sample (Andrade-Cetto and Heinrich 2011). The plant species secures a high UV score that indicates there are many use reports for that plant, while a low score indicates fewer use reports cited by the informants. A total of 5395 use reports have been documented in these surveys which are categorized in fifteen different ailments. These include diarrhoea and dysentery ailments totally 914 use reports which is the highest number of records.

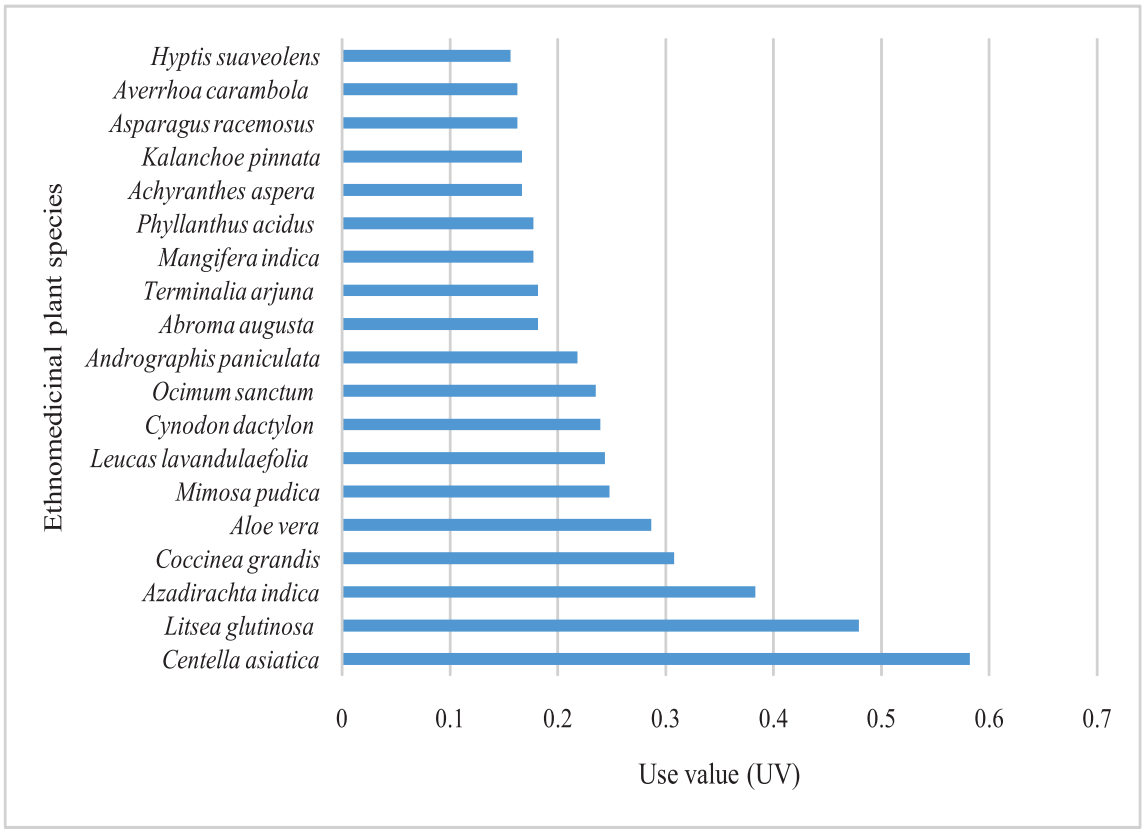


Fig. 3.8. Use value of top twenty ethnomedicinal plant species

The highest use value reported in this study was 0.58, and the lowest value was 0.002. The most relatively important used medicinal plants were *Centella asiatica* (0.58), *Litsea glutinosa* (0.48), *Azadirachta indica* (0.28), *Coccinea grandis* (0.27), *Cynodon dactylon* (0.22), *Ocimum sanctum* (0.21), *Andrographis paniculata* (0.21), *Leucas lavandulaefolia* (0.21), *Terminalia aurjuna* (0.17), *Mangifera indica* (0.17), *Phyllanthus acidus* (0.17), *Achyranthes aspera* (0.16), *Kalanchoe pinnata* (0.16), *Asparagus racemosus* (0.16), *Averrhoa carambola* (0.16), *Hyptis suaveolens* (0.15), *Adhatoda zeylanica* (0.13) and *Heliotropium indicum* (0.14) (Fig. 3.8).

3.1.8.3. Ailments treated with plants and informants consent

*F*ic values determine the consensus or agreement between informants for the particular ailments category, where number of species is low and citation is high than a high *F*ic value is found. In the present study *F*ic values varied from 0.95 to 0.79 (Table 3.4). An average *F*ic value is found 0.83 which is near 1, so the result indicates that there is a strong consensus or agreement between informants for the use of medicinal plant species for that particular ailments category. The category with highest degree of consensus from the informants was diarrhoea and dysentery attained the maximum *F*ic value of 0.95. The ranking followed with remarks from informants related to concerns of respiratory tract disorder (0.94), diabetics (0.93), gynecological problem (0.93), dermatological (0.91), sexual problem (0.91), gastrointestinal (0.90), musculoskeletal (0.90), helminthiasis (0.90) mental disorder (0.89), cardiovascular (0.88), fever and pain (0.87), dental problem (0.87), jaundice (0.79) and others including snake bite, anti aging, weight loss etc (0.79). Such values indicated that maximum informants agreed to treat such ailments using medicinal plants in Brahamanbaria.

The highest informant consensus factor value was obtained by diarrhoea & dysentery ailment (*F*ic = 0.95) and species responsible for this high consensus were *Centella asiatica, Litsea glutinosa, Holarrhena antidysenterica, Scoparia dulcis, Paederia foetida* and *Clerodendrum viscosum.* However the *F*ic value indicates that these ethnomedicinal plant species were most widely used for the treatment of diarrhoea & dysentery. For the illness group of gynoecological, fever & pain and respiratory tract disorder was the second highest according to the informant consensus factor value (*F*ic = 0.93), the most important species for Gynoecological use were *Abroma augusta, Lawsonia inermis, Mimosa pudica, Hibiscus rosa-sinensis, Tamarindus indica. Alternenthera sessilis* and *Plumbago zeylinica* were used mostly for fever category.

Table 3.4. Factor of Informant Consensus (*F*ic) for different (15 Categorized) ailments.

Category	No. of taxa	No. of citation	*F*ic values	Most cited ethnomedicinal Plants
Diarrhoea & dysentery	45	914	0.95	*Centella asiatica*, *Litsea glutinosa*, *Scoparia dulcis*, *Holarrhena antidysenterica*, *Paederia foetida*, *Stephania japonica*, *Clerodendrum viscosum*, *Dalbergia sissoo*
Respiratory tract disorder	30	506	0.94	*Ocimum sanctum*, *Echinopsis peruviana*, *Adhatoda zeylanica*, *Leucas lavandulaefolia*
Gynecological	32	468	0.93	*Eclipta alba*, *Abroma augusta*, *Mimosa pudica, Lawsonia inermis*, *Butea monosperma*
Diabetics	44	637	0.93	*Coccinea grandis*, *Momordica indica*, *Syzygium cumini*, *Ficus racemosa*, *Kalanchoe pinnata*

Category	No. of taxa	No. of citation	*F*ic values	Most cited ethnomedicinal Plants
Sexual Problem	32	374	0.92	*Aloe vera*, *Hyptis suaveolens*, *Mimosa pudica*, *Litsea glutinosa*, *Bombax ceiba*
Dermatological	46	532	0.92	*Azadirachta indica, Heliotropium indicum, Phyllanthus acidus, Solanum sisymbrifolium*
Gastrointestinal	48	527	0.91	*Pithecellobium dulce*, *Phyllanthus embelica*, *Hyptis suaveolens*
Musculoskeletal	50	515	0.90	*Cissus quadrangularis, Aerva sanguinolenta, Cynodon dactylon, Thevetia peruviana, Mikania cordata*
Helminthiasis	13	121	0.90	*Cuscuta reflexa, Ananus sativus, Glycosmis pentaphylla*
Mental disorder	11	96	0.89	*Asparagus racemosus, Datura metel, Bacopa monneiri, Streblus asper*
Cardiovascular	17	150	0.89	*Terminalia arjuna,Achyranthes aspera, Terminalia bellirica, Rauvolfia serpentina*
Fever and pain	23	187	0.88	*Andrographis paniculata, Cajanus cajan , Echinopsis peruviana, Plumbago zeylanica, Alternanthera sessilis*
Dental problem	24	184	0.87	*Kalanchoe serrata, Psidium guajava, Ricinus cummunis, Jatropa gosspifolia*
Jaundice	23	106	0.79	*Ageratum conyzoides, Blumea lacera, Achyranthes bidentata, Oenanthae javanica*
Others	17	79	0.79	*Aegle marmelos, Andrographis paniculata*

For respiratory tract disorder *Ocimum sanctum*, *Adhatoda zeylenica*, *Leucus lavandulaefolia* were used mostly. High F*ic* values also indicate that the species which are traditionally used to treat these ailments are worth searching for bio-active compounds.

Table 3.5. Ailments grouped by major ailment categories

Category no.	Category	Common diseases/ Medical terms	No. of species
1	Gastrointestinal	Abdominal pain, Appetizer, Constipation, Laxative, Digestion, Gastric	50
2	Musculoskeletal	Cut injury, Rheumatoid arthritis. Inflammation, Muscle pain, Paralysis,	48
3	Dermatological	Abscess, Acne. Dandruff, Daud, Eczema, Itching, Scabies. Skin allergy, Skin whitening, Dermatitis, Rash	46
4	Dirrhoea& dysentery	Diarrhoea, Dysentery	45
5	Diabetics	Diabetes, Liver complain, Edema	44

Category no.	Category	Common diseases/ Medical terms	No. of species
6	Gynecological	Irregular menstruation, Leucorrhoea, Lactation. Labor pain, Urine infection, Abortion, Menstrual pain	32
7	Respiratory tract disorder	Cold, Cough, Asthma, Bronchitis, Pneumonia, Tonsillitis	30
8	Sexual Problem	Impotency, Aphrodisiac, Excessive semen flow, Energy tonic,	32
9	Dental problem	Toothache, Tooth infection, Oral infection	24
10	Fever and pain	Fever, pain, Headache, Malaria	23
11	Jaundice	Jaundice, Hepatitis	23
12	Cardiovascular	Burning chest pain, Heart disease, High blood pressure, Blood purifier	16
13	Helminthiasis	Anthelmintic, Ringworm	13
14	Mental disorder	Headache. Mental disorder	11
15	Others	Dog bite, Poison, Evil eye, Obesity, Vomiting, Hair dye, Hum, Snake bite	17

Each species may be listed in several categories.

Table 3.5 showed that maximum plants used for musculoskeletal (50 species), followed by gastrointestinal (48 species.), dermatological (46 species), diarrhoea and dysentery (45 species), diabetics (44 species), gynecological (32 species), sexual problem (32 species) and respiratory tract disorder (30 species).

3.1.8.4. Fidelity level (Fl)

The medicinal plants that are widely used by the local people have higher Fl values than those that are less popular. The percentage of informants claiming the use of a plant species for the same major purpose was estimated using the Fidelity level index. The analyzed categories with major agreements to highlight the most important plants in each category are listed in (Table 3.6). Among the reported plants, 20 species have the highest Fl of 100% most of which were used in the single ailment category with multiple informants.

The plants with highest Fl of 100% were *Adhatoda zeylanica* Medikus*, Ananas sativus* (Lindl.) Schult. f., *Aerva sanguinolenta* (L.) Blume, *Butea monosperma* (Lam.) Taub., *Calotropis procera* (Ait.) R. Br., *Catharanthus roseus* L., *Dalbergia sissoo* Miq., *Echinopsis peruviana* (Britton & Rose), *Ficus racemosa* L., *Holarrhena antidysenterica* (L.) Wall. ex Decne*, Jatropha gossypifolia* L., *Kalanchoe serrata* Mann. & Boit., *Mikania cordata* (Burm. f.) Robinson, *Momordica indica* L. *Paederia foetida* L., *Syzygium cumini* (L.) Skeels, *Thevetia peruviana* (Pers.) K. Schum. *Scoparia dulcis* L.*, Vitex nigundo* L. and *Zingiber officinale* Rosc.

Table 3.6. Fidelity level (Fl) of most cited ethnomedicinal plants.

Scientific name	Np	Nt	FL (%)
Adhatoda zeylanica Medikus	72	72	100
Aerva sanguinolenta (L.) Blume	49	49	100
Ananas sativus (Lindl.) Schult. f.	37	37	100
Butea monosperma (Lam.) Taub.	30	30	100
Calotropis procera (Ait.) R. Br.	33	33	100
Catharanthus roseus L.	30	30	100
Dalbergia sissoo Miq.	52	52	100
Echinopsis peruviana (Britton & Rose)	37	37	100
Ficus racemosa L.	30	30	100
Holarrhena antidysenterica (L.) Wall. ex Decne.	47	47	100
Jatropha gossypifolia L.	30	30	100
Kalanchoe serrata Mann. & Boit.	38	38	100
Lippia alba (Mill.) Briton *et* Wilson	33	33	100
Mikania cordata (Burm. f.) Robinson	36	36	100
Momordica indica L.	46	46	100
Paederia foetida L.	34	34	100
Syzygium cumini (L.) Skeels	43	43	100
Thevetia peruviana (Pers.) K. Schum	65	65	100
Vitex nigundo L.	34	34	100
Scoparia dulcis L.	56	56	100
Zingiber officinale Rosc.	31	31	100

Some plants also showed very high Fl value (upto 90%) were *Centella asiatica*, *Litsea glutinosa, Azadirachta indica*, *Ocimum sanctum*, *Mangifera indica*, *Hyptis suaveolens*, *Psidium guajava*, *Cajanus cajan*, *Cynodon dactylon*, *Coccinea grandis*, *Trewia nodiflora*, *Abroma augusta*, *Eclipta alba* and *Glycosmis pentaphylla.* The maximum Fl for the above plants indicated 100% choice of the interviewed informants for treating specific ailments and this could be an indication of their healing potential.

3.1.9. New Reports

Based on literature survey among the 485 formularies recorded in the study area, four plants recorded as new ethnomedicinal plant and 96 formularies using 77 species have been reported as new for Bangladesh compared with published literature (Hassan and Khan 1986, 1996, Mia and Huq 1988, Alam 1992, Yusuf *et al.* 1994, 2006, 2009; Chowdhury *et al*. 1996, Ghani 2003, Uddin *et al*. 2001, 2004, 2006, 2008, 2012, 2014, 2015, 2016, 2017, Khan *et al.* 2002, Chakma *et al*. 2003, 2010, Mollic *et al.* 2010, Rahman *et al*. 2003, 2014, Sajib and Uddin 2013, Uddin *et al.* 2014, 2015, Khan *et al*. 2014,http://www.mpbd.info). These are *Kalanchoe serrata* Mann. & Boit. *Achyranthes bidentata* Blume, *Lippia alba* (Mill.) Briton *et* Wilson, *Echinopsis peruviana* (Britton & Rose) (Table 3.7) and (Plate 12).

In the present study, *Kalanchoe serrata* used for toothache*, Achyranthus bidentata* used for jaundice*, Lippia alba* (Mill.) Briton *et* Wilson used for dirrhoea and dysentery and *Echinopsis peruviana* (Britton & Rose) used for cold and cough.

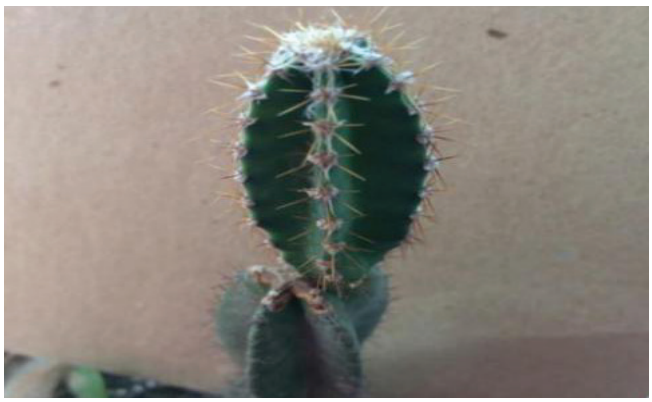
Another use found in the ancient Chinese folk doctors placed the juice from the smashed root of *A. bidentata* into vagina to induce abortion, and the decoction from *A. bidentata* was used for female blood clots based on its anticoagulative activity. Today, the root of *A. bidentata* and its medical applications are prescribed and updated in the Chinese Pharmacopeia (2010 edition) as an important herbal medicine. Its multiple pharmacological effects include anti-osteoporosis, antitumor and immunomodulatory activities (Jiang *et al.* 2017).

Lippia alba (Mill.) N.E. Br. ex Britton & P. Wilson (Verbenaceae) is an aromatic plant widely used all over South and Central America for different purposes. Several papers have presented ethnopharmacological studies dealing with *L. alba* as sedative, antidepressant and analgesic properties. The essential oil of *L. alba* also has many applications such as stomachic, anti-spasmotic, digestive, anti-hemorrhoidal and anti-asthmatic (Hennebelle 2008).

Kalanchoe serrata Mann. & Boit

Lippia alba (Mill.) Briton et Wilson

Achyranthes bidentata Blume



Echinopsis peruviana (Britton & Rose)

Plate 12. New ethnomedicinal plant species

Table 3.7. New formularies compared with previous ethnomedicinal studies.

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Abelmoschus esculentus (L.) Moench	Diabetes	Fruit	Boiled with salt and eaten occasionally	Fruit is used for dirrhoea in Bandarban district (Uddin *et al*. 2015), This plant used in chronic dysentery, gonorrhoea, urinary discharges, strangury, diarrhoea, spesrmatorrhoea and cancer (www.mpbd.info)
Abroma augusta (L.) L. f.	Diabetes	Stem	Soaked in water & one glass taken everyday	Leaves juice is used for control hiccup (Sajib and Uddin 2013), gastric, pneumonia, jaundice, urinary trouble (Uddin *et al*. 2016), abortion, asthma, bronchites, carbuncle, constipation, cough, epistaxis, gastric tumor, gout, gynecological disease, hook worm infestation and hysteri (www.mpbd.info)
		Leaf	Soaked in water over night than taken internally in morning	
Abutilon hirtum (Lamk.) sweet.	Fever	Leaf	Paste taken internally	
Achyranthes aspera L.	Evil eye	Root	Tied it into a tabiz at Saturday or Tuesday	Leaves juice is used for dysentery (Uddin *et al*. 2015), Rheumatism (Sajib and Uddin 2013), Jaundice (Sajib and Uddin 2015), toothache (Uddin *et al*. 2016), jaundice (Uddin *et al*. 2015), laxative, stomachic, carminative, astringent, depurative, emetic and good diuretic, found efficacious in renal dropsis and general anasarc, used in piles, boils, skin eruptions, kidney stone and colic (www.mpbd.info)
Achyranthes bidentata (Blume)	Jaundice	Leaf	Juice taken internally	
Aegle marmelos (L.) Corr.	Eye complain	Stem	Tied young stem around the Head	Fruit is used for vomiting in Cox,s Bazar (Uddin *et al*. 2013), dysentery (Sajib and Uddin 2013), energy tonic (Sajib and Uddin 2015), ulcer (Uddin *et al*. 2016), fruits are astringent, digestive, tonic, stomachic, laxative, appetizer, unripe fruit is used in diarrhoea (www.mpbd.info)

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Alstonia scholaris L. R. Br.	Pain	Bark	Paste applied externally	Leaves juice is internally taken for joint pain and fever (Uddin *et al*. 2012), cough (Uddin *et al*. 2015) The bark is astringent, tonic, anthemintic, laxative, febrifuge, alterative and antiperiodic. It is a valuable remedy in chronic diarrhoea and the advanced stages of dysentery, also useful in catarrhal fever, skin diseases and malaria (www.mpbd.info)
Blumea lacera (Burm. f.) DC. Wight.	Jaundice	Root	Juice taken internally	Stop bleeding (Sajib and Uddin 2015), Cholera, dysentery, piles (Uddin *et al*. 2015), rheumatic pain (Uddin *et al*. 2015), plant is stomachic, antispasmodic, antipyretic and diuretic, cures bronchitis, fevers and burning sensation (Uddin *et al*. 2013), leaf juice is anthelmintic, febrifuge, stimulant and diuretic (www.mpbd.info).
Bombax ceiba L.	Headache	Bark	Paste applied externally on head	Decoction of bark is externally applied for Skin disease (Uddin *et al.* 2015), root is taken to treat gastritis and sexual weakness (Sajib and Uddin2013, 2015, Uddin *et al*. 2015), The bark is emetic, used as a styptic in metrorrhagia. The gum is acrid, astringent, demulcent, tonic, alterative, haemostatic and aphrodisiac, useful in diarrhoea, dysentery (Uddin *et al*. 2016) menorrhagia, cough, leucorrhoea, stomatitis and burning of the body (www.mpbd.info).
	Diabetes	Bark	Grinded & mixed with water than taken internally	
Bursera serrata Colebr.	Stop bleeding	Fruit	Powder mix with water & taken internally until disease is cured	
Cajanus cajan L.) Millsp.	Body pain	Leaf	Fried & eaten	Dog bite (Sajib and Uddin 2015), leaves are used in diseases of the mouth and piles, chewed in cases of aphthae and spongy gums, laxative, given in jaundice (Uddin *et al.* 2016, Uddin and Hassan 2016, Uddin *et al.* 2015). The seeds are astringent to the bowels and anthelmintic (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Cassia fistula L.	Rheumatic pain	Fruit	Dried to made tablet & taken internally two times daily	Extract prepared from root is applied to the affected area for the treatment of piles (Uddin *et al.* 2013), constipation (Sajib and Uddin 2013), dysentery (Uddin and Hassan 2014) leaves are laxative and antiperiodic, useful in ulcers, juice of the young leaves is used to cure ringworms, fruit is laxative, given in liver disorder (www.mpbd.info).
	Leucchoea	Leaf	Decoction taken internally	
Centella asiatica (L.) Urban	Eye complain	Leaf	Two drops of decoction applied externally on eye	Leaves juice is used for the treatment of jaundice, fever, gastrititis (Uddin *et al*. 2015), brain tonic (Uddin *et al*. 2015), plant is alterative, astringent, tonic, diuretic, laxative, digestive and antipyretic, improves appetite, voice and memory, cures dysentery, leucoderma, urinary discharges, bronchitis, inflammations, fevers (www.mpbd.info).
Citrus grandis (L.) Osbeck	Diabetes	Leaf	Juice taken internally	The fruit is considered nutritive, cardiotonic and refrigerant, useful in influenza, cough, catarrh and asthma (Uddin *et al*. 2015). The rind is anthelmintic, useful in vomiting, epilepsy, chorea and convulsive cough (www.mpbd.info).
Clerodendrum viscosum Vent.	Dirrhoea	Leaf	Extract internally taken by children	Extract prepared from leaves applied to the treatment of swelling legs (Uddin *et al*. 2013), cold, diabetes (Uddin *et al*. 2015), fever (Uddin *et al*. 2016), plant is tonic, leaves and roots are used in asthma, tumours and certain skin diseases. Infusion of the leaves is used as bitter tonic and antiperiodic in malaria (Uddin and Hassan 2014). Expressed juice of the leaves is laxative and cholagogue (www.mpbd.info)
Clinogyne dichotoma (Roxb.) Salishb. Ex Benth	Rheumatic pain	Rhizome	Decoction taken occasionally	Ear complain (Uddin *et al*. 2015)
Coccinea grandis (L.) Voigt.	Headache	Leaf	Paste applied on head	Leaves is used for treatment of Diabetics and dysentery (Rahman 2015, Haque and Uddin *et al*. 2017, Sajib and Uddin 2015), Juice of the plant is used in diabetes. It is also used in anorexia, epilepsy, asthma, fever, dropsy, catarrh and gonorrhoea. Leaves are externally used in skin eruptions. Leaf juice is taken in the morning for 7 days to normalize hypertension (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Cocos nucifera L.	Rheumatic pain	Fruit	Pulp taken internally	Fever, Urin infection (Uddin *et al*. 2016), coconut milk is refrigerant, aphrodisiac, laxative and anthelmintic, useful in bronchitis, water is refrigerant, demulcent and in large dose aperient. Water of unripe fruit is largely used as cooling in diarrhoea (www.mpbd.info)
Commelina benghalensis L.	Eye complain	Whole plant	Grinded & applied externally on eye	The plant is demulcent, refrigerant, laxative and emollient, useful in leprosy, otitis media and sores (www.mpbd.info).
	Jaundice	Whole plant	Juice taken internally	
Crataeva magna (Lour.) DC.	Dirrhoea	Leaf	Juice taken internally	Joint pain (Uddin *et al*. 2015)
	Ear complain	Leaf	Juice taken internally	
Curcuma longa L.	Toothache	Flower	Paste applied on teeth	Used in Diabetes (Uddin et al.2016), Skin disease, toncilitis (Uddin *et al*. 2015). The rhizome is laxative, carminative, diuretic, stimulant, vulnerary, tonic, externally rhizome is used in the treatment of scabies, itches, boils, abscess, eczema, leucoderma, eye diseases, pains, bruises and sprains (www.mpbd.info).
Curcuma zedoaria (Christm.) Rosc.	Jaundice	Rhizome	Juice taken internally	Rhizomes and tubers are stimulant, carminative, stomachic, expectorant, demulcent, diuretic, rubefacient and cooling, used in flatulence and dyspepsia and as a corrector of purgatives, applied to bruises and sprains. (www.mpbd.info).
Cuscuta reflexa (Roxb.)	Epilepsy	Whole plant	Juice taken internally	Fructure (Uddin *et al.* 2013), Dirrhoea (Uddin and Hassan 2014).Plant is astringent, expectorant, carminative, tonic, purgative, diuretic and anthelmintic, and reported to have anti-fertility properties, used in jaundice in Rema-Kalenga (www.mpbd.info)

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Cynodon dactylon L. Pers.	Jaundice	Leaf	Juice of young leaf internally taken by chewing	The plant is used in piles, leucorrhoea, toothache, eczema, excessive menstrual discharges, stomatitis, epistaxis, bruises and hiccup, cuts and wounds (www.mpbd.info).
Cestrum nocturnum L.	Vomitting	Flower	Inhale the smell of flower	
Chromolaena odorata (L.) R. M. King & H. Rob.	Dysentery	Leaf	Juice is taken internally	Reduced pressure (Uddin *et al*. 2015)
Datura metel L.	Dog bite	Leaf	Paste applied on affected area	Rheumatism (Sajib and Uddin 2015, Uddin *et al*. 2013), Allergy (Uddin and Hassan 2014). Leaves are used as a local application for rheumatic swellings of the joints, lumbago, sciatica, neuralgia, painful tumours and glandular inflammations, such as mumps (www.mpbd.info).
Dillenia indica L.	Diabetes	Fruit	Taken internally	The fruits are tonic and laxative, used in diarrhoea, dysentery and burns in Khagrachari. The fruit juice is used as a cooling beverage in fevers and as an expectorant in cough mixture. The bark and leaves possesses astringent properties (www.mpbd.info)
Eclipta alba (L.) Hassk.	Leucchoea	Whole plant	Juice mixed with *turmeric* than taken internally for 7 days	Hair tonic (Sajib and Uddin 2015), plant is tonic, antipyretic, stomachic, anthelmintic, pectoral, anti-asthmatic and expectorant, cures inflammations, hernias, eye diseases, bronchitis, asthma, leucoderma, anaemia, itching, night blindness, improves the colour of the hair and promote grow (www.mpbd.info)
	Toothache	Root	Mixed with *turmeric* than chewed	
	Eye complain	Leaf	Two drops of juice applied on eye	
Echinopsis peruviana (Britton & Rose)	Fever & Cold	Aerial part	Juice taken internally three times daily	

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
	Daud	Aerial part	Paste applied externally	
	Fever & Cold	Stem	Juice is prepared by warmed the leave which taken internally three times daily	
Elaeocarpus robustus Roxb.	Vomitting	fruit	Internally taken by pregnant women	Appetizer (Uddin *et al*. 2015). Leaves are used in rheumatism. Fruits are prescribed in dysentery and diarrhoea. Infusion of the bark and leaves are used as a mouth-wash for inflammed gums (www.mpbd.info).
Entada scandens Benth.	Aphrodiasiac	Seed	One spoonful powder taken internally	mumps (www.mpbd.info)
Eriochloa procera (Retz.) C.E. Hubb.	Skin disease	Whole plant	Decoction taken internally for 2 days	
	Toothache	Whole plant	Mixed with *turmeric* and *garlic* which is used externally	
Eryngium foetidum L.	Appetizer	Whole plant	Taken internally as salad	
	Odontology	Whole plant	Juice taken internally	
Erythrina indica Lamk.	Burned injury	Root	Paste applied burned area with oil	Anthelminctic (Uddin *et al*. 2013). Leaves are stomachic, anthelmintic, laxative, diuretic, gatactagogue and emmenagogue, applied externally for dispersing venereal buboes, juice is poured in to the ear to relief earache and is used as an anody (www.mpbd.info).
Euphorbia hirta L.	Lactation	Whole plant	Juice taken internally as necessary	Dirrhoea, tonic, ulcer (Uddin *et al*. 2015)

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Euphorbia tirucalli L.	Cut injury	Latex	Applied externally	Extract prepared from Leaves taken to the treatment of dirrhoea (Uddin *et al*. 2013)
Ficushispida L.	Dandruff	Seed	Burned seed taken internally	Reduce pain (Uddin *et al*. 2013) All parts of the plant are cooling, astringent to the bowels and antidysenteric, useful in ulcers, biliousness, psoriasis, anaemia, piles, jaundice, haemorrhage of the nose and mouth. Fruit, seeds and bark are purgative, emetic, lactagogue and tonic (www.mpbd.info).
Glinus oppositifolius (L.) Aug	Fever & pain	Whole plant	Cooked and eaten with rice	The plant is stomachic, aperient and antiseptic, used in skin diseases and for suppression of the lochia. Warmed herb moistened with castor oil is a good cure for earache. The juice is applied to itch and other skin diseases (www.mpbd.info).
Heliotropium indicum L.	Headache	Leaf	Grinded with salt than applied externally on eye	Plants are astringent, emollient, vulnerary and diuretic, used in ulcers, sores, wounds, gum boils, skin affections, stings of insects and rheumatism (www.mpbd.info).
Imperata cylindrica (L.) P. Beauv.	Impotence	Root	Juice taken internally	Roots are used in fever
Ipomoea fistulosa Mart. ex Choisy	Cut injury	Stem	Latex is applied externally on the affected area	Plant is used as antidiabetic. Whole plant or its infusion is used in low fever and skin diseases. Root is aphrodisiac and laxative, useful in strangury and diarrhoea (www.mpbd.info)
Kalanchoe pinnata (Lamk.) Pers.	Menusturation	Leaf	Chewed to take the decoction internally	Urinary problem, (Uddin *et al*. 2008, Uddin *et al*. 2016), leaves are diuretic, antilithic and insecticidal, applied to wounds, boils and bites of insects. It is useful in bronchial affections, kidney stones, blood dysentery, gout and jaundice. Juice of the warmed leaves is drunk for cough (www.mpbd.info).
Kalanchoe serrata Mann & Boit.	Toothache	Leaf	Decoction is applied externally into the mouth	
Lablab purpureus (L.) Sweet.	Etching	Leaf	Rubbing	Seeds are considered laxative, diuretic, galactagogue, febrifuge, stomachic, tonic, antispasmodic and aphrodisiac, useful in inflammations. Leaves are emmenagogue and reputed alexipharmac, given in colic (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Lactuca sativa L.	Heartahce	Leaf	Taken internally as salad	
Lannea coromandelica (Houtt.) Mers, TH-132	Labour pain	Stem	Tied around the body	The bark is considered astringent and stomachic, used as a lotion in impetigenous eruptions, leprous and obstinate ulcers, cures sprains, bruises, skin eruptions, heart diseases, dysentery and mouth sores (www,mpbd.info). Decoction of the bark is used for toothach (Uddin *et al*. 2015).
Leucus lavandulaefolia Smith, TH-137	Constipation	Leaf	Juice taken internally	Leaves are roasted and eaten with salt as a febrifuge and to restore appetite. Juice employed in headaches, cough, scabies and cold. Leaves mixed with salt and kerosene is useful as poultice in sores and wounds (www.mpbd.info).
Lippia alba (Mill.) Briton et Wilson, TH-138	Dirrhoea	Leaves	Juice taken 2/3 times every day until disease is cured	
Litsea glutinosa (Lour.) Robinson, TH- 08	Chest pain	Bark	Paste applied externally	Jaundice and dysentery (Uddin and Hassan 2014), the mucilaginous bark is largely employed as a demulcent and mild astrigent in diarrhoea and dysentery. Freshly ground bark used as an emollient application to bruises and as a styptic dressing for wounds. It is also considered aphrodisiac (www.mpbd.info).
Ludwigia prostrata Roxb, TH-187	Dirrhoea	Leaf	Cooked & taken internally	
Manihot esculenta Crantz TH-285	Jaundice	Root	Juice taken internally	Jaundice (www.mpbd.info)
Manilkara zapota (L.) P. Royen TH-279	Cold and cough	Leaf	Decoction is taken internally twice daily	Bark is febrifuge, astringent and tonic, given in diarrhoea. Fruits soaked in melted butter whole night and eaten in the next morning is considered preventive against biliousness and febrile attacks. Seeds are diuretic (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Mentha arvensis L, TH-37	Leucorrhoea	Whole plant	Juice taken internally or eaten as salad	This plant is used in Appetizer, stomach upset, dyspepsia, refrigerant, stomachic, diuretic, stimulant, expectorant,carminative, diaphoretic, antispasmodic, emmenagogue, jaundice, vomiting, fevers, indigestion, cephalalgia, antineuralgic (www.mpbd.info).
Mesua ferra L.	Dysentery	Leaves/ Flower	Decoction taken internally in empty stomach until disease is cured	Flower and root extract used in prickly heat and for coldness of body (Uddin *et al*. 2013)
Mimusops elengi L.	Toothache	fruit	Soaked water used for gurgeling	Flowers are expectorant, cures biliousness, liver complaints, diseases of the nose and headache, smoked to relief asthma. The pulp of the ripe fruit is astringent and useful in curing chronic dysentery (www.mpbd.info)
Mucuna pruriens (L.)	Urothral stone	Leaf	Juice taken internally for several days	Plant is used in Weakness, nervine tonic, skin disease, rheumatism, purgative, emmenagogue, fever, cholera, diuretic, ulcers, anthelmintic, vermifuge, ascarids, aphrodisiac (www.mpbd.info).
Nyctanthes arbortristis L.	Menstruration	Seed	Juice taken internally	Fever, anthelminctic (Uddin *et al*. 2017), leaves are antibilious, used in bilious fever and rheumatism, given to children for the expulsion of round and thread-worms, with honey the juice is given in chronic (www.mpbd.info).
Ocimum sanctum L.	Toothache	Leaf	Mixed with *cumin* seed to form paste which is applied externally	Cold and cough (Sajib and Uddin 2013, Uddin *et al*. 2015), ringworm (Uddin and Hassan), leaves are demulcent, expectorant and antipyretic, juice is used for the treatment of coughs, colds, catarrh and bronchitis, useful in gastric disorder, earache, ringworm, leprosy and itches (www.mpbd.info)
	Diabetes	Leaf	Juice taken internally	
Oenanthe javanica (Blume) DC.	Jaundice	Leaves	Juice taken internally	
Opuntia dillenii Haw.	Pain	Root	Grinding to form powder which is taken internally with water every morning	The plant is used in Impotence, digestive, carminative, diuretic, purgative, leucoderma, enlarged spleen, urinary burning, vesicular calculi, ophthalmia, dandruff, whooping cough, ashma, gonorrhoea (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Oroxylum indicum (L.) Kurz.	Fertility	Leaf	Juice taken internally by married women	Leaves juice is used for the treatment of cough (Sajib and Uddin 2013), constipation, Jaundice (Uddin *et al*. 2015), tender fruits are expectorant, carminative, stomachic and reputed emollient, useful in leucoderma. Seeds are purgative. Stem is used in scorpion-stings. The powder and infusion of the bark are diaphoretic, and useful in acute rheumatism (www.mpbd.info).
Pandanus foetidus Roxb. Fl.	Fracture bone	Root	Mixed with leave of *Azadirachta indica* and *Curcuma longa* to form paste which is applied externally	
Paspalum scrobiculatum L.	Diarrhoea	Whole plant	Tied around waist until cure	
Pedilanthus tithymaloides Poit.	Cut injury	Stem	Latex is applied externally on the affected area	
Phyllanthus acidus (L.) Skeels.	Lactation	Fruit	Taken internally as necessary	Used in skin disease (Sajib and Uddin 2013) bronchitis, biliousness, urinary concretions and piles, useful in thirst, vomiting and constipation. The root and the seeds are cathartic (www.mpbd.info).
Phyllanthus reticulatus Poir.	Eye complain	Stem	Grinded 3 twigs with salt than 3 drop of juice applied on eye at night for 2/3 days	Dysentery (Sajib and Uddin 2013). The leaves are employed as a diuretic and cooling medicine. Juice of the leaves is used in diarrhoea of infants. Pills made in combination with the leaf juice, camphor and cubebs are allowed to dissolve in the mouth as a remedy for spongy and bleeding gum (www.mpbd.info).
Piper betle L.	Toothache	Leaf	Chewed & taken the decoction	The plant is used in rheumatism (Sajib and Uddin 2013, Uddin *et al*. 2015), cut injury (Uddin and Hassan 2014), stomach pain, carminative, stimulant, antiseptic, astringent, boils, cold, fever, lice infestation, rabies (www.mpbd.info).
Pithecellobium dulce (Roxb.) Benth.	Absess	Bark	Paste applied externally	The bark is used as a febrifuge and decoction of it is given as an enema (www.mpbd.info).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
	Dirrhoea	Bark	Boiled in water which is taken twice daily	
Portulaca oleracea L.	Dysentery	Whole plant	Decoction is given to children	The herb is refrigerant, alterative, vulnerary, antiscorbutic, aperient and diuretic, useful in scurvy, diseases of the liver, spleen, kidney and bladder. It is also prescribed in the treatment of cardio-vascular diseases, dysuria, hematuria, gonorrhoea (www.mpbd.info).
Ricinus communis L.	Vomitting	Stem	Tied around the neck of children	Impotence (Uddin *et al*. 2015), ringworm, absess (Uddin and Hassan 2014), Seed oil is a strong purgative, used externally as a massage for rheumatic pains, joint pain, paralysis and internally for the treatment of constipation (www.mpbd.info).
Solanum sisymbrifolium Lamk.	Dirrhoea	Root	Decoction is taken internally	
	Jaundice	Root	Juice taken internally in a empty stomach for 7 days	
Spondias pinnata (L. F.) Kurz	Dandruft	Bark	Paste applied externally	The bark is astringent and refrigerant, infusion of the bark is given in dysentery, diarrhoea and to prevent vomiting. Paste of the bark is used as an embrocation for both articular and muscular rheumatism (www.mpbd.info).
Streblus asper Lour.	Epilepsy	Leaf	Paste applied on head	Root extracts used for exceesive menustration (Uddin *et al*. 2013), dysuria and dysentery (Yusuf, 2009), Pox, dysurea (Sajib and Uddin 2013)
Syzygium samarangense (Blume) Merr. & Perry	Diabetes	Fruit	Juice taken internally	
Tamarindus indica L.	Urine infection	Leaf	Blended with water & one glass of juice taken every morning in empty stomach until cure	Heart disease, chiken pox, rheumatic pain (Sajib and Sajib 2013), abscess (Uddin and Hassan 2014), ringworm (Uddin *et al*. 2015), constipation impotence, reduced pressure (Uddin *et al*. 2015).

Scientific name	Ailments	Part use	Treatment mode	Previous report of ethnomedicinal uses
Thevetia peruviana (Pers.) K. Schum.	Cut injury	Stem	Latex applied externally on injured area	Urinary problem (Uddin *et al*. 2008), rheumatism, cardiac stimulant, used in fever, abortifacient; used for suicidal and homicidal purposes (www.mpbd.info)
Trewia nudiflora L.	Dysentery	Bark	Grinded with bark of *mango* and mix with water than taken internally	

3.2. Antibacterial activity

3.2.1. Selected ethnomedicinal Plants

A list of 247 medicinal plant under 89 families have been recorded in between June 2015 to June 2017 from 467 local people using mainly key informant's interview and also followed by group discussions, field interviews and plant interviews. These plants have been used to treat 73 ailments through 485 formularies. In order to identify the most important ethnomedicinal plants in the study area, Factor of informant consensus (F_{ic}), Fidelity level (Fl), Citation frequency (Cf) and Use Value (UV) of ethnomedicinal plants have been calculated.

Table 3.8. Selected ethnomedicinal plant species based on highest consent values

Plants name and voucher number	Citation frequency (Cf)	Fidelity level (Fl)	Formularies found in current study	Uses in other reference
Litsea glutinosa (Lour.) Robinson, TH- 08	42.1%	91.28%	Two or three eaves were mashed with water than 150 ml taken morning & evening until the disease iscured	Dysentery (Uddin and Hassan 2014), Absess, Diarrhoea Impotence (Uddin *et al*. 2015, 2012) Cuts and wounds (Rahman 2010)
Scoparia dulcis L., TH-172	14%	100%	Decoration of leaves taken	Infection (Uddin *et al.* 2015) Dysentery (Sajib and Uddin 2013), Fever (Uddin *et al*. 2015)
Holarrhena antidysenterica (L.) Wall. ex Decne., TH-148	12.50%	100%	Juice of fresh leaves taken in the morning for seven days	Dysentery (Uddin *et al*. 2015) skin disease (Rahman 2010)
Clerodendrum viscosum Vent., TH-153	12.20%	91.93%	Two spoonful extract of leaves taken twice daily	Cold, Diabetics, Stomachache (Uddin *et al*. 2015, 2012), Vomiting (Rahman 2014), Antihelminthes (Uddin and Hassan 2014)
Dalbergia sissoo Miq, TH-104	11.20%	100%	One or two spoonful juice taken twice daily for seven days	Dysentery (Uddin *et al.* 2015, Uddin and Hassan 2014) Absess (Rahman 2014)
Phyllanthus reticulatus Poir., TH-61	10%	76%	One spoonful of leave extracts were taken	Diarrhoea (Uddin *et al*. 2015, Sajib and Uddin 2013)
Paederia foetida L., TH-30	8.2%	100%	Paste taken internally with or without rice	Diarrhoea (Uddin *et al*. 2015
Stephania japonica (Thunb.) Miers., TH-60	6.3%	64%	Grinded & mixed with water which is taken internally twice a day for 7 days	Dysentery, ear complain (Uddin *et al.* 2015), pain (Sajib and Uddin 2013)

Litsea glutinosa (Lour.) Robinson

Stephania japonica (Thunb.) Miers.

Phyllanthus reticulatus Poir.

Clerodendrum viscosum Vent.

Holarrhena antidysenterica (L.) Wall.*ex* Decne.

Scoparia dulcis L.

Paederia foetida L.

Dalbergia sissoo Miq

Plate 13. Selected ethnomedicinal plant species for antibacterial activity

Maximum F_{ic} value was found in case of Diarrhoea and dysentery category (F_{ic}= 0.95). This disease category was treated by 51 ethno-medicinal plant species by the local people of Brahmanbaria district.

The most important plants of this category was *Centella asiatica* with 241 citation (Cf=52%), *Litsea glutinosa* (menda) with 192 citation (Cf= 42%), *Scoparia dulcis* with 55 citation (Cf= 12.3%), *Clerodendrum viscosum* with 57 citation (Cf=12.47%), *Mangifera indica* with 57 citation (Cf= 12.4%), *Holarrhena antidysenterica* with 54 citation (Cf=12.2%), *Dalbergia sissoo* with 52 citation (Cf=11.37%), *Phyllanthus reticulatus* with 10% citation frequency, *Paederia foetida* with 8.2% citation frequency and *Stephania japonica* with 6.3% citation frequency.

Among them eight medicinal plant species have been selected for antibacterial activity based on the consensus analysis (Table 3.6).Though *Centella asiatica* and *Mangifera indica* (with 57 citation, Cf= 12.4%) were two highly cited ethnomedicinal plants of this category but not selected for antibacterial activity as they were studied before.

Leaves were used as plant material for all the selected plant species. The local people collected fresh leaves from the study area of these plant species and used for the treatment of diarrhoea and dysentery. Photographs of the selected ethnomedicinal plant species are provided in Plate 13.

3.2.2. Plant extracts yield

Ethanol extraction gave different extraction yields. *Dalbergia sissoo* had the highest yield (22%) followed by *Phyllanthus reticulatus* (20.6%), *Litsea glutinosa* (18.8%), *Clerodendrum viscisum* (17%), *Scoparia dulcis* (14.4%), *Paederia foetida* (13%), *Stephania japonica* (12.74%) and *Holarrhena antidysenterica* (12.4%) (Table 2). Extraction yield from a plant has a great effect on the overall efficacy and selection for bioprospecting and in the calculation of total activity (Eloff 1998).

Table 3.9. Plant extracts yield (Weight of dry extracts in grams /Initial dry plant extracts) × 100.

Plant extracts	Weight of dry extract in grams	Initial dry plant extracts in grams	Extraction Yield % after freeze drying
Dalbergia sissoo Miq.	11	50	22%
Phyllanthus reticulatus Poir.	10.3	50	20.60%
Litsea glutinosa (Lour.)Robinson	9.4	50	18.80%
Clerodendrum viscosum Vent.	8.5	50	17%
Scoparia dulcis L.	7.12	50	14.24%
Paederia foetida L.	6.5	50	13%
Stephania japonica (Thunb.) Miers.	6.369	50	12.74%
Holarrhena antidysenterica (L.) Wall. *Ex* Decne.	6.2	50	12.40%

3.2.3. Antibacterial activity

Antibacterial activity of aqueous and solvent extracts of all the selected plant extracts were carried out by determining the zone of inhibition using Kirby Bauer disc diffusion method (Bauer *et al*. 1966). After collection of plant samples, aqueous and ethanol extractions of leaves were made for each plant species. Both the aqueous and ethanol extracts of leaves were screened for antibacterial activity through disc diffusion assays against eight clinical strains belonging to Grampositive *Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus cereus* and Gramnegative *Escherichia coli*, *Pseudomonas aeruginosa, Salmonella paratyphi*, *Shigella dysenteriae* and *Shigella boydii*. Antibacterial activity were analyzed using the ANOVA single factor statistical tool indicated that there was a significant difference in the sensitivity of the tested bacteria to the various extracts (p<0.001). In this present study, leaf extract have been assessed for their antibacterial activity.

Results showed that the highest zone of inhibition was prominent for the positive control Ciprofloxacin (30µg/disc) ranging from (24-28mm). No zone of inhibition found for negative control (Ethanol) (Plate 14). Most of the plant extracts showed clear zone of inhibition excepts S*tephania japonica*. The results revealed that maximum plant extracts were potentially effective in suppressing growth of pathogenic bacteria with variable potency.

Table 3.10 illustrated the antibacterial activity of eight ethnomedicinal plants. *Litsea glutinosa* was the most effective in retarding bacterial growth followed by *Dalbergia sissoo*, *Scoparia dulcis*, *Holarrhena antidysenterica* against 3 and *Clerodendrum viscosum* against 2 tested bacterial strains. *Paederia foetida* and *Phyllanthus reticulatus* were effective only against *E. coli* and *S. aureus,* respectively.

Table 3.10. Mean diameter of inhibition zones (mm) with standard error of mean

Plant species	Solvent	*Bacillus cereus*	*Bacillus subtilis*	*Staphylococcus aureus*	*Esherichia coli*	*Shigella dysenteri*	*Pseudomonas aeruginosa*	*Shigella boydii*	*Salmonella paratyphii*
Litsea glutinosa	Aqueous	14.2±0.64	-	16.8±0.29	21.6± 0.33	12.9±0.37	-	10.7±0.88	-
	Ethanol	10.6±1.05	-	17.6± 0.56	18 ± 0.14	12.5±0.37	-	10.3±0.88	-
Dalbergia sissoo	Aqueous	14.6±0.23	-	10.2 ± 1.02	9.7± 0.57	-	-	-	-
	Ethanol	15.4±0.38	-	11.6±0.22	15.6± 0.58	-	-	-	-
Scoparia dulcis	Aqueous	12 ± 0.57	-	14.4±0.22	13.2± 0.22	-	-	-	-
	Ethanol	9.7 ± 0.55	-	14.9 ± 0.87	13.1± 0.21	-	-	-	-
Holarrhena antidysenterica	Aqueous	-	9.9 ± 0.23	12.2 ± 0.43	14.7± 0.55	-	-	-	-
	Ethanol	-	10.1±0.27	13.5 ± 0.73	16.1 ±0.44	-	-	-	-
Clerodendrum viscosum	Aqueous	-	-	-	13.8± 0.56	-	-	13.1±0.38	-
	Ethanol	-	-	-	10.6± 0.22	-	-	11.3±0.78	-
Phaederia foetida	Aqueous	-	-	-	12.5± 0.44	-	-	-	-
	Ethanol	-	-	-	10.5± 0.35	-	-	-	-
Phyllanthus reticulatus	Aqueous	-	12.5±0.36	-	-	-	-	-	-
	Ethanol	-	12.9±0.45	-	-	-	-	-	-
Stephania japonica	Aqueous	-	-	-	-	-	-	-	-
	Ethanol	-	-	-	-	-	-	-	-
(+) control	Ciprofloxacin	28.2±0.41	24 ± 0.14	25.5 ± 0.22	25.2± 0.26	23.5±0.27	27.6 ± 0.45	27.1±0.15	**25.5 ±0.26**
(-) control	Ethanol	-	-	-	-	-	-	-	-

Values are the mean of ten replicates ± standard error. P<0.001

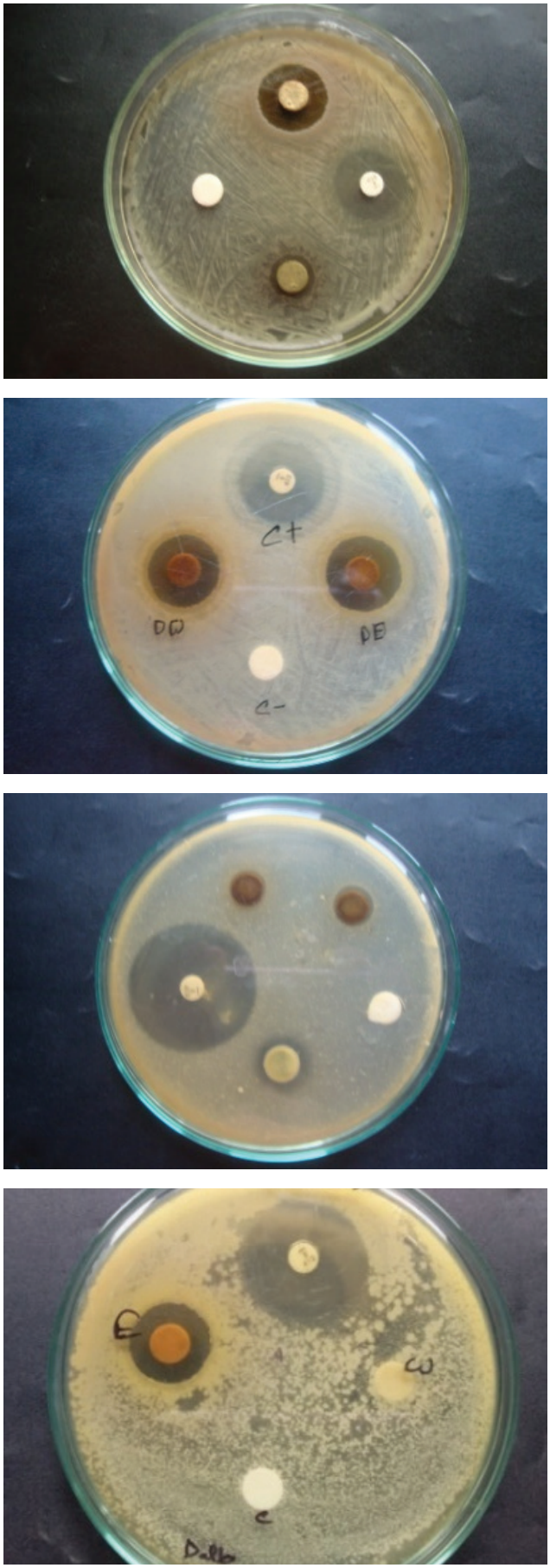


Plate 14. Inhibition zones of different plant extracts over the tested bacterial strains.

3.2.4. Antibacterial activity of *Litsea glutinosa*

Litsea glutinosa is a semi-evergreen dioecious tree species, used for treating various human ailments and diseases. The plant is used for dysentery (Uddin and Hassan 2014), diarrhoea and impotence (Uddin *et al*. 2015). It is principally used as a binding agent in incense-stick industry and lately seriously being considered as binding agent in tablet formulations and as plasters for fractured limbs (Ramana and Raju 2017). In the present study this plant species used for mainly dysentery (with 42% citation) and also used for bone fracture, jaundice, impotence, chest pain and diabetes. To validate the local knowledge antibacterial activity of leave extract has been carried out against eight bacterial strain.

The result showed that the highest antibacterial activity was found from the aqueous leave extracts against *Escherichia coli* followed by *Staphylococcus aureus*, *Bacillus cereus*, *Shigella dysenterie* and *Salmonella boydii.* In case of ethanol extraction the highest antibacterial activity was found against *Escherichia coli* followed by *Staphylococcus aureus*, *Shigella dysenterie*, *Bacillus cereus* and *Salmonella boydii* (Fig. 3.8).

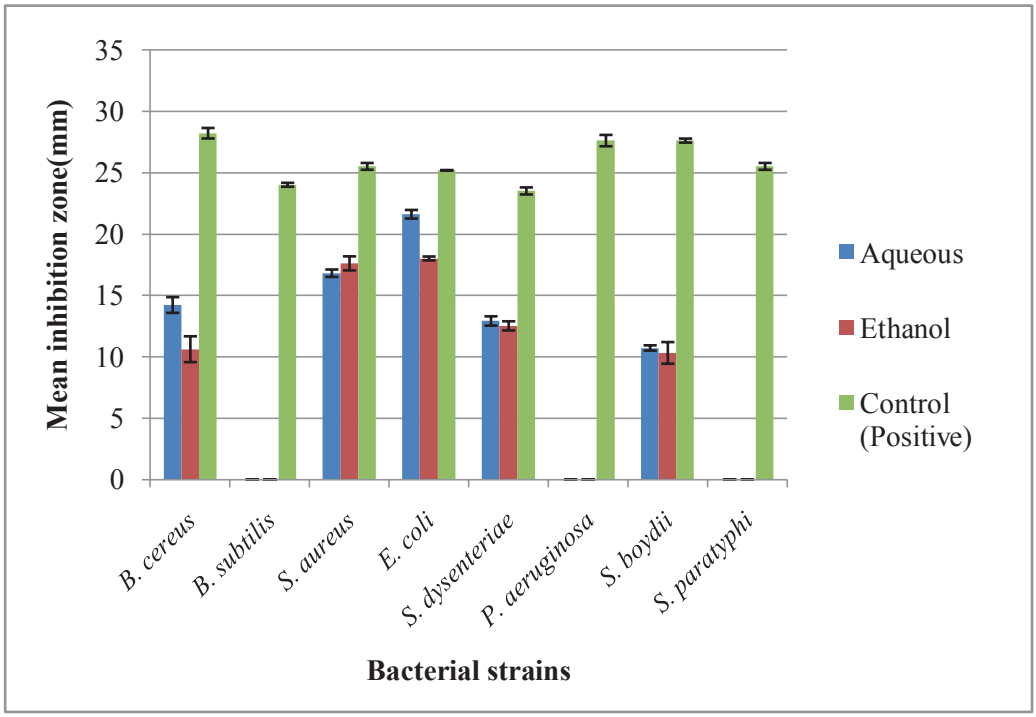


Fig. 3.8. Mean zone of inhibition of *Litsea glutinosa* against eight bacterial strains (n=10, p>0.001)

3.2.5. Antibacterial activity of *Dalbergia sissoo*

Dalbergia sissoo, also known as Indian rosewood tree (Shisham in hindi) is best known for its use as timber wood. Investigators have reported that it possesses many biomodulatory activities like osteogenic activity (Dixit *et al*. 2012), antispermatogenic activity (Vasudeva and Vats 2011), antimicrobial activity (Yadav 2008) and anti-inflammatory activity

(Hajare 2001). In present study this plant species was used for the treatment of dysentery with 32 citation and 100% fidelity level. The result showed that the highest antibacterial activity was found from the aqueous leave extracts against *Bacillus cereus* followed by *Staphylococcus aureus and Escherichia coli.* In case of ethanol extraction the highest antibacterial activity was found against *Escherichia coli* followed by *Bacillus cereus* and *Staphylococcus aureus* (Fig. 3.9).

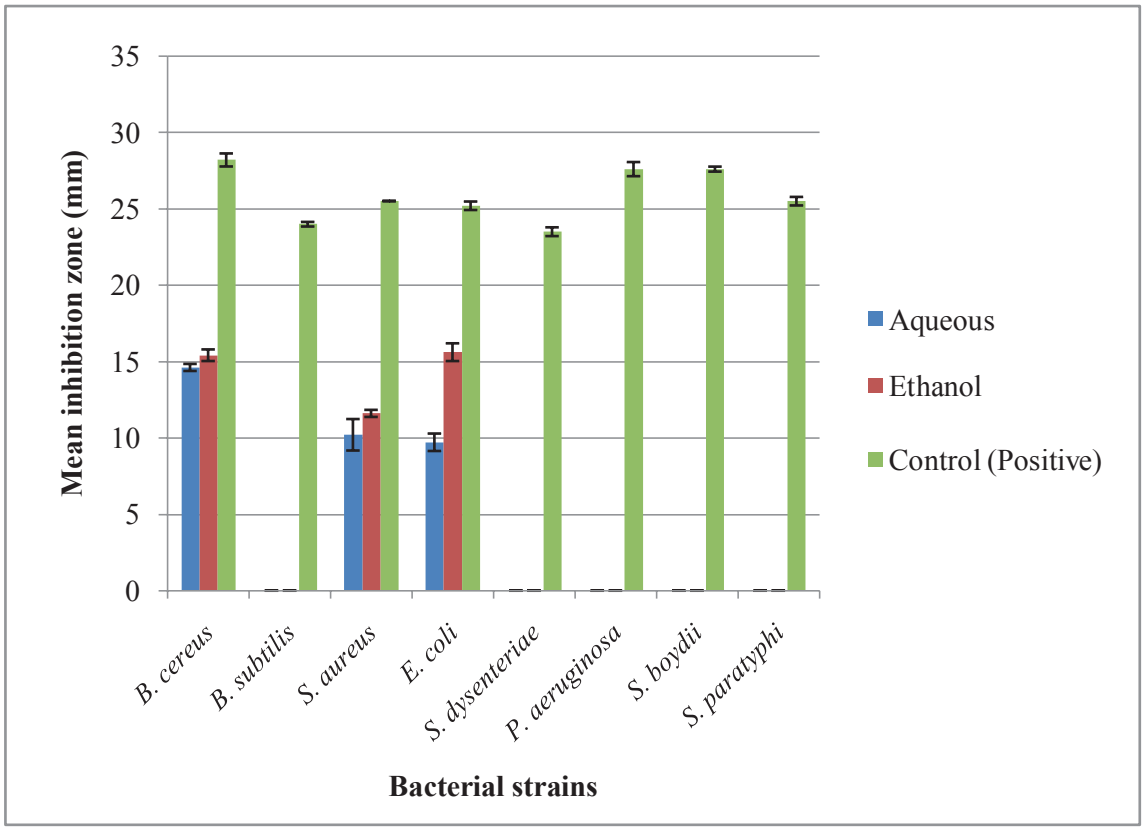


Fig. 3.9. Mean zone of inhibition of Dalbergia sissoo against eight bacterial strains (n=10, p>0.001)

3.2.6. Antibacterial activity of *Scoparia dulcis*

Scoparia dulcis L. belongs to the family Scrophulariaceae is an important ethnomedicinal plant, commomnly called as sweet broom weed. It is a prennial herb, widely distributed in tropical and subtropical regions (Wankhar 2015). This plant species is known as chinigura gach to the local people of the study area which was used for the treatment of diarrhoea. To evaluate the ethnomedicinal report, antibacterial activity was carried out. The result revealed that this plant species showed antibacterial activity against three bacterial strains. Maximum zone of inhibition was found against *E. coli* (14.9 ± 0.87) and minimum inhibition zone was found against *B. cereus* (9.7 ±0.55) for ethanol extraction. In case of aqueous extracts maximum zone was found against *S. aureus* (14.4 ±0.22) and minimum zone of inhibition was found against *B. cereus* (9.7 ± 0.57).

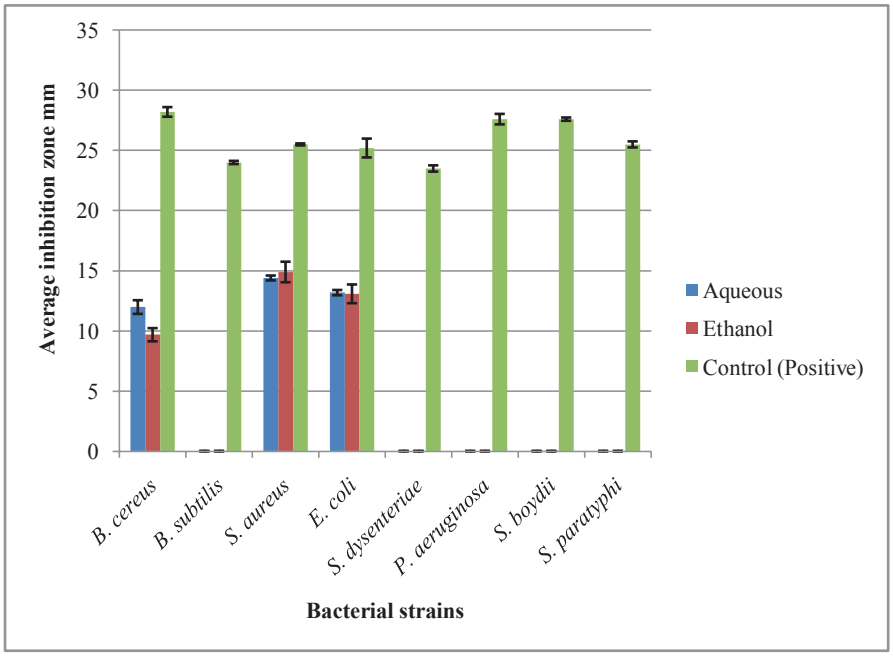


Fig. 3.10. Mean zone of inhibition of *Scoparia dulcis* against eight bacterial strains (n=10, p>0.001)

3.2.7. Antibacterial activity of *Holarrhena antidysenterica*

Holarrhena antidysenterica, commonly called as kurchi belongs to family Apocynaceae. Bark is antidiarrhoeal and antidysentric and used in fevers, piles, leprosy, diseases of skin and spleen, dysentery and diarrhoea. Leaves are used to cure ulcers, wounds, muscles pain, and menstrual problems (Kritikar and Basu 1984). In present study juice of fresh leaf was taken by the local people for the treatment of dysentery. As the local people used the leaf as plant parts so that leaf extract selected for antibacterial test. Further this plant species showed antibacterial activity against *E. coli* followed by *S. aureus* and *B. cereus* both for aqueous and ethanol extracts.

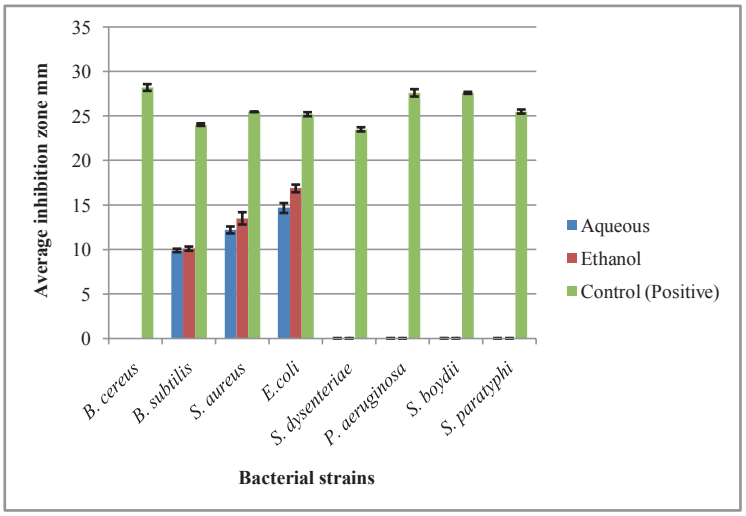


Fig. 3.11. Mean zone of inhibition of *Holarrhena antidysenterica* against eight bacterial strains (n=10, p>0.001)

3.2.8. Antibacterial activity of *Clerodendrum viscosum*

Clerodendrum viscosum is a common plant belonging to the family verbenaceae, grows as a weed on roadside and waste land. The plant has been used as an antiseptic, antiinflammatory, antipyretic, vermifuge, treatment of tumors, leprosy and skin diseases (Warrier 1996). In present study leaf was used by the local people for the treatment of Diarrhoea. Based on the ethnomedicinal survey this plant species selected for antibacterial activity and the result showed antibacterial activity against *E. coli* followed by *S. paratyphii* both for aqueous and ethanol extracts. In this particular experiment aqueous extract showed higher antibacterial activity than ethanol extracts.

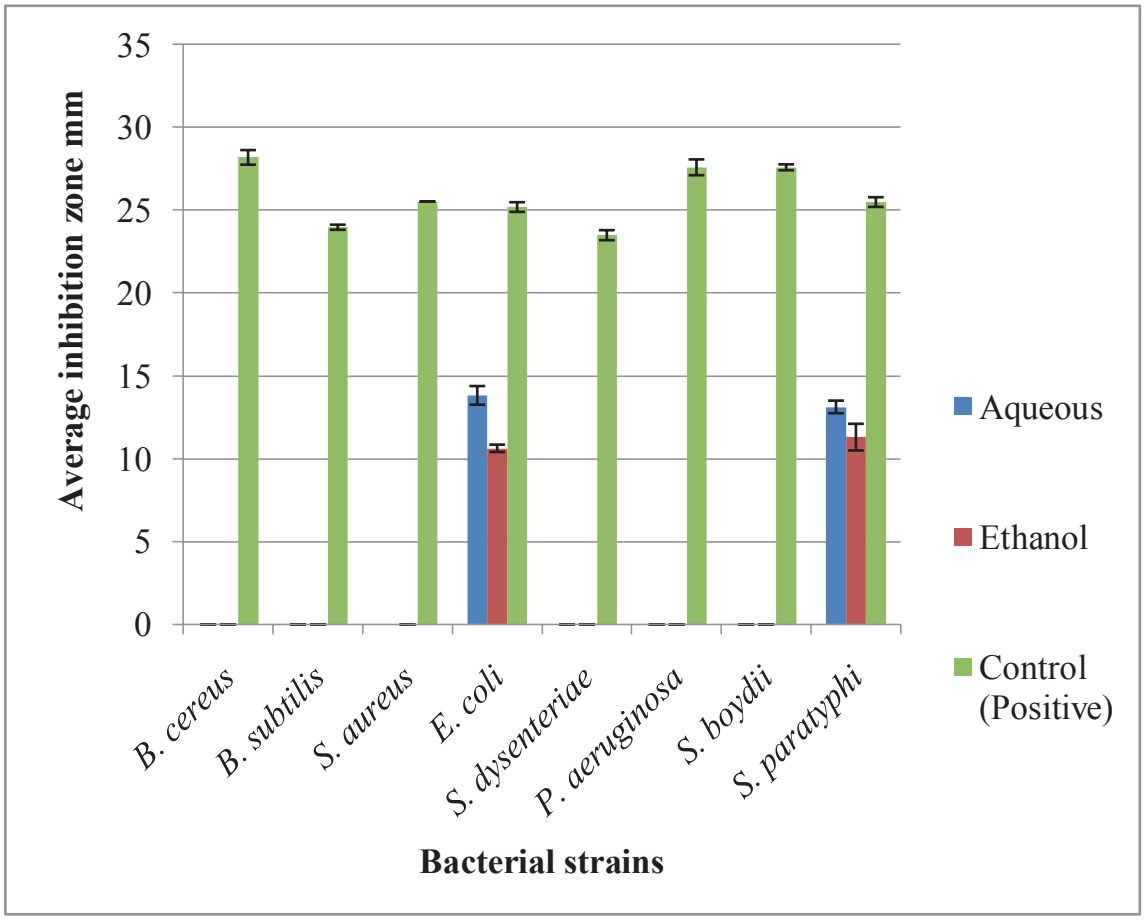


Fig. 3.12. Mean zone of inhibition of *Clerodendrum viscosum* against eight bacterial strains (n= 10, p>0.001)

3.2.9. Antibacterial activity of *Paederia foetida*

The plant *Paederia foetida* L. has traditionally been used for medicinal purposes. In present study this plant species was used by the local people of the study area for the treatment of diarrhoea with 31 citation. Based on the ethnomedicinal value this plant species was further selected for antibacterial activity test which showed inhibition zone against only against *Staphylococcus aureus* both the aqueous and ethanol extracts.

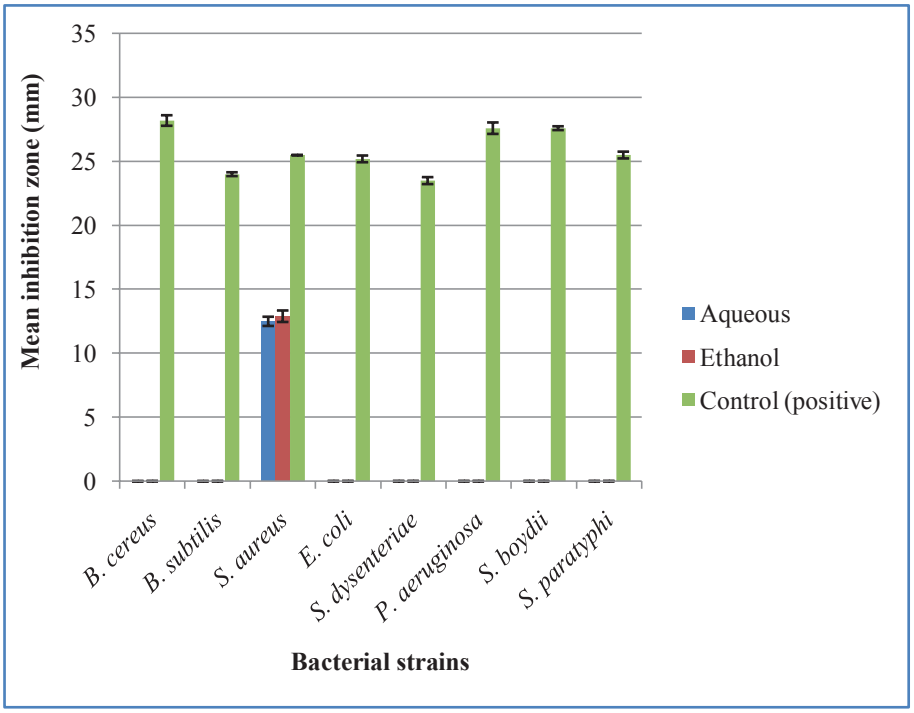


Fig. 3.13. Mean zone of inhibition of *Paederia foetida* against eight bacterial strains (n= 10, p>0.001)

3.2.10. Antibacterial activity of *Phyllanthus reticulatus*

Phyllanthus reticulatus is a large medicinal shrub and commonly found all over the Bangladesh. This plant species mostly cited for diarrhoea, toothache and eye complain by the local people of the study area. In this study the plant species showed antibacterial activity only against *S. aureus* for aqueous and ethanol extracts.

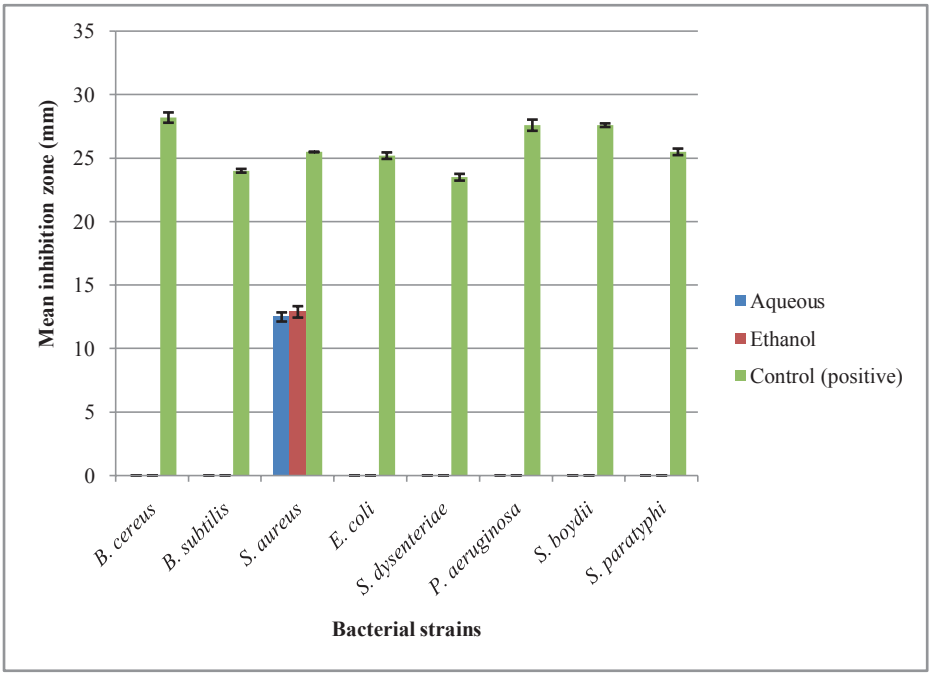


Fig. 3.14. Mean zone of inhibition of *Phyllanthus reticulatus* against eight bacterial strains (n= 10, p>0.001)

Among the eight selected ethnomedicinal plant, *Stephania japonica* did not show any antibacterial activity. That might be happen due to the active chemical constituents might not have been soluble in ethanol or water or it does not have such bioactive compound. Though the plant was cited by 6.3% local people and antibacterial test was not done before so that it selected for antibacterial test in present study. The ineffectiveness of *P. reticulatus* and *P. foetida* might reflect the lack of antibacterial compounds in the plants. On the other hand *Litsea glutinosa*, *Dalbergia sissoo*, *Scoparia dulcis*, *Holarrhena antidysenterica* and *Clerodendrum viscosum* possesses good antibacterial activity which could be a good chemical constituents for future drug discovery program.

3.2.11. Minimum Inhibitory Concentration

Minimum inhibitory concentration (MIC) is the lowest concentration which resulted in maintenance or reduction of inoculums viability (Mahfuzul *et al*. 2007). Minimum inhibitory concentration assays has been done to determine the concentration at which the extracts are effective. Among the selected ethnomedicinal plant, the species showed the highest antibacterial activities further tested for minimum inhibitory concentration test. *Litsea glutinosa* and *Dalbergia sissoo* were used for MIC test against *Escherichia coli*, *Bacillus cereus* and *Staphylococcus aureus* and MIC test of *Scoparia dulcis* was carried out against *E. coli* and *S. aureus.*

Table 3.11. Minimum Inhibitory Concentrations of extract of *Litsea glutinosa*

Test tube no.	Nutrient broth (ml)	Dilution solution of ethanol extracts(mg/ml)	Inoculums added	*E.coli*		*S. aureous*		*B. cereus*	
				Aq	Et	Aq	Et	Aq	Et
1	10	32	50 µl	-	-	-	-	-	-
2	10	16	50 µl	-	-	-	+	-	+
3	10	8	50 µl	-	+	+	+	+	+
4	10	4	50 µl	+	+	+	+	+	+
5	10	2	50 µl	+	+	+	+	+	+
6	10	1	50 µl	+	+	+	+	+	+
Cm	10	0	0	-	-	-	-	-	-
Cs	10	32	0	-	-	-	-	-	-
Ci	10	0	50µl	+	+	+	+	+	+

Aq- Aqueous, Et- Ethanol, +=Indicates growth, - = Indicates no growth
Cm= control medium, Cs=control of solvent, Ci=control of inoculum

The result of MIC of *Litsea glutinosa* are presented in Table 3.11 and the photographs are provided in plate 15(A). The results indicated that leave extract of *L. glutinsa* had positive inhibitory effect on bacterial growth even at low concentration (>4mg/ml) against *E. coli.* The MIC values are lower in case of aqueous extracts than that of ethanol extracts against *E. coli* and *B. cereus.*

Table 3.12. Minimum Inhibitory Concentrations of *Dalbergia sissoo*

Test tube no.	Nutrient broth (ml)	Dilution solution of ethanol extracts(mg/ml)	Inoculums added	*E.coli*		*S. aureus*		*B. cereus*	
				Aq	Et	Aq	Et	Aq	Et
1	10	32	50 µl	-	-	-	-	-	-
2	10	16	50 µl	-	-	-	-	+	-
3	10	8	50 µl	+	+	+	+	+	+
4	10	4	50 µl	+	+	+	+	+	+
5	10	2	50 µl	+	+	+	+	+	+
6	10	1	50 µl	+	+	+	+	+	+
Cm	10	0	0	-	-	-	-	-	-
Cs	10	32	0	-	-	-	-	-	-
Ci	10	0	50µl	+	+	+	+	+	+

Aq- Aqueous, Et- Ethanol, +=Indicates growth, - = Indicates no growth

Cm= control medium, Cs=control of solvent, Ci=control of inoculum

The result of MIC of *Dalbergia sisssoo* are presented in Table 3.12 and the photographs are provided in plate 15(B). The results indicated that leave extract of *D. sissoo* had good activity to inhibit bacterial growth at the concentration (16mg/ml) against *E. coli and B. cereus*.

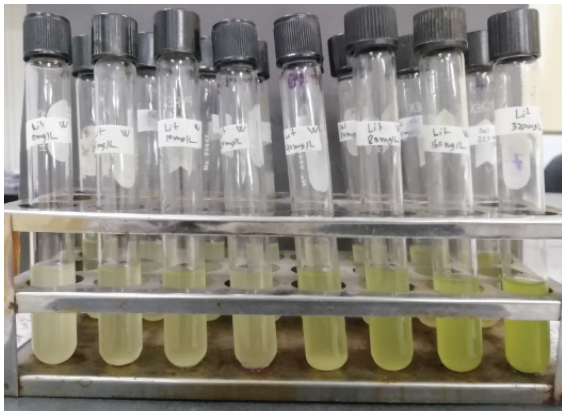
Table 3.13. Minimum Inhibitory Concentrations of ethanolic extract of *Scoparia dulcis*

Test tube no.	Nutrient broth (ml)	Dilution solution of ethanol extracts(µg/ml)	Inoculums added	*E.coli*		*S. aureus*	
				Aq	Et	Aq	Et
1	10	32	50 µl	-	-	-	-
2	10	16	50 µl	-	-	+	-
3	10	8	50 µl	+	-	+	+
4	10	4	50 µl	+	+	+	+
5	10	2	50 µl	+	+	+	+
6	10	1	50 µl	+	+	+	+
Cm	10	0	0	-	-	-	-
Cs	10	32	0	-	-	-	-

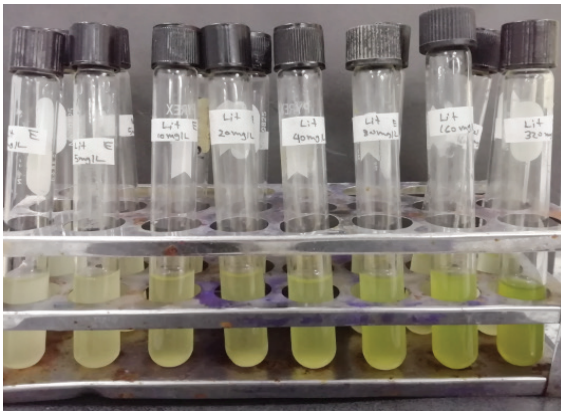
Aq- Aqueous, Et- Ethanol, +=Indicates growth, - = Indicates no growth

Cm= control medium, Cs=control of solvent, Ci=control of inoculum

Scoparia dulcis did'nt show antibacterial activity against *B. cereus*. So that MIC of *Scoparia dulcis* carried against *E. coli* and *S. aureus*. The result of MIC of *Scoparia dulcis* are presented in Table 3.13 and the photographs are provided in plate 15(C).

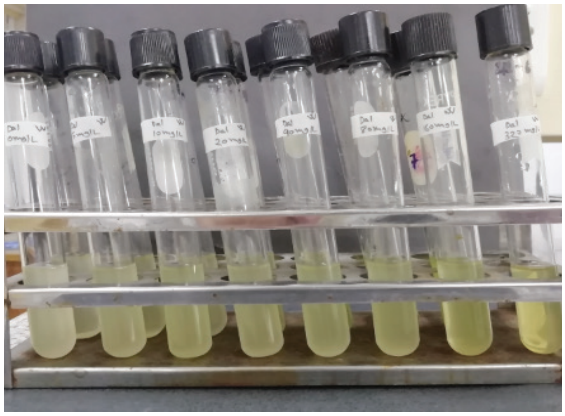


Litsea glutinosa (Aqueous extract)

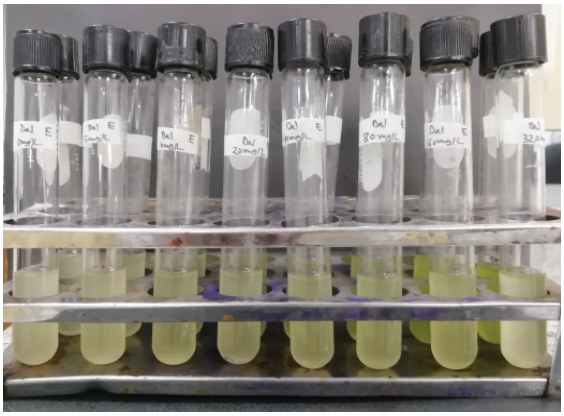


Litsea glutinosa (Ethanol extract)

Plate 15 (A)



Dalbergia sissoo (Aqueous extract)



Dalbergia sissoo (Ethanol extract)

Plate 15 (B)

Scoparia dulcis (Aqueous extract)

Scoparia dulcis (Ethanol extract)

Plate 15(C)

Plate 15. MIC of three plant species against *Escherichia coli*, *Staphylococcus aureus* and *Bacillus cereus*

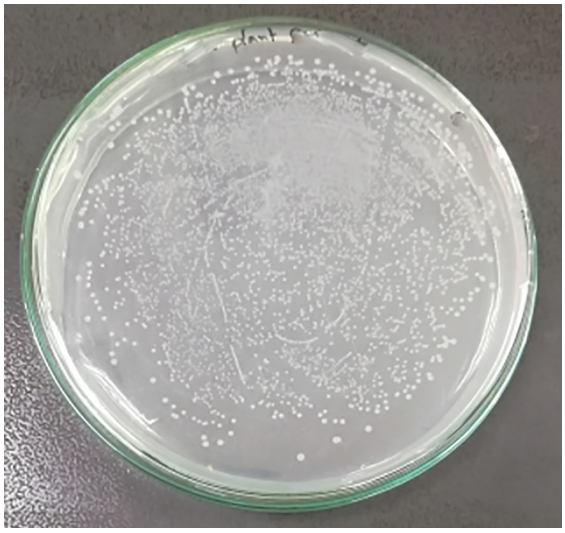
The results indicated that leave extract of the *Scoparia dulcis* requisite moderately higher concentration to inhibit bacterial growth (8mg/ml) against *E. coli* and against *S.aureus* (16mg/ml) for ethanol extraction.

However, the *Litsea glutinosa* extract acted against more bacterial strains and had lower MIC values than that of *Scoparia dulcis.* The extracts with the least MIC values were from *Litsea glutinosa* (4 mg/ml) against *E. coli* (Table 3.10), *Dalbergia sissoo* (4 mg/ml) against *B. cereus* and *Scoparia dulcis* (8mg/ml) against *E. coli* and *S. aureus*.

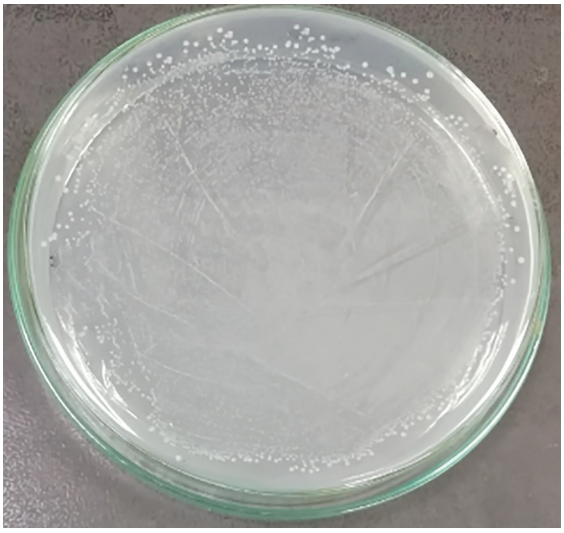
Result showed that the MICs were higher than 4mg/ml. The information of the uses of the leaves of *Litsea glutinosa*, *Dalbergia sissoo* and *Scoparia dulcis* provided by the people of Brahmanbaria is in agreement of the present results found in antibacterial activities.

3.2.12. The Minimum Bactericidal Concentration (MBC)

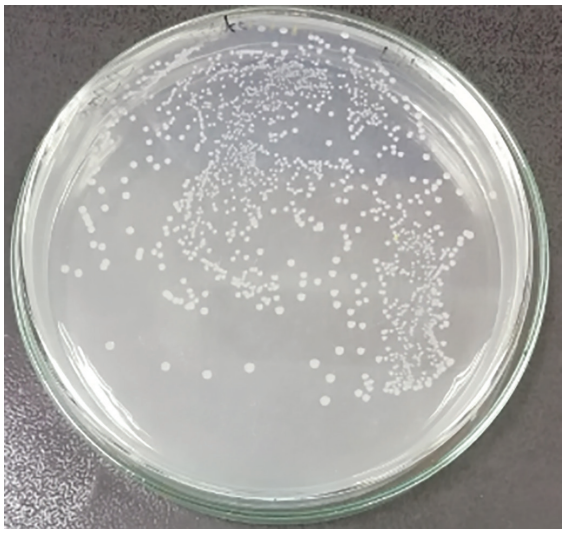
The plant species showed MIC values were further investigated for MBC test by spreading 5µl inoculated media from each test tube that was used for minimum inhibitory concentration test. Minimum bactericidal effects were exhibited with various degrees in all the selected plant extracts. *Litsea glutinosa* had showed highest inhibition zone against *Escherichia coli* with a MIC value at 4mg/ml. And required minimum bactericidal concentration of 16mg/l (Plate 16).The plant *Dalbergia sissoo* had second the highest antibacterial activity with MIC value of 4mg/l, and required a concentration of 32mg/l to be bactericidal (the minimum bactericidal concentration). MBC value was found from extracts of *Dalbergia sissoo* at 32 mg/ml against *E. coli* (Plate 17) and both ethanol and aqueous extracts showed the MBC value at 32mg/ml. The value of the lowest MBC obtained was not more four times higher than that of MIC's on the corresponding bacterial strains, it seems possible that the sample tested was possessed the antimicrobial activity.



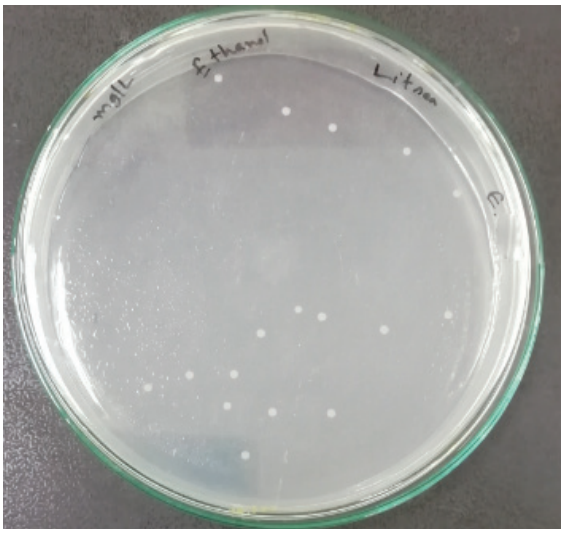
Plant extract (0 mg/l)



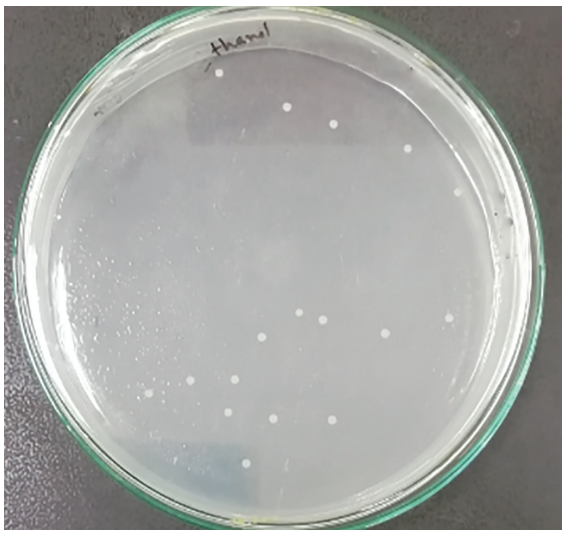
Plant extract (1 mg/l)



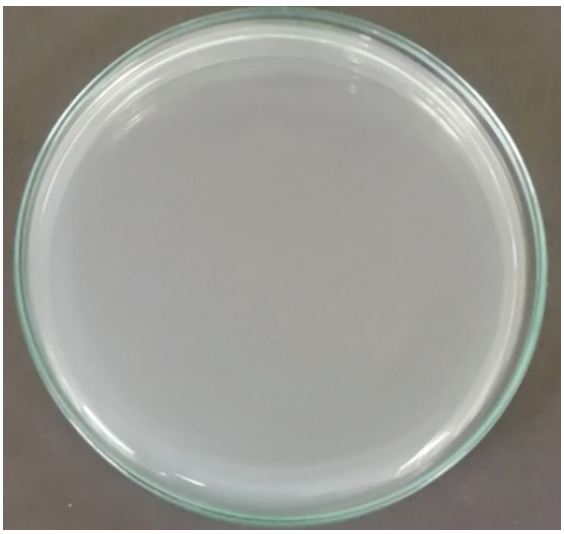
Plant extract (2 mg/l)



Plant extract (4 mg/l)

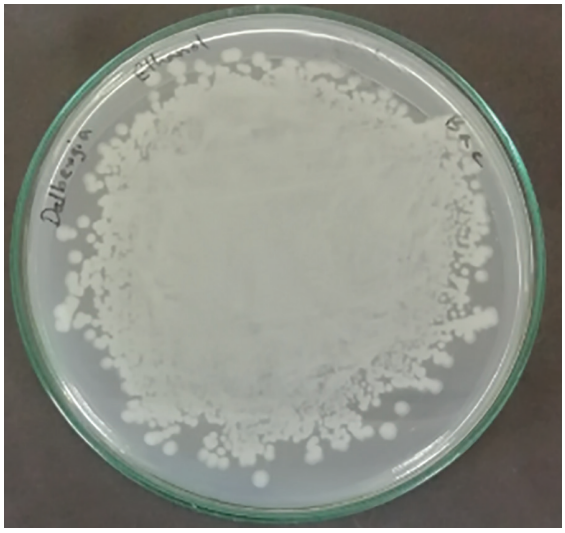


Plant extract (8 mg/l)

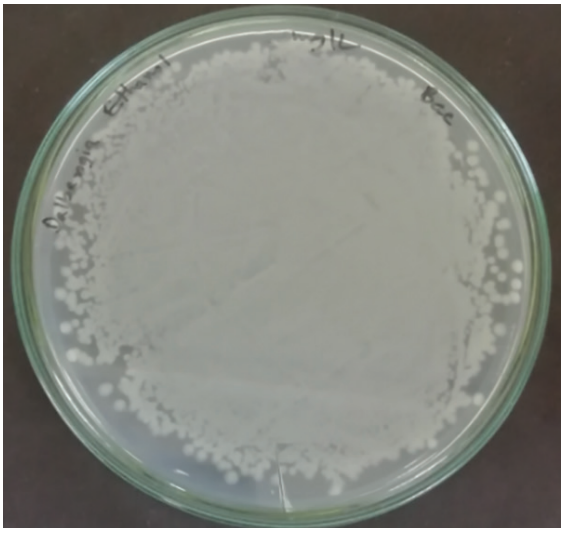


Plant extract (16 mg/l)

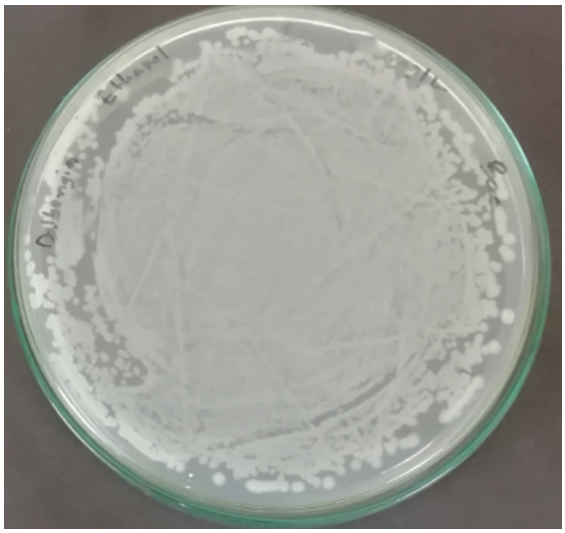
Plate 16. Growth of *E. coli* in different concentration of *Litsea glutinosa*



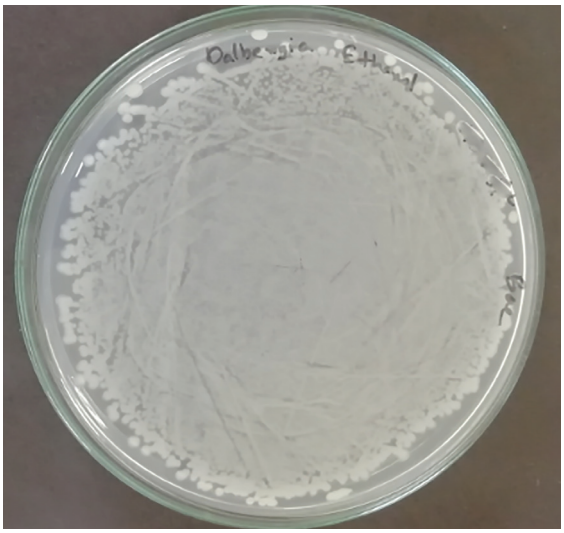
Plant extract (0mg/l)



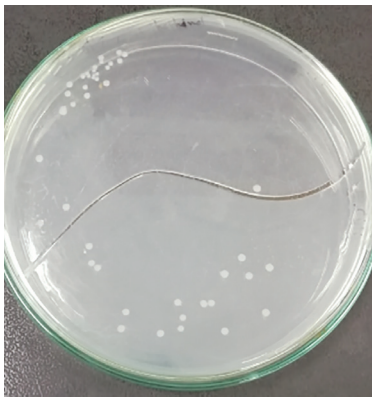
Plant extract (1 mg/l)



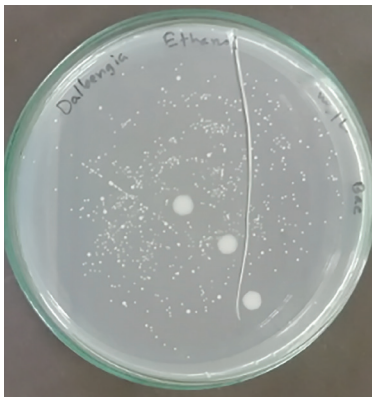
Plant extract (2 mg/l)



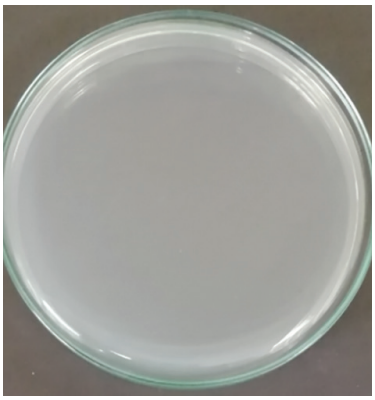
Plant extract (4 mg/l)



Plant extract (8mg/l)



Plant extract (16 mg/l)



Plant extract (32 mg/l)

Plate 17. Growth of *E. coli* in different concentration of *Dalbergia sissoo*

3.3 Cytotoxicity and safety of the extracts

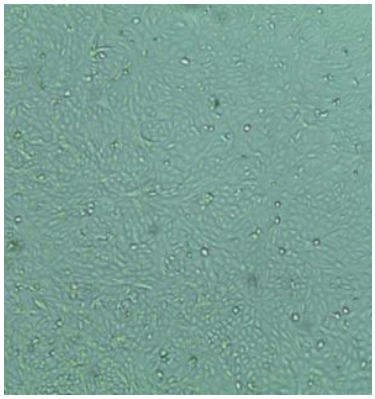
To previse that crude plant extracts or natural products are safe for use, the cytotoxicity of crude plant extracts was carried out. Cytotoxic activity of five plant extracts has been examined from the service provided by the Centre for advanced research in sciences, University of Dhaka (CARS). 10 mg crude plant extracts have been dissolved in 1ml of 20% DMSO to make a concentration of 10mg/ml.

The cytotoxic effect of *Litsea glutinosa, Dalbergia sissoo* and *Scoparia dulcis* on Vero cell lines was evaluated. Results of the cytotoxicity evaluation against Vero cell line of these three plant extracts are shown in Table 3.14 and Plate 18.

Table 3.14 Cytotoxicity effect of DMSO plant extract (25µl) against Vero cell line (3×10^4/ 200µl)

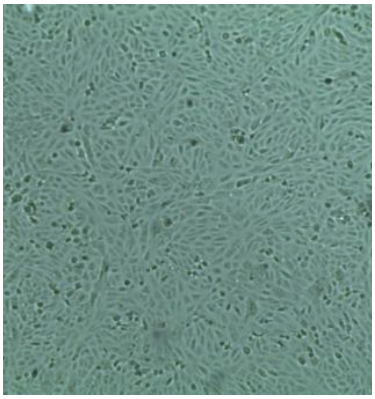
Sample ID and name	Survival of cells (Vero cell)	Remarks
Litsea glutinosa **, *S-2***	**>95%**	No cytotoxicity was observed on Vero cell line.
Dalbergia sissoo, **S-3**	**>95%**	
Scoparia dulcis, **S-4**	**>95%**	
Solvent - (Media + Cells)	**100%**	
Solvent+ (Media +Cells + DMSO 2%)	**>95%**	

The extract of these three plants showed lowest death of cells and highest survival of cells more than 95% indicated that they have no toxicity level at vero cell line (Table 3.14). These results lend support for the traditional use of the plants for the treatment of diarrhoea and dysentery. So that the present result supported the safe use of these plants. The toxicity should also be determined in *in vivo* studies before a definitive conclusion can be reached.

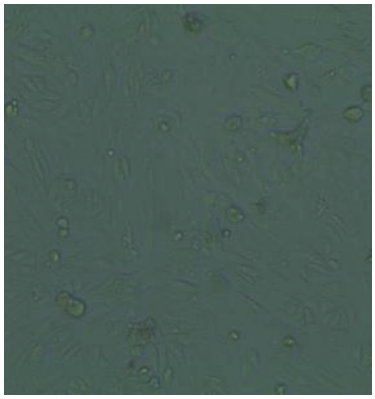


Solvent (Media + Cell)

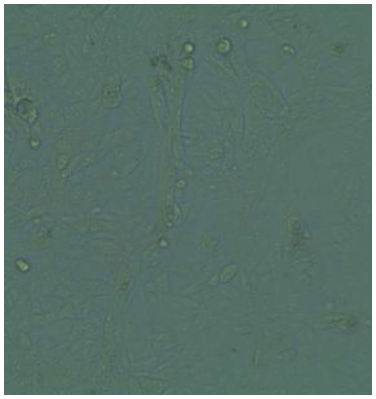
Solvent+
(Media +Cells + DMSO 2%)



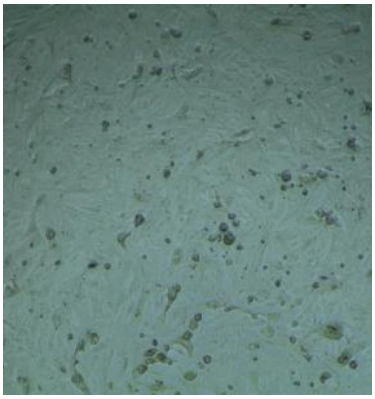
Plant extracts of *Litsea glutinosa*



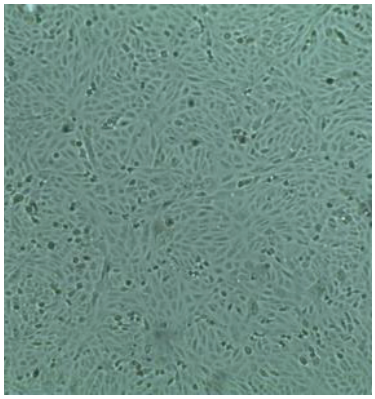
Solvent (Media + Cell)



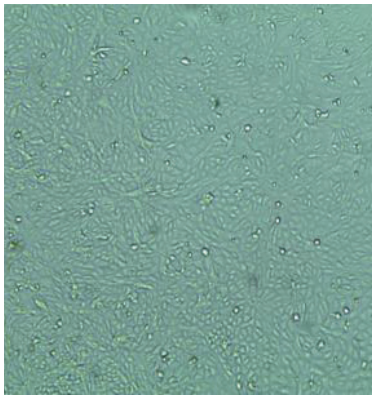
Solvent+
(Media +Cells + DMSO 2%)



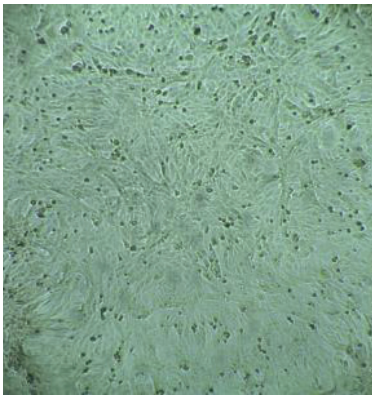
Plant extracts of *Dalbergia sissoo*



Solvent (Media + Cell)



Solvent+
(Media +Cells + DMSO 2%)



Plant extracts of *Scoparia dulcis*

Plate 18: Morphological changes of the Vero cells after three plant extracts, treatment at 10mg/ml concentrations for 24 hours.

3.4. Validation of ethnomedicinal knowledge

The antibacterial activity of eight selected ethnomedicnal plants against *Escherichia coli* statistically correlate against their citation frequency. The both extract of selected ethnomedicinal plant has the greatest activity against *E. coli*. Correlation (r = 0.70) was demonstrated between the frequency of mention and the inhibition zone against *E. coli* for the selected ethnomedicinal plants (Fig. 3.15).

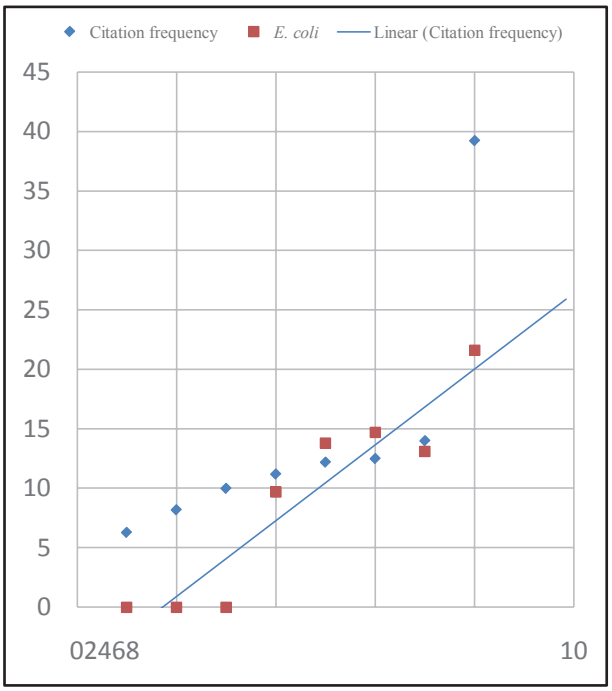


Fig. 3.15 Correlation between citation frequency of eight ethnomedicinal plants for aqueous extracts and antibacterial activities (r= 0.7027, P= 0021, n=8)

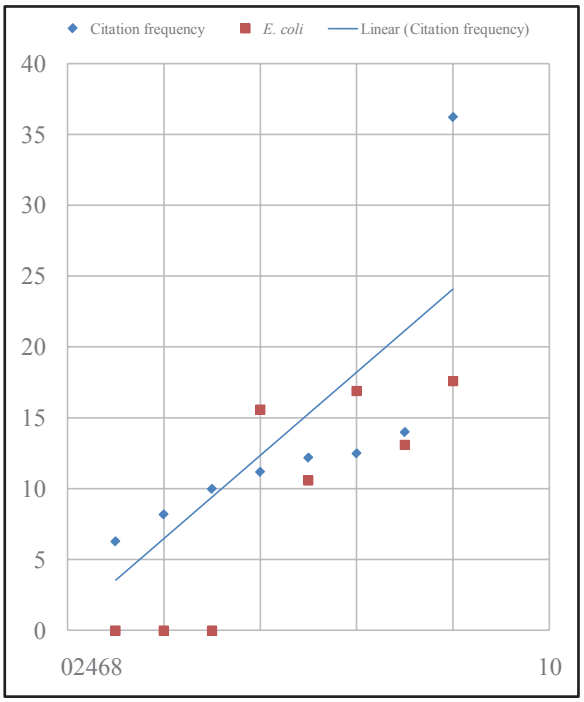


Fig.3.16 Correlation between citation frequency of eight ethnomedicinal plants for ethanolic extracts and antibacterial activities (r= 0.8039, P= 0.007, n=8)

In Fig. 3.16, correlation (r = 0.80) was demonstrated between the frequency of mention and the inhibition zone against *E. coli* for the ethanolic extracts of selected ethnomedicinal plants.

The result showed, there are significant correlation found between most cited ethnomedicinal plant species and antibacterial activity. Both the aqueous and ethanol extract of *Litsea glutinosa* showed positive co relation against *Escherichia coli.* The correlation between the inhibition zones and the frequency of mentions (Fig. 3.15 and 3.16) gave support to the verifiable knowledge on medicinal plants of the local people of Brahmanbaria.

3.5. Threats to ethnomedicinal plants

The most cited species were always vulnerable to extinction in the study area due to over harvesting. It was observed that the collection of bark as medicinal part from the wild were not sustainable. People often collecting plant parts in an unsustainable way. They uprooted herbaceous plant like *Asparagus racemosus*, *Mimosa pudica*, *Ocimum sanctum* and debarked many trees like *Litsea glutinosa, Terminalia aurjuna, Bombax ceiba* in an unsustainable way. As a result the number of important ethnomedicinal plants decrease day by day. Threats have been identified by using preference ranking method which was used to rank the causes responsible for the degradation of ethnomedicinal plant in the study area. Ten key informants were interviewed to bring out the top most threats to important medicinal plant in the study area. Among the ten key informants eight were *koviraj* (traditional healer) and two were knowledgeable elder.

Table 3.15 demonstrated that lack of awareness was ranked by key informants for the threats to ethnomedicinal plants in the study area followed by unsustainable collection, industrialization & Urbanization, overpopulation, habitat degradation, environment pollution & climate change, exotic & invasive species. Besides these threats, some other threats for the ethnomedicinal plants in the study area were roadside construction, flashflood, firewood, brickfield, invasive species and encroachment into the agricultural land.

Table 3.15. Threats of ethnomedicinal plants using Preference ranking method.

Threats	KI-1	KI-2	KI-3	KI-4	KI-5	KI-6	KI-7	KI-8	KI-9	KI-9	KI-10	KI-11	KI-12	Total	Rank
Lack of awareness	10	9	7	8	10	7	10	9	7	8	8	10	7	110	1st
Unsustainable collection	7	8	6	5	6	6	7	8	6	5	5	6	8	83	2nd
Industrialization & Urbanization	4	5	5	6	5	5	4	5	5	6	6	5	6	67	3rd
Overpopulation	5	3	3	3	7	2	5	3	3	3	7	7	5	56	4th
Habitat degradation	3	4	2	4	4	2	0	4	2	4	4	4	3	40	5th
Environment pollution & Climate change	4	2	7	2	3	7	4	2	0	2	2	3	4	42	6th
Exotic & Invasive species	2	1	1	2	1	1	2	1	1	0	0	1	1	14	7th

KI= Key Informants

Plate 19. Threats of ethnomedicinal plants: A- Roadside construction, B-Unsustainable collection, C- Industrialization, D- Flashflood, E, F- Environment pollution

Plate 19 continue: G, H- Firewood, I- Brickfield, J- Encroachment into the agricultural land, K: Invasive species, L: Exotic plantation into the agricultural land.

Taxonomic Enumeration of ethnomedicinal plants

An extensive ethnomedicinal study in Brahmanbaria district has been made resulting in recording of 247 species under 210 genera and 89 families. The taxonomic enumeration includes the nomenclature, short description, flowering and fruiting, representative specimen with voucher number of each ethnomedicinal plant species.

Family name: Annonaceae

Annona reticulata L., Sp. Pl.: 537 (1753). Local name: Ata

Small tree, leaves lanceolate to oblanceolate, inflorescence extra axillary, usually 2-3 flowered, fruit sub-globose to roughly heart-shaped, almost smoot. *Flowering and fruiting*: October- January. *Ecology*: plain lands. *Representative specimen*: Akhaura, 27-06-2015, Tahmina Haque, 143 (DUSH).

Artabotrys hexapetalus (L. f.) Bhandari, Baileya 12: 149 (1965). Synonym: *Annona hexapetala* L. f. (1781). Local name: Kathalichapa.

Robust climber or scandent shrub, leaves oblong-lanceolate, flowers yellow, solitary or in pairs, odorous, fruit obovoid. *Flowering and fruiting*: almost throughout the year. *Ecology*: planted in gardens. *Representative specimens*: Sorail, 05-09-16, Tahmina Haque, 246 (DUSH).

Family name: Lauraceae

Cinnamomum tamala Nees & Eberm., Med. Pharm. Bot.2: 426 (1831). Synonyms: *Lauras tamala* Buch.-Ham. (1822), Lauras albiflora Wall. (1830). Local name: Tej pata.

Medium-sized evergreen tree, leaves opposite, subopposite or alternate, inflorescence a panicle, flowers grey outside and yellow inside, fruit a drupe. *Flowering and fruiting*: February- October. *Ecology*: evergreen forests, also cultivated. *Representative specimens*: B.baria, 18-07-17; Tahmina Haque, 44 (DUSH).

Cinnamomum zeylanicum Blume (1826). Synonym: *Cinnamomum verum* J. S. Persl, Prin. Rostlin 2: 36 (1825).

Moderate-sized evergreen tree, leaves opposite or subopposite, ovate, ovate-lanceolate, inflorescence a lax panicle, many-flowered, silky pubescent, fruits ovoid-oblong, apiculate, dark purple. *Flowering and fruiting*: January-March. *Ecology*: planted. *Representative specimens*: B.baria, 18-07-17; Tahmina Haque, 267 (DUSH).

Litsea glutinosa (Lour.) Robinson, Philip. J. Bot. Sci. 6: 321 (1911). Synonyms: *Sebifera glutinosa* Lour. (1790), Litsea sebifera (Willd.) Pers. (1807). Local name: Menda.

A small to medium-sized, evergreen tree, leaves variable, alternate, subterminal on

branches, flowers yellow or white, dioecious, stamens 9-20, fruit spherical berry, black when ripe. *Flowering and fruiting*: April-January. *Ecology*: village thickets, forest areas. *Representative specimens*: Tahmina Haque, 08 (DUSH)

Family name: Piperaceae

Peperomia pellucida (L.) H. B. & K., Nov. Gen. Sp. 1: 64 (1815). Synonym: *Piper pellucidum* L. (1753). Local name: Luchipata.

A succulent, slender, much-branched, annual berb with translucent cylindrical stem, leaves alternate, flowers very small, in terminal and lateral spikes, fruit minute. *Flowering and fruiting*: July-September. *Representative specimen*: Tahmina Haque, 201 (DUSH)

Piper betle L., Sp. Pl.: 28 (1753). Synonym: *Chavica betle* (L.) Miq. (1844). Local name: Bonalapan.

A perennial stout twining climber, branches with swollen nodes, leaves alternate, simple, margin entire, inflorescence cylindrical spike, sepals and petals absent, in male spikes stamens 2, filament short, anthers reniform, female spikes fleshy, styles short, stigmas 3-5, tomentose, fruit fleshy drupe. *Flowering and fruiting*: December-May. *Ecology*: dry shady place in well- drained friable loamy and clayey soil rich in organic soil. *Representative specimens*: Tahmina Haque, 144 (DUSH)

Piper nigrum L., Sp. Pl.: 28 (1753). Synonym: *Piper aromaticum* Lamk. (1791). Local Name: Golmorich.

A stout, glabrous, long climber; stem terete, sparingly rooting, thickened at the nodes, leaves coriaceous, broadly ovate, acuminate, glabrous, flowers in slightly interrupted glabrous spikes of variable length, fruit globose, red when ripe. *Flowering and fruiting*: August-December. *Representative specimen*: Tahmina Haque, 167 (DUSH)

Piper chaba Hunter (1809). Synonym: *Piper retrofractum* Vahl, Enum. 1: 314 (1804).

Perennial bushy climbing shrub, leaves simple, alternate, ovate-oblong or lanceolate, spikes erect or patent, fruit a drupe, broadly round, hard and pungent, seeds globose, white and mealy inside. *Flowering and fruiting*: throughout the year. *Representative specimen*: Tahmina Haque, 276 (DUSH)

Family name: Nelumbonaceae

Nelumbo nucifera Gaertn., Fruct. 1: 73, t. 19, f. 2 (1788). Synonym: *Nymphaea nelumbo* L. (1753). Local Name: Padma.

Perennial aquatic herb, rhizome stout and creeping, leaves of young plants floating, of older plants raised above the surface of water, orbicular, peltate, prominently veined from

the centre on the under surface, petiole with c 1 mm long scattered prickles, flowers rose or white. *Flowering and fruiting*: April-October. *Representative specimen*: Tahmina Haque, 203 (DUSH)

Family name: Nymphaeaceae

Nymphaea rubra Roxb. ex Andr., Bot. Rep. 8: 104, t. 503 (1808). Synonym: *Nymphaea pubescens* auct. non Willd. (1798). Local Name: Padmakanchan.

Perennial aquatic herb, leaves simple, long-petioled, lamina reniform to orbicular, repand to dentate and somewhat crispate along margin, flowers crimson-red. *Flowering*: throughout the year. *Representative specimen*: Tahmina Haque, 292 (DUSH)

Family name: Ranunculaceae

Nigella sativa L., Sp. Pl.: 753 (1762). Synonym: *Nigella indica* Roxb. (1824). Local Name: Kalojira.

Annual herb, loosely pubescent, stem striate, simple or branched, leaves decompound, flowers without involucre, petals stipulate, fruit a follicle, seeds ovoid to subtrigonous. *Flowering and fruiting*: throughout the year. *Ecology*: cultivated fields, homesteads. *Representative specimens*: Tahmina Haque, 80 (DUSH)

Family name: Menispermaceae

Tinospora crispa (L.) Hook. f. & Thoms., Fl. Ind. 1: 183 (1855). Synonym: Menispermum crispum L. (1763). Local Name: Guloncho.

Lofty, woody, climber, entirely glabrous, stem tuberculate or warted, leaves ovate to oblong-ovate, flowers small, green, fruits oblong, yellow or red. *Flowering and fruiting*: January-June. *Representative specimens*: Kosba Tahmina Haque, 59 (DUSH).

Family name: Moraceae

Artocarpus heterophyllus Lamk., Encycl. Meth. 3: 210 (1789). Synonyms: Artocarpus philippensis Lamk. (1789), Artocarpus brasiliensis Gomez (1812). Local Name: Kathal.

Medium-sized to large semi-evergreen tree, plant exudes white latex when injured, leaves simple, alternate, male inflorescence on upper and lower branches, female inflorescence borne axillary on short leafy shoots. *Flowering and fruiting*: February-July. *Ecology*: well-drained highlands. *Representative specimens*: Akhaura, 10-09-16, Tahmina Haque, 306 (DUSH).

Artocarpus lakoocha Roxb. (1832). Synonym: *Artocarpus lacucha* Buch.-Ham., Mem. Wern. Soc. 5: 333 (1826).

Deciduous tree, leaves oblong, elliptic, hispid, fruits globose, sublobed, yellow when ripe. *Flowering and fruiting*: February-May. *Ecology*: common on the hill slope. *Representative specimens*: Bijoynagar, 10-06-16, Tahmina Haque, 283 (DUSH)

Ficus benghalensis L., Sp. Pl.: 1059 (1753). Synonym: *Ficus indica* L. (1753). Local Name: Botgach.

Very large, evergreen to semi-deciduous tree with strong prop roots and accessory trunks, leaves alternate, simple, petioles hairy, leaf blade ovate, male flowers ostiolar, numerous, sepals 2-3, stamen solitary, female flowers numerous, mixed with gall flowers, sepals 3-4, elongated styles and bifid stigmas, fig depressed globose, pinkish red. *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 5-2-04-16; Tahmina Haque, 166 (DUSH).

Ficus hispida L. f., Suppl. Pl.: 442 (1781). Synonym: *Ficus oppositifolia* Roxb. (1798). Local Name: Dumur.

A shrub or small tree with a spredaing crown, oppositely arranged leaves, on long stalks, ovate, oblong, or obovate-oblong, figs appear in leaf axil on normal leafy shoots, solitary or paired, yellow or red when mature, top-shaped, covered with short hairs. Flowering: June-July. *Ecology*: open places along the base of foothills. *Representative specimens*: Nabinagar, 2-04-16; Tahmina Haque, 53 (DUSH)

Ficus racemosa L., Sp. Pl.: 1060 (1753). Synonym: *Ficus glomerata* Roxb. (1798). Local Name: Jogdumur.

A low tree, monoecious plant, bark greyish-brown, leaves alternate, blades at early stage have hairs, symmetric, margin entire, stipulate, male and female flowers pedicillate, styles lateral and stigmas clavate. *Flowering and fruiting*: May-July. *Ecology*: moist areas near streams. *Representative specimens*: Tahmina Haque, 256 (DUSH).

Streblus asper Lour., Fl. Cochinch. 2: 615 (1790). Synonym: *Trophis aspera* Retz. (1790). Local Name: Howra.

Bushy, small, evergreen tree with milky juice, leaves altenate, elliptic or obovate, flowers dioecious, axillary, male flowers in globose heads, female flowers solitary, fruit 1-seeded berry, yellow when ripe. *Flowering and fruiting*: February-June. *Representative specimens*: Tahmnia Haque, 157 (DUSH)

Family name: Nyctaginaceae

Boerhaavia diffusa L., Sp. Pl. 1: 3(1753). Synonym: *Boerhaavia repens* L. (1753). Local Name: Punarnabba

Spreading, prostrate herb with long trailing branches, leaves unequal, ovate, flowers in

umbelliform clusters, perianth pink, capsule clavate, 5-ribbed, glandular. Flowering: April-June. Fruit ripen: July-August. *Ecology*: waste places, along roadsides, near habitations, in and along cultivated fields and in open cleared patches in forests. *Representative specimens*: Sorail, 07-09-17, Tahmina Haque, 14 (DUSH).

Family name: Cactaceae

Echinopsis peruviana (Britton & Rose) Friedrich & G.D. Rowley, I. O. S. Bull. 3: 97 (1974). Local Name: Hiz gach.

A fast-growing columnar cactus, plant is bluish-green in color, with frosted stems, it has large, white flowers. Groups of 6-8 honey-colored to brown rigid spines, located at the nodes. *Flowering and fruiting*: very rare. *Ecology*: the mountain desert areas at an altitude of 2000-3000 meters above sea level. *Representative specimens*: Tahmina Haque, 134 (DUSH).

Opuntia dillenii Haw., Suppl. Pl. Suce.: 79 (1819). Synonym: *Cactus dillenii* Ker-Gawl. (1818). Local Name: Mansha gach.

Succulent perennial undershrub, with flattened stem-segments broadly oblong, ovate or suborbicular, oreoles raised, densely elongate bristly, spines yellowish to brownish, leaves small, deciduous, flowers sessile, solitary. Representative specimen: Tahmina Haque, 78 (DUSH)

Family name: Chenopodiaceae

Chenopodium album L., Sp. Pl. 1: 219 (1753).

Annual herb, leaves rhombic, deltoid or lanceolate, irregularly lobutate, upper leaves smaller and more entire than the lower, flowers very small in clusters, forming complex or lax paniculate often mealy spikes, fruit a membranous utricle. *Flowering and fruiting*: December-March. *Representative specimens*: Bijoynagar, 04-09-16; Tahmina Haque, 237 (DUSH)

Family name: Amaranthaceae

Achyranthes aspera L., Sp. Pl. 1: 204(1753). Synonym: *Cyathula geniculata* Lour. (1790). Local Name: Ufuthlenga.

Erect, perennial herb, stem usually branched, leaves simple, opposite, orbicular, obovate, inflorescence terminal and lateral spikes, flowers greenish to red, fruit an utricle. *Flowering and fruiting*: throughout the year. *Ecology*: roadsides. *Representative specimen*: Kosba, 01.06.2016, Tahmina Haque, 87 (DUSH)

Acyranthus bidentata (Blume). Synonyms**:** *Achyranthes hispida*, *Achyranthes japonica*, *Achyranthes chinensis*. Local Name: Ultautrengsa.

Erect or straggling herb, much-branched, stem and branches indistinctly quadrangular, leaves elliptic-oblong to broadly oval, inflorescences at first dense, finally lax and elongating to as much as 20 cm, bracts narrowly lanceshaped, capsule 2-3 mm long, seed filling the capsule, cylindrical, smooth. *Flowering and fruiting*: throughout the year. *Ecology*: roadsides. Representative specimen: Kosba, 01.06.2016, Tahmina Haque, 217 (DUSH)

Aerva sanguinolenta (L.) Blume, Bijdr.: 547 (1825). Synonym: *Achyranthes sanguinolenta* L., Sp. Pl. 2: 85 (1762). Local Name: Rongila.

Annual herb, leaves lanceolate, flowers on branched terminal infloresence. *Flowering and fruiting*: December-January. *Ecology*: edge of the road, planted as ornamental plant. *Representative specimens*: Kosba 10-12-16, Tahmina Haque, 58 (DUSA).

Alternanthera sessilis (L.) R. Br. ex Roem. & Schult., Syst. 5: 554 (1819). Synonym: *Gomphrena sessilis* L. (1753). Local Name: Golhisa.

Perennial herb with prostrate stems, leaves opposite, linear or elliptic, inflorescence white, often clusters, flowers in sessile spikes. *Flowering and fruiting*: throughout the year. *Ecology*: roadsides, edges of aquatic body. Representative specimen: Kosba, 01.06.2016, Tahmina Haque, 121 (DUSH)

Amaranthus spinosus L., Sp. Pl. 1: 991 (1753). Local Name: Kantanoitta.

Annual erect herb, leaves elliptic to lanceolate, inflorescence a head, green, axillary clusters, flowers small. *Flowering and fruiting*: throughout the year. *Ecology*: wasteland. Representative specimen: B.bariasadar, 28.02.2016, Tahmina Haque, 126 (DUSH)

Amaranthus tricolor L., Sp. Pl. 1: 989 (1753). Synonym: Amaranthus gangeticus L. (1759). Local Name: Lal shakh.

Annual erect herb, leaves elliptic to lanceolate, infloresence a head, axillary and terminal, flowers increasingly distant. *Flowering and fruiting*: throughout the year. *Ecology*: cultivated in home garden. Representative specimen: B. bariasadar, 28.02.2016, Tahimna Haque, 102 (DUSH)

Celosia cristata L., Sp. Pl. 1: 235 (1753). Local Name: Morogful.

Annual herbaceous plant, leaves linear to ovate, inflorescence variously branched, cock-comb like terminal and axillary spike, flowers red, whitish, creamy-yellow, fruit a circumscissile capsule. *Flowering and fruitin*g: throughout the year. Representative specimen: Tahmina Haque, 278 (DUSH)

Cyathula prostrata (L.) Blume, Bijdr.: 549 (1825). Synonym: *Achyranthes prostrata* L. (1762). Local Name: Dengi.

Decumbent herbs, leaves opposite, rhomboid, acute at both ends, thinly pubescent, spike terminal, slender, solitary, flowers in groups of 3-5, elliptic, acute, hooked awn-like in neutor flowers, ovary ovoid, style simple, stigma capitellate. *Flowering and fruiting*: August-March. *Ecology*: settled areas, shaded localities and roadsides. *Representative specimen*: Kosba, 25-04-19; Tahmina Haque, 214 (DUSH).

Family name: Portulacaceae

Portulaca oleracea L., Sp. Pl. 1: 445 (1753). Synonym: *Portulaca officinarum* Crantz (1766), *Portulaca suffruticosa* Thw. (1858). Local Name: Nontashakh.

Annual, prostate, succulent herb, stem reddish, quite glabrous, leaves fleshy, subsessile, alternate or subopposite, rounded and truncate at the apex, flowers yellow, few together, in sessile terminal heads, capsule ovoid, circumsciss. *Flowering and fruiting*: throughout the year. *Representative specimens*: Tahmina Haque, 289 (DUSH)

Family name: Basellaceae

Basella alba L. (1753). Synonym: *Basella rubra* L., Sp. Pl: 272 (1753). Local name: Puipata

Much-branched twiner, stem green or colored, leaves fleshy, simple, alternate, inflorescence racemes or spikes, flower sessile, bisexual, white, red or greenish, fruits berry-like, black when ripe with red or purplish juice, seed erect, globose. *Flowering and fruiting*: November-March. *Ecology*: kitchen garden. *Representative specimens*: Sorail, 07-09-17, Tahmina Haque, 11 (DUSH).

Family name: Molluginaceae

Glinus oppositifolius (L.) A. Dc., Bull. Herb. Boiss. 2(1): 522 (1901). Synonym: Mollugo oppositifolia L. (1753). Local Name: Gimashakh.

A prostrate annual herb, leaves in pseudowhorls of 3-6 or opposite, 1-2.5 cm × 3-6 mm, flowers greenish-white, seeds numerous. *Flowering and fruiting*: flowering almost all year round. *Ecology*: in savanna woodland, wet depressions, on river banks and along roadsides, often in sandy soils. *Representative specimens*: Nabinagar, 02-04-16; Tahmina Haque, 298 (DUSH).

Family name: Polygonaceae

Antigonon leptopus Hook. et Arn., Bot. Beech. Voy.: 308, t. 69 (1841). Local Name: Anantamul.

Perennial vine, leaves simple, alternately arranged, lamina heart-shaped, bright pink

flower clusters have hairy stalks, small brown fruit (achenes) cone-shaped and shiny. *Flowering and fruiting*: flowering may occur throughout the year. *Ecology*: roadsides, disturbed sites, waste areas and old gardens in the wetter tropical and subtropical regions. *Representative specimen*: Tahmina Haque, 247 (DUSH)

Persicaria hydropiper (L.) Spach, Hist. Veg. 10: 536 (1841). Synonym: Polygonum hydropiper L. (1753).

Annual herb, leaves lanceolate, glabrous, ocrea tubular, flowers in terminal or lateral racemes, ocreolae tubular, tepals 4 or 5, nut biconvex or trigonous occurring in same plant, black, reticulate. *Flowering and fruiting*: August-April. *Ecology*: sandy areas along the bank of water bodies. *Representative specimen*: Tahmina Haque, 88 (DUSH)

Rumex maritimus L., Sp. Pl. 1: 335 (1753). Local Name: Ban palang.

Arect annual herb, stem angled and deeply grooved, leaves lanceolate, base narrowed into the petiole, flowers very small, in axillary whorls, lax or dense, arranged in panicled racemes, leafy to the top. *Flowering and fruiting*: January-May. *Ecology*: on the banks of stagnant water bodies. *Representative specimen*: Tahmina Haque, 243 (DUSH)

Family name: Plumbaginaceae

Plumbago zeylanica L., Sp. Pl.: 151 (1753). Local Name: Dorer gach.

A perennial rambling herb, leaves ovate, subacute, entire, glabrous, flowers white, in elongate spikes, calyx narrowly tubular, persistant, densely covered with stalked sticky glands, corolla white, tube slender, obovate-oblong, capsules oblong. *Flowering and fruiting*: October-December. *Ecology*: Waste places. *Representative specimen*: Tahmina Haque, 49 (DUSH)

Family name: Dilleniaceae

Dillenia indica L., Sp. Pl. 1: 535 (1753). Synonym: *Dillenia speciosa* Thunb. (1791). Local Name: Chalta.

A medium-sized to large evergreen tree, bark smooth, leaves simple ,alternate, flowers solitary, pendant, sepals 5, petals 5, white with green veins, stamens in 2 distinct groups, inner stamens larger, fruits enclosed by large fleshy sepals. Seeds without aril. *Flowering and fruiting*: May-February. *Representative specimen*: Tahmina Haque, 110 (DUSH)

Family name: Theaceae

Camellia sinensis (L.) O. Kuntze, Acta Horti Petrop. 10: 195 (187). Synonym: *Thea sinensis* L. (1753). Local Name: Chapata.

Evergreen shrub or small tree which usually trimmed to below 2 m (6.6 ft) when cultivated for its leaves, leaves obovate-lanceolate, flowers yellow-white, fruit a subglobose capsule. *Flowering and fruiting*: June-January. *Representative specimens*: Tahmina Haque, 266 (DUSH)

Family name: Clusiaceae

Mesua ferrea L., Sp. Pl.: 515 (1753). Synonym: *Mesua nagassarium* (Burm. f.) Kosterm. (1976). Local Name: Nageshor.

Medium to large evergreen tree, leaves simple, decussate, opposite, very variable, linear-lanceolate or elliptic-oblong, coppery-reddish when young, flowers white, fruit a berry, ovoid to globose, with a conical tip. *Flowering and fruiting*: February-October. *Representative specimen*: Tahmina Haque, 295 (DUSH)

Family name: Elaeocarpaceae

Elaeocarpus robustus Roxb. (1832) Synonyms: *Craspedum tectorium* Lour. (1790), *Elaeocarpus tectorious* (Lour.) Poir in Lamk., Encycl. Suppl. 2: 704 (1812). Local Name: Jolpai

A medium-sized to large evergreen tree, with buttress and stilt roots, bark greenish-grey, leaves ovate, acute to acuminate, base rounded, racemes 10-25 flowered, flowers white, fragrant, sepals lanceolate, petals obtriangular, hairy on margin and at base, divided to middle into 40-50 segments, stamens 40-50, anthers bearded, fruit a drupe, greenish-yellow, edible, very acidic. *Flowering and fruiting*: May-October. *Ecology*: subtropical forests. *Representative specimens*: Sorail,16-04-17; Tahmina Haque, 98 (DUSH)

Family name: Sterculiaceae

Abroma augusta (L.) L. f. Suppl: 341 (1781). Synonyms: *Theobroma augusta* L. (1776), *Abroma mollis* DC. (1824). Local Name: Ulotkombol.

Shrub or small tree, leaves simple, alternate, repand-denticulate, flowers dark red, fruit an obpyramidal capsule. *Flowering and fruiting*: June-December. *Ecology*: gardens, prefers hot and moist climate. *Representative specimen*: Kosba 11.03.2016, Tahmina Haque, 34 (DUSH)

Sterculia villosa Roxb. ex Smith in Rees, Cycl. 34: No. 16 (1816). Synonym: *Sterculia ornata* Wall. ex Kurz (1873). Local Name: Udal.

Small to medium-sized, deciduous tree, leaves simple, crowded at ends of branchlets, flowers pinkish, in crowded drooping panicles, fruit follicle, many seeded, red when ripe. *Flowering and fruiting*: March-May. *Ecology*: hill slopes. *Representative specimens*: Tahmina Haque, 177 (DUSH)

Family name: Bombaceae

Bombax ceiba L., Sp. Pl: 511 (1753). Synonyms: *Bombax heterophyllum* L. (1767), *Bombax heptaphylla* Cav. (1788), *Bombax malabaricum* DC. (1824). Local Name: Tula gach.

Large-sized fast growing tree, leaves digitately compound, flowers solitary, pedunculate, bisexual, red, orange or yellow, fruit oblong capsule, dehiscent, forming cottons from inner walls, seeds embedded in cotton. *Flowering and fruiting*: January-April. *Ecology*: forest and village thickets, mostly cultivated. *Representative specimens*: Sorail, 23-11-16, Tahmina Haque, 40 (DUSH)

Family name: Malvaceae

Abelmoschus esculentus (L.) Moench, Meth. Pl.: 617 (1794). Synonym: *Hibiscus esculentus* L. (1753). Local Name: Vendi.

Annual herb, leaves palmately lobed, flowers white to yellow, fruit capsule. *Flowering and fruiting*: throughout the year. *Ecology*: cultivated land. Representative specimen: Akhaura, 24.06.2015, Tahmina Haque, 215 (DUSH)

Abutilon hirtum (Lamk.) Sweet, Hort. Brit. ed. 1: 53 (1826). Synonym: Sida hirta Lamk. (1783). Local Name: Sida.

Erect shrub, densely pubescent, leaves ovate to orbicular, deeply cordate at base, tomentose below, flowers axillary, solitary, orange-yellow with or without a purple centre, capsule densely tomentose. *Flowering and fruiting*: October-April. *Ecology*: moist soil, usally near the ditches and roadsides. *Representative specimen*: Akhaura, 01.06.2016, Tahmina Haque, 230 (DUSH)

Hibiscus rosa-sinensis L., Sp. Pl.: 694 (1753). Local Name: Roktojaba.

A shrub, stem woody, leaves with petioles which are hairy, flowers solitary, calyx 5-lobed, petals 5, variously coloured, red, rose-yelow, staminal column longer than petals, antheriferous at upper half, fruit not set in Bangladesh.Flowering: January- December. *Ecology*: parks, house gardens as ornamental. *Representative specimens*: Tahmina Haque, 163 (DUSH)

Hibiscus sabdariffa L., Sp. Pl.: 695 (1753). Synonym: *Hibiscus digitatus* Cav. (1787). Local Name: Mestapata.

An annual or perennial herb or woody-based subshrub, leaves deeply three- to five-lobed, arranged alternately on the stems, flowers white to pale yellow with a dark red spot at the base of each petal, red calyx, consisting of 5 large sepals, pointed bracts around the base, begins to enlarge, becomes fleshy, crisp but juicy, capsule turns brown and splits open

when mature and dry. *Flowering and fruiting*: November-February. *Ecology*: cultivated on highland. *Representative specimen*: Tahmina Haque, 58 (DUSH)

Sida cordifolia L., Sp. Pl.: 684 (1753). Synonym: Sida herbacea Cav. (1785). Local Name: Barela.

Shrubby, softly hairy and with much stellate hairs nearly all over, leaves cordate, ovate-oblong, flowers yellow, fruit a schizocarp. *Flowering and fruiting*: September-December. *Representative specimens*: Tahmina Haque, 208 (DUSH).

Urena lobata L., Sp. Pl.: 692 (1753). Synonym: *Urena palmata* Roxb. (1832). Local Name: Jangli gagra.

Shrubby perennial, leaves usually broader than long, flowers small, clustered in the axils, pink, capsules pubescent, covered with blunt spines. *Representative specimen*: Tahmina Haque, 205 (DUSH).

Family name: Lecythidaceae

Barringtonia acutangula (L.) Gaertn., Fruct. 2: 97, t. 101 (1791). Synonym: *Eugenia acutangula* L. (1753). Local Name: Eijol gach.

Small to medium-sized tree, leaves obovate to oblanceolate, crowded at the ends of branches, flowers on slender, drooping long racemes, fruits oblong, crowned with persistent calyx lobes. *Flowering and fruiting*: May-octaber, *Ecology*: on the roadside edge, near water. Representative specimen: Simrail, 10.10.17, Tahmina Haque, 305 (DUSH).

Family name: Passifloraceae

Passiflora foetida L., Sp. Pl.: 959 (1753). Synonym: *Passiflora hirsuta* Lodd. (1818). Local Name: Passion flower.

A slender climber, leaves palmately 3-lobed, flowers white with purple center, solitary, axillary, fruit like a small gooseberry, yellow when mature. *Flowering and fruiting*: May-December. Representative specimen: Tahmina Haque, 286 (DUSH)

Family name: Caricaceae

Carica papaya L., Sp. Pl: 1036 (1753**)**. Local Name: Pepe.

Tree, with milky latex, leaves large, palmately 5-7 lobed, petioles very long, flowers fragrant and night blooming, fruit a pulpy berry, green turning into yellow when ripe. *Flowering and fruiting*: throughout the year. *Ecology*: kitchen gardens and fields. *Representative specimens*: Akhaura, 17-07-16, Tahmina Haque, 18 (DUSH)

Family name: Cucurbitaceae

Coccinia grandis (L.) Voigt, Hort. Suburb. Calc.: 59 (1845). Synonym: *Coccinia indica* Wight & Arn. (1834), *Coccinia cordifolia* Cogn. (1881).

Perennial, climbing herb, stem slender, much-branched, glabrous, tendrils filiform, leaves entire to palmately lobed, in male flowers calyx tube campanulate, corolla white or yellow, in female flowers style slender, fruit glabrous, pulp red, juicy. *Flowering and fruiting*: March-December. *Ecology*: roadsides, grasslands, hedge, forests. *Representative specimens*: Kosba, 18-07-17; Tahmina Haque, 03 (DUSH)

Cucumis sativus L., Sp. Pl. ed. 1: 1012 (1753). Synonym: *Cucumis setosus* Cogn. (1881). Local Name: Sasha.

A hispidly hairy prostrate or climber, leaves broadly cordate-ovate, villous-hispid, male flowers fasiculate, corolla 2-3 cm long, yellow, female flowers solitary or fasciculate, peduncle robust, yellow, fruit oblong, short or long, green, turns rusty brown when mature. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 268 (DUSH).

Cucurbita maxima Duch. ex Lamk., Encycl. 2: 151 (1786). Local Name: Mistikumra.

Large hispid climbing herb, leaves nearly orbicular in outline, 5-angled, flowers monoecious, solitary, yellow, large, campanulate, fruit fleshy, large, and greatly varies in size and shape. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 303 (DUSH).

Gymnopetalum cochinchiensis (Lour.) Kurtz, J. As. Soc. Beng. 40: 57 (1871). Synonym: *Bryonia cochinchinensis* Lour. (1790). Local Name: Jongliful.

Perennial climbing herb, leaves ovate, undivided or lobed up to the middle, flowers white, fruit oblong-ovate, orange, 10-ribbed. *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 2-04-16; Tahmina Haque, 211 (DUSH)

Lagenaria siceraria (Molina) Standl., Publ. Field Mus. Nat. Hist. Chicago, B. Ser. 3: 435 (1930). Synonym: *Lagenaria vulgaris* Seringe (1825). Local Name: Lau.

Climbing vine, with hairy stems, leaves simple, margins shallowly toothed, flowers solitary, monoecious, petals 5, crisped, cream or white with darker veins, pale yellow at the base, fruit large, variable, subglobose to cylindrical, flask-shaped or globose. *Flowering and fruiting*: throughout the year. *Ecology*: alluvial sandy soil and red loam, on flat areas and moderate slopes, on rocky ridges, on river banks and in dry river beds, in disturbed areas. Representative specimen: Tahmina Haque, 296 (DUSH)

Momordica charantia L. var. **charantia** C. B. Clarke in Hook. f., Fl. Brit. Ind. 2: 616 (1879). Synonyms: *Momordica indica* L. (1754), *Momordica elegans* Salisb. (1796). Local Name: Titkona.

An annual climbing herb, stem branched, puberulous, simple, leaves reniform or subornicular, plants monoecious, male flowers solitary, bracts entire, foliacious, calyx lobes ovate-lanceolate, corolla yellow, lobes obovate, obtuse or retuse, female flowers often bracteates at base, fruits muricate-tuberculate, seeds numerous. *Flowering and fruiting*: May-October. *Ecology*: sandy loam soil rich in organic matter. *Representative specimens*: Tahmina Haque, 120 (DUSH).

Momordica cochinchinensis (Lour.) Spreng., Syst. Veg. 3: 14 (1826). Synonym: *Muricia cochinchinensis* Lour. (1790). Local name: Kakrol.

A perennial climbing herb with tuberous roots, stem smooth, tendrils simple, leaves broadly suborbicular, divided to the middle into 3 or rarely 5 lobes, lobes ovate, lanceolate, dioecious plant, male flowers bracteate, bracts sessile, cucullate, calyx lobes narrow, acute, corolla whitish-yellow, stamens 3, filaments thick with black and white marks, female flowers bracteate at middle, calyx and corolla as male, style slender, stigma 3, fruit red, fleshy, ovoid, densly aculeate. *Flowering and fruiting*: July-November. *Ecology*: forests and thickets, and fertile, well- drained sandy loam soils in warm humid climate. *Representative specimens*: Tahmina Haque, 212 (DUSH).

Family name: Capparaceae

Crataeva magna (Lour.) DC., Prodr. 1: 243 (1824). Synonym: *Crataeva nurvala* Buch.-Ham. (1827). Local name: Barunpata.

A small much-branched deciduous tree, leaves 3-foliolate, lanceolate or obovate, acute, flowers many, in dense terminal corymbs, greenish white, fruit a globose or ovoid, woody berry. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 32 (DUSH).

Family name: Brassicaceae

Brassica nigra (L.) Koch in Röhling, Deutsch. Fl. ed. 3, 4: 713 (1833). Synonym: Sinapsis nigra L. (1753). Local name: Sarisha.

Annual, rigid, erect herb, lower leaves lyrate, deeply pinnatifid or pinnatisect, flowers ebracteate, bright yellow, fruits seedless, dark brown. *Flowering and fruiting*: March-May. *Representative specimens*: Kosba, 17-07-17, Tahmina Haque, 263 (DUSH).

Family name: Moringaceae

Moringa oleifera Lamk., Encycl. 1 (2): 398 (1785). Synonym: *Moringa zeylanica* Pers. (1830). Local name: Sajna.

A small tree, stem with corky bark, leaves tripinnate, compound, inflorescence a panicle, flowers pedicillate, bisexual, zygomorphic, pentamerous, white, sepals 5, free, petals 5, polypetalous, unequal, stamens 5, anthers waxy, yellow or orange, styles slender with perforated stigmas, fruit elongated capsule, seeds winged, many. *Flowering and fruiting*: October-March. *Ecology*: lower elevations, but grows upto 1300 m altitude, fertile, drought tolerant well drained soil. *Representative specimens*: Tahmina Haque, 26 (DUSH)

Family name: Sapotaceae

Manilkara zapota (L.) P. van Royen, Blumea 7: 410 (1953). Synonym: *Achras zapota* L. (1753). Local name: Sofeda.

Small evergreen tree with milky latex, leaves simple, alternate, crowded at the end of branchlets, lamina ovate-elliptic to elliptic-lanceolate, flowers in leaf axils, bisexual, white, fruit a fleshy berry, usually globose, rusty-brown. *Flowering and fruiting*: almost throughout the year. Representative specimen: Tahmina Haque, 279 (DUSH)

Mimusops elengi L., Sp. Pl.: 349 (1753). Local name: Bokul.

Large evergreen tree, leaves simple, alternate, lamina ovate, oblong or elliptic-oblong, flowers bisexual, clustered in leaf axils, creamy-white, fragrant, open flower star-shaped, fruit a berry, orange when ripe, seed embedded in juicy pulp. *Flowering and fruiting*: March-June. Representative specimen: Tahmina Haque, 294 (DUSH)

Family name: Ebenaceae

Diospyros malabarica (Desr.) Kostel., Allg. Med.-Pharm. Fl. 3: 1099 (1834). Synonym: *Diospyros peregrina* Guerke (1891). Local name: Deshi gab.

A small to medium-sized evergreen tree, knotty and wanty trunk and bushy crown, bark blackish brown with white blotches, leaves simple, alternate, flowers unisexual, whitish in short axillary cymes, male flowers shortly pedunculte, rusty pubescent, stamens 24-64, female flowers solitary, larger than male ones, style 4, stigmas 8 with 4-12 staminoids, fruits globose berry. *Flowering and fruiting*: May-August. *Ecology*: moist shady places along edges of water bodies. *Representative specimens*: Tahmina Haque, 284 (DUSH)

Family name: Crassulaceae

Kalanchoe pinnata (Lamk.) Pers. (1805). Synonym: *Bryophyllum pinnatum* (Lamk.) Oken, Allg. Naturgesch. Vol. 111(3): 1966 (1841). Local name: Pathorkuchi

A succulent, perennial plant, with a fleshy cylindrical stem, leaves thick, fleshy, elliptical in shape, curved, inflorescence terminal panicle, with many pendent, red-orange flowers, fruits follicles. *Flowering and fruiting*: December-April. *Ecology*: arid regions. Representative specimen: Tahmina Haque, 09 (DUSH)

Kalanchoe serrata Mann & Boit. Local name: Sarnakomol

Very fast growing, drought tolerant small shrub. *Flowering and fruiting*: Throughout the year. Representative specimen: Tahmina Haque, 93 (DUSH)

Family name: Rosaceae

Fragaria chinensis Losinsk. (1926). Synonym: *Frageria vesca* L., Sp. Pl. 1: 494 (1753), Local name: Strawberry

Perennial herb, leaves palmately 3-foliolate, leaflets broadly ovate, inflorescence 3-flowered erect cyme, flowers white, fruit achene, obovoid, bright red. *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 127 (DUSH)

Rosa damascena Mill., Gard. Dict. ed. 8: 15 (1768). Local name: Golap.

Strongly armed shrub, leaves pinnate, leaflets serrate, flowers large, solitary, scented, often double, fruits without tomentose. *Flowering and fruiting*: November-March. *Ecology*: cultivated. *Representative specimens*: Tahmina Haque, 129 (DUSH)

Family name: Mimosaceae

Acacia catechu (L. f.) Willd, Sp. Pl. 4: 1079 (1806). Synonym: *Mimosa catechu* L. f. (1781). Local name: khoier.

Medium-sized deciduous tree, leaves bipinnate, often armed, pinnae 4-24 pairs, leaflets 20-50 pairs, opposite, linear-oblong, flowers creamy-white, fruit a pod, dark chocolate-brown to reddish-brown or blackish when dry. *Flowering and fruiting*: March-December. *Ecology*: alluvial soil, waste places, along roadsides. *Representative specimens*: , 05-09-17, Tahmina Haque, 216 (DUSH)

Acacia nilotica (L.) Delile subsp. **indica** (Benth.) Brenan, Kew Bull. 12: 84 (1957). Synonym: *Mimosa nilotica* L. (1753). Local name: Babla.

Fast growing tree with stipular spine, leaves pinnately compound, pinnae 3-12 pairs, leaflets 10-30 pairs, linear-oblong, flowers bright yellow, fruit a pod. *Flowering and fruiting*: May-April. *Ecology*: scrubs, waste palces and along roadsides. *Representative specimens*: Tahmina Haque, 248 (DUSH)

Albizia lebbeck (L.) Benth. & Hook., Lond. J. Bot. 3: 87 (1844). Synonym: *Mimosa lebbeck* L. (1753). Local name: Sirish koroi.

Tree, leaves bipinnate, pinnae 2-5 pairs, leaflets 3-9 pairs, flowers white, with numerous stamens, fragrant, fruit a pod, linear-oblong, strap-shaped. *Flowering and fruiting*: September- December. *Ecology*: Fallow land. *Representative specimens*: Kosba 10-12-16, Tahmina Haque, 249 (DUSA)

Entada rheedii Spreng., Syst. veg. 2: 325 (1825). Synonyms: *Mimosa entada* L. (1753), Entada scandens auct. non Benth. (1842).

A vigorous woody climber, leaves pinnately compound, flowers pentamerous, sessile or subsessile, white, fruit pod. *Flowering and fruiting*: May-November. *Ecology*: forests, along side of river streams. *Representative specimens*: Tahmina Haque, (DUSH)

Leucaena leucocephala (Lamk.) de Wit., Taxon 10: 53 (1961). Synonyms: *Mimosa glauca* L. (1753), Mimosa leucocephala Lamk. (1783). Local name: Sada lajonti.

Low to medium-sized deciduous tree, leaves bipinnately compound, pinnae 3-10 pairs, leaflets 5-20 pairs, small, linear to linear-oblong, inflorescence axillary to subterminal, densely globose, pedunculate heads, flowers small, tubular, brown or creamy-white, fruit a pod, strap-shaped, flat, compressed, straight. *Flowering and fruiting*: March-November. Representative specimen: Tahmina Haque, 248 (DUSH)

Mimosa pudica L., Sp. Pl. 1: 518 (1753). Synonym: *Mimosa aspirata* Blanco (1837). Local name: Lajonti.

A low, prostrate annual or perennial herb, leaves pinnately compound, very sensitive to touch, stipulate, rachis hispid and prickly, without thrones at the junction of pinnae, flowers small, sessile, corolla pink, narrowly campanulate, fruit a pod. *Flowering and fruiting*: September-December. *Ecology*: roadsides, grassy fields, fallow lands. *Representative specimens*: Tahmina Haque, 35 (DUSH)

Pithecellobium dulce (Roxb.) Benth., Lond. J. Bot. 3: 213 (1844). Synonyms: Inga dulcis (Roxb.) Willd. (1806), *Mimosa dulcis* Roxb. (1832). Local name: Moccasarif gach.

A small to medium-sized evergreen tree, armed with straight stipular thorns, leaves bipinnate, each pinna with a pair of leaflets, leaflets oblique, obovate-oblong, obtuse, flowers small, whitish in small globular heads, solitary or fascicled in axils of bracts. *Flowering and fruiting*: January-July. *Representative specimen:* Tahmina Haque, 231 (DUSH)

Family name: Caesalpiniaceae

Cassia fistula L., Sp. Pl. 1: 377 (1753). Synonyms: *Cathartocarpus fistula* (L.) Pers. (1805), Cassia rhombifolia Roxb. (1832). Local name: Sonajaron gach.

Deciduous tree, leaves compound, leaflets ovate-elliptic, inflorescenes large pendulous racemes, flowers bright yellow, showy, fruit pod. *Flowering and fruiting*: March-June. *Ecology*: generally dry lands, backyards of houses, roadsides, gardens, fallowlands and margins of cultivated lands. *Representative specimens*: Akhaura, 27-04-16, Tahmina Haque, 200 (DUSH).

Saraca asoca ((Roxb.) de Wild., Blumea 15: 394 (1968). Synonym: *Jonesia asoca* Roxb. (1795). Local name: Asok.

Small to medium-sized, evergreen tree with spreading branches, leaves pinnately compound, leaflets 4-6 pairs, oblong-lanceolate, obtuse or acute, flowers numerous in dense axillary corymbs, yellow to red in color, fruit a pod. *Flowering and fruiting*: February-September. *Ecology*: plain land and hilly areas. Representative specimen: Tahmina Haque, 175 (DUSH)

Senna alata (L.) Roxb., Fl. Ind. 2: 349 (1832). Synonym: *Cassia alata* L. (1753). Local name: Daudmordan.

Large shrub, leaves compound, flowers showy, in spiciform, pedunculate, erect, racemes, bright yellow, pods linear-oblong, with a broad wing down the middle of each valve. *Flowering and fruiting*: September-January. *Representative specimens*: Tahmina Haque, 74 (DUSH)

Tamarindus indica L., Sp. Pl. 1: 34 (1753). Synonyms: *Tamarindus occidentalis* Gaertn. (1878), Tamarindus officinalis Hook. f. (1878). Local name: Tentul.

Large tree with spreading crown, leaves peripinnately compound, leaflets unequal and rouned at the base, inflorescence a terminal receme, flowers pale or golden yellow, fruit pod, light brown, septate, sour in taste. *Flowering and fruiting*: April -December. *Ecology*: Wastelands, backyards of houses, roadsides, well-drained soils of sandy, poor soil, even in rocky terrains. *Representative specimens*: Tahmina Haque, 197 (DUSH)

Family name: Fabaceae

Abrus precatorious L., Syst. Nat. ed. 12: 472 (1767). Synonym: *Glycine abrus* L. (1753). Local name: Kuch.

Slender, perennial climber, leaves apripinnate, leaflets 10-20 pairs, opposite, flowers in raceme, crowded, pink or white, fruit a pod. *Flowering and fruiting*: July-September. *Ecology*: invasive species grows in warm temperate to tropical region. Representative specimen: Akhaura, 01.06.2016, Tahmina Haque, 139 (DUSH)

Butea monosperma (Lamk.) Taub. in Engl. & Prantl, Nat. Pflanz. 3(3): 366 (1894). Synonym: *Erythrina monosperma* Lamk. (1788). Local name: Polash.

Small to medium-sized deciduous tree, leaves pinnately trifoliolate, flowers bright orange-red, in racemes, fruit a pod. *Flowering and fruiting*: January-March. *Ecology*: grows in open grassland areas. *Representative specimens*: Tahmina Haque, 304 (DUSH)

Cajanus cajan (L.) Millsp., Publ. Field. Mus. Nat. Hist. Bot. Ser. 2: 53 (1900). Synonyms: *Cytisus cajan* L. (1753), Cajanus indicus Spreng. (1826). Local name: Arol.

Erect shrub, leaves pinnately trifoliate, leaflets acute, inflorescence a terminal panicle, flowers yellow, with reddish brown lines, fruit pod. *Flowering and fruiting*: December -April. *Ecology*: plain lands, along the margin of crop fields, grasslands, roadsides, river beds, gardens, sands to black soil, an altitude upto 1600m. Representative specimen: Tahmina Haque, 162 (DUSH)

Clitoria ternetea L., Sp. Pl.: 753 (1753). Local name: Nilkontho.

Woody climber, leaves unipinnate, short stalked, inflorescence solitary axillary, corolla rich blue in colour with greenish veins on the vexillum, dimorphic the vexilIary stamen free, fruit up to 5-12 cm long, beaked 8-10-seeded, glabrous or sparsely pubescent. *Flowering and fruiting*: January-July. *Ecology*: cultivated as garden plant. *Representative specimens*: Champoknagar, 18-07-18; Tahmina Haque, 52 (DUSH).

Crotalaria juncea L., Sp. Pl.: 714 (1753). Synonym: *Crotalaria benghalensis* Lamk. (1786). Local name: Junjune.

A tall annual, branches numerous, leaves linear or oblong, appressed silky, flowers large, yellow, in erect terminal and lateral 12-20 flowered racemes, sessile, inflated, clothed with short fulvous silky hairs. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 188 (DUSH).

Crotalaria pallida Ait., Hort. Kew. 3: 20 (1789). Synonym: *Crotalaria striata* DC. (1825). Local name: Jhunjune.

An erect low shrub, leaves 3-foliolate, leaflets 7-10 cm long, obovate-oblong, obtuse or subacute, glabrous above and obscurely silky beneath, racemes 20-50-flowered, corolla yellow striped with red, pods turgid, deflexed, rather recurved, 20-30-seeded. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 188 (DUSH).

Dalbergia sissoo Roxb., Fl. Ind. 3: 223 (1832). Synonym: *Amerimonum sissoo* (Roxb.) O. Kunze (1891). Local name: Sissoo.

A medium-sized to large, deciduous tree, young parts hairy, bark thick, inner bark fibrous, light brown, turning into dark brown, leaves alternate, imparipinnate, lateral vein 5 pairs, stipules lanceolate, flowers sessile, yellowish white, densely hairy, calyx hairy, teeth

short, petals pale yellow, stamens 9 in one bundle, fruit pod, strap-shaped. *Flowering and fruiting*: March-June, *Ecology*: highland. *Representative specimens*: Tahmina Haque, 104 (DUSH)

Desmodium triflorum (L.) DC., Prodr. 2: 334 (1825). Synonym: *Hedysarum triflorum* L. (1753). Local name: Kufilingi.

A small herb, leaflets obovate, truncate, flowers pedicillate, calyx pubescent, teeth very long, pods 3-5 jointed. *Flowering and fruiting*: all the year. *Ecology*: fallow lands, waste places, grassland. *Representative specimens*: Tahmina Haque, 71 (DUSH)

Erythrina variegata L., Diss. Herb. Amb. Amoen. Acad. 4: 122 (1754), Synonums: *Erythrina picta* L. (1753), *Erythrina indica* Lamk. (1786). Local name: Kulaimander.

A medium-sized, spiny, deciduous tree, leaves trifoliate, alternate, bright emerald-green, flowers bright pink to scarlet in erect terminal racemes, fruit a cylindrical torulose pod. *Flowering and fruiting*: January-March. *Ecology*: on deep alluvial loams, silts and clays. Representativespecimens: Sorail: Tahmina Haque, 70 (DUSH)

Lablab purpureus (L.) Sweet, Hort. Brit. ed. 1: 481 (1827). Synonym: Dolichos lablab L. (1753). Local name: Choi.

Annual or occasionally short-lived perennial legume, leaves alternate and trifoliolate, flowers white to blue or purple in colour, about 1.5 cm long, typically papillonaceous in shape, fruits linear, smooth and beaked pods. *Flowering and fruiting*: November-March. *Ecology*: in grassland, bushland and gallery forests. Representative specimen: Tahmina Haque, 125 (DUSH)

Mucuna pruriens (L.) DC., Prodr. 2: 405 (1825). Synonym: *Dolichos puriens* L. (1754). Local name: Bonno shim.

Annual or perennial large climbing herb, leaves pinnately 3-foliolate, ovate, rhomboid, racemes short peduncled, drooping, flowers purplish, fruit a pod, thickly leathery, oblong, beset with stinging hairs. *Flowering and fruiting*: October-March. Representative specimen: Tahmina Haque, 196 (DUSH)

Sesbania sesban (L.) Merr., Philippine J. Sci. Bot. 7: 235 (1912). Synonym: *Sesbania aegyptiaca* Poir. (1806). Local name: Dhaincha.

Small soft-wooded tree of rapid growth and brief duration, flowers yellow, in lax-flowered axillary racemes, pod linear, pendulous, twisted, slightly torulose, sharply beaked. *Flowering and fruiting*: April-July. *Representative specimens*: Tahmina Haque, 219 (DUSH)

Trigonella foenum-graecum L., Sp. Pl. 3: 777 (1753). Local name: Methi.

Annual aromatic herb, leaves pinnately trifoliate, flowers solitary, yellowish-white, fruit pod. *Flowering and fruiting*: February- Auguest. *Ecology*: cultivated land. Representative specimen: Akhaura, 24.6.15, Tahmina Haque, 101 (DUSH).

Vigna unguiculata (L.) Walp., Repert. Bot. Sys. 1: 779 (1842). Synonyms: *Dolichos unguiculatus* L. (1753), *Dolichos biflorus* L. (1753), *Dolichos sinensis* L. (1754). Local name: Barbati.

Climbing, glabrous, annual herb, taproot with large, globular nodules, leaves trifoliate, flowers few in subcarpitate racemes, fruit a pod. *Flowering and fruiting*: Troughout the year. *Ecology*: cultivated in dry land. Representative specimen: B.baria- 24.8.15. Tahmina Haque, 253 (DUSH).

Family name: Lythraceae

Lawsonia inermis L., Sp. Pl.: 349 (1753). Synonyms: *Lawsonia spinosa* L. (1753), Lawsonia alba Lamk. (1789). Local name: Mehedi.

A leaf sheathing shrub, lateral branches 4-gonous, leaves opposite, inflorescence terminal panicle, flowers fragrant, sepals and petals 4, styles thick, stigmas capitate, fruit capsule. *Flowering and fruiting*: June-December. *Ecology*: high land. *Representative specimens*: Tahmina Haque, 33 (DUSH)

Family name: Myrtaceae

Psidium guajava L., Sp. Pl. 1: 470 (1753). Synonyms: *Psidium pyriferum* L. (1753), *Psidium pomiferum* L. (1768). Local name: Peara.

Small tree, leaves opposite, young leaves opposite-decussate, old ones opposite-superposed, flowers white, fruit a berry, ovoid, globose crowned by calyx limb. *Flowering and fruiting*: flowers in hot season and fruits in rainy season. *Ecology*: homesteads, roadsides. *Representative specimens*: Tahmina Haque, 109 (DUSH)

Syzygium cumini (L.) Skeels, USDA Bur. Pl. Industr. Bull. 248: 25 (1912). Synonyms: *Syzygium jambolanum* (Lamk.) DC. (1828), Eugenia cumini (L.) Druce (1914). Local name: Jam.

Large semi-evergreen tree, leaves opposite, lamina ovate or ovate-oblong, flowers whitish, fruit berry, variable in size, ovoid, oblong or globose, black, juicy, seeds 1 per fruit usually. *Flowering and fruiting*: March-June. *Ecology*: villages, gardens, roadsides. *Representative specimens*: Tahmina Haque, 19 (DUSH)

Syzygium jambos (L.) Alston, Trimen, Handb. Fl. Cetlon 6: 115 (1931). Synonym: *Eugenia jambos* L. (1753). Local name: Golapjam.

Medium-sized tree, leaves narrowly oblong-lanceolate to lanceolate, flowers white, in terminal, raceme like cymes, berry white or yellowish when ripe, globose or pyriform. *Flowering and fruiting*: March-June. *Representative specimens*: Tahmina Haque, 161(DUSH)

Syzygium samarangese (Blume) Merr. & Perry, J. Arn. Arb. 19: 115 (1938). Synonyms: *Eugenia javanica* Lamk. (1789), *Jambosa samarangensis* DC. (1828). Local name: Lal jamrul.

Small to medium-sized tree, leaves subsessile, thinly coriaceous, flowers white, in lax terminal cymes, fruit shining, obturbinate, with terminal ring of persistant sepals. *Flowering and fruiting*: March-July. *Ecology*: home gardens. *Representative specimens*: Tahmina Haque, 160 (DUSH)

Family name: Punicaceae

Punica granatum L., Sp. Pl.: 472 (1753). Local name: Dalim.

Shrub or low tree, leaves opposite, clustered, leathery, narrower at both ends, flowers scarlet, fruits yellowish, often red flushed roundish, calyx lobes adhering at the top. *Flowering and fruiting*: January-December. *Ecology*: plainlands. *Representative specimens*: Tahmina Haque, 28 (DUSH)

Family name: Onagraceae

Ludwigia adscendens (L.) Hara, J. Jap. Bot. 28: 291 (1953). Synonyms: *Jussiaea repens* L. (1753), *Jussiaea adscendens* L. (1767). Local name: Mulsi.

Rarely creepint to floating herb, rooting at the nodes and with conspicuous white, erect, spindle-shaped pneumatophores arising in clusters at the nodes of floating stem, leaves simple, alternate, broadly oblong-elliptic, flowers white, solitary in the axils or at the end of branches, fruit a capsule. *Flowering and fruiting*: March-December. Representative specimen: Tahmina Haque, 252 (DUSH)

Ludwigia prostrata Roxb., Fl. Ind. 1: 441 (1820). Synonym: *Jussiaea prostrata* (Roxb.) H. Lev. (1910). Local name: Nakful.

An anual herb, leaves elliptic to lanceolate, flowers yellow, capsule narrow, cylinrical. *Flowering and fruiting*: *Flowering and fruiting*: July-Octaber. *Ecology*: on the forest edge, plain lands. Status: cultivated. Representative specimen: B. bariasadar, 28.02.2016, Tahmina Haque, 187 (DUSH)

Family name: Melastomataceae

Melastoma malabathricum L., Sp. Pl.: 390 (1753). Synonym: *Melastoma affine* D. Don (1823). Local name: Jonglitezpata.

An undershrub, leaves oblong-lanceolate, flowers purple, fruits ovovate, seed black. *Flowering and fruiting*: May-December. *Ecology*: on the forest edge. *Representative specimens*: Kosba, 5-1-2-04-16; Tahmina Haque, 185 (DUSH)

Family name: Combretaceae

Terminalia arjuna (Roxb. ex DC.) Wight & Arn., Prodr.: 314 (1834). Synonyms: *Pentaptera arjuna* Roxb. ex DC. (1828), *Terminalia urjan* Royle (1835). Local name: Aurjun.

Medium to large tree, leaves opposite or sub opposite, inflorescence of spikes, flowers pale yellow or yellowish-white, fruit an ovoid 5-winged nut. *Flowering and fruiting*: April- October. *Ecology*: roadsides and gardens, lawns around bunglows. *Representative specimens*: Tahmina Haque, 01 (DUSH)

Terminalia bellirica (Gaertn.) Roxb., Pl. Corom. 2: 54 (1798). Synonyms: *Myrobalanus bellirica* Gaertn (1791). Local name: Bohera.

Deciduous tree, bark thick, blackish, leaves obovate, spirally arranged along the branchlets, inflorescence of axillary spike where male towards apex and female below, flowers yellowish, fruit drupe, very hard when dry. *Flowering and fruiting*: March-November. *Ecology*: moist deciduous forests, evergreen and semi-evergreen forests of low altitude. *Representative specimens*: Tahmina Haque, 31 (DUSH)

Terminalia chebula Retz., Obs. Bot. 5: 31 (1788). Synonyms: *Myrobalanus chebula* Gaertn (1790), Terminalia tomentalla Kurz (1873). Local name: Haritoki.

Medium to large deciduous tree, leaves opposite or sub opposite, margin entire, inflorescence spikes, flowers yellowish or dull white, fruit drupe, pale greenish-yellow. *Flowering and fruiting*: April-October. *Ecology*: moist deciduous to evergreen forests. *Representative specimens*: Tahmina Haque, 13 (DUSH)

Family name: Santalaceae

Santalum album L., Sp. Pl. 1: 349 (1753). Synonym: *Santalum myrtifolium* Roxb. (1820). Local name: Chandon gach.

Small evergreen tree, leaves opposite to subopposite, elliptic, ovate, inflorescence terminal and axillary, flowers creamy-white, scented, fruit a drupe, globose, black when ripe. Representative specimen: Tahmina 272 (DUSH)

Family name: Euphorbiaceae

Acalypha indica L., Sp. Pl.: 1003 (1753). Synonym: *Cupaments indica* Rafin. (1838). Local name: Muktojhuri.

Erect annual herb having cup-shaped involucre that surrounds the small flowers in the catkin-like inflorescence, leaves broad ovate, flower spikes are long, monoecious, fruit 3-lobed, tuberculate and pubescent. *Flowering and fruiting*: throughout the year. *Ecology*: waste, moist and shady places. *Representative specimens*: Tahmina Haque, 106 (DUSH)

Euphorbia antiquorum L., Sp. Pl.: 450 (1753). Synonym: *Euphorbia arborescens* Roxb. (1832). Local name: Narahiz.

A small succulent tree, usually shrub-like, with plentiful white sap, spines paired, sharp, leaves few, borne on the ridges, succulent, alternate, flowers yellowish-green to pinkish, capsules glabrous turning deep red on maturity. Flowering: January. *Ecology*: dry lands. *Representative specimens*: Nabinagar, 5-04-16; Tahmina Haque, 264 (DUSH)

Euphorbia hirta L., Sp. Pl.: 454 (1753). Synonym: *Euphorbia capitata* Lamk. (1785). Local name: Dudhgach.

An annual herb, leaves elliptic, flowers on axillary cymes, fruits capsule. *Flowering and fruiting*: April-October. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 02-04-16;Tahmina Haque, 76 (DUSH)

Euphorbia tirucalli L., Sp. Pl.: 45. (1753). Synonym: *Arthrothamnus tirucalli* (L.) Klotz. (1860). Local name: Dudhraj.

A shrub or small tree with pencil-thick, green, smooth, succulent branches, fleshy stem with fragile succulent twigs, leaves oval, the yellow flowers at the ends of the branches. *Flowering and fruiting*: *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 2-04-16; Tahmina Haque, 299 (DUSH)

Jatropha gossypifolia L., Sp. Pl.: 1066 (1753). Synonym: *Adenopropium elegans* (Pohl) Muell.-Arg. (1826)., TH-198 Local name: Lal veron.

A declared noxious weed, leaves are purple and sticky when young and become bright green with age, flowers small, red with yellow centres appear in clusters, followed by cherry-sized seed pods. *Flowering and fruiting*: all year round. *Ecology*: savannah woodland, riparian areas, monsoon vine forests and coastal foreshores. Representative specimen: Tahmina Haque, 198 (DUSH)

Manihot esculenta Crantz, Inst. 1: 167 (1766). Synonym: *Jatropha manihot* L. (1753). Local name: Cassava.

Shrub with terete tuber, leaves stipulate, lamina palmately 3-9 lobed, fruit a capsule, ellipsoid. *Flowering and fruiting*: September-January. Representative specimen: Tahmina Haque, 285 (DUSH)

Pedilanthus tithymaloides (L.) Poit., Ann. Mus. Paris 19: 390 (1812). Synonym: *Euphorbia tithymaloides* L. (1753). Local name: Koj gach.

An ornamental laticiferous fleshy shrub, leaves ovate or ovate-lanceolate, succulent, cyathia in terminal crowded cymes. *Flowering and fruiting*: March-June. Representative specimen: Tahmina Haque, 147 (DUSH)

Phyllanthus acidus (L.) Skeels, U.S. Dept. Agric. Bur. Pl. Ind. Bull. 148: 17 (1909). Synonym: *Averrhoa acida* L. ((1753). Local name: Arboroi.

Deciduous glabrous tree, leaves alternate, stipulate, lamina ovate to ovate-lanceolate, flowers minute, red, in dense clusters, fruit drupe, depressed-globose, greenish-yellow to whitish. *Flowering and fruiting*: March-June. Representative specimen: Tahmina Haque, 97 (DUSH)

Phyllanthus emblicaL., Sp. Pl.: 982 (1753). Synonyms: *Emblica officinalis* Gaertn. (1790), *Dichelactina nodicaulis* Hance (1852). Local name: Amloki.

A monoecious deciduous tree, bark grey, smooth, leaves stipulate, stipules triangular, leaf blade oblong, flowers in axillary cymes, male flowers pedicillate, anthers erect, stamens 3, sepals 6 in female flowers, obtuse or rounded, fruits subglobose, smooth, succulent, greenish or yellowish white. *Flowering and fruiting*: March-September. *Ecology*: village grooves, scrub and dry open sparse forests. *Representative specimens*: Tahmina Haque, 05 (DUSH)

Phyllanthus niruri L., Sp. Pl.: 981 (1753). Local name: Bhuiamla.

Monoecious erect annual herb, leaves stipulate, lamina elliptic-oblong to elliptic-oblanceolate, floers yellowish, very numerous, axillary, fruit trilobite-subglobose. *Flowering and fruiting*: August-October. Representative specimen: Tahmina Haque, 108 (DUSH)

Phyllanthus reticulatus Poir. in Lamk., Enclycl. Meth. B. 5: 298 (1804). Synonym: *Phyllanthus multiflorus* Willd. (1805). Local name: Sitki.

A scandent shrub, leaves elliptic-oblong, flowers on axillary racemes, fruits globose, black when ripe. *Flowering and fruiting*: December-March. *Ecology*: on the bank of the channel, roadside. *Representative specimens*: Akhaura, Tahmina Haque, 61 (DUSH)

Ricinus communisL., Sp. Pl.: 1007 (1753).

Erect, tree-like glaucous herb, stem hollow, woody at base, leaves stipulate, leaf blade lanceolate, in male flowers calyx lobes elliptic-ovate, yellowish-green, in female flowers calyx lobes lanceolate, purplish, fruits smooth, densely covered with bristle-tipped fleshy processes, seeds shiney greyish, flecked. *Flowering and fruiting*: mostly in winter, almost throughout the year. *Ecology*: waste places, village grooves, nitrogen rich soil is preferred. *Representative specimens*: Tahmina Haque, 21 (DUSH)

Trewia nudiflora L., Sp. Pl.: 1193 (1753). Synonym: *Trewia macrophylla* Roxb. (1821). Local name: Medda.

Medium-sized tree, leaves ovate, lanceolate, cordate, flowers minute, fruits globose. *Flowering and fruiting*: May-August. *Ecology*: On the bank of channel. *Representative specimens*: Kosba Tahmina Haque,11 (DUSH).

Family name: Rhamnaceae

Ziziphus mauritiana Lamk., Encycl. Method. Bot. 3: 319 (1789). Synonym: *Ziziphus jujuba* (L.) Gaertn. (1788). Local name: Boroi.

Small to medium-sized tree with drooping branches, leaves petiolate, inflorescence cymose, flowers bisexual in sessile cymes. *Flowering and fruiting*: July-Dercember. *Ecology*: plainland to highland, can thrive under dry condition. *Representative specimens*: Tahmina Haque, 131 (DUSH)

Family name: Vitaceae

Cissus quadrangualnis L., Syst. Nat. ed. 12(1): 124 (1767). Synonym: *Vitis quadrangularis* Wall. ex Wight & Arn. (1834). Local name: Arenga.

A evergreen climber, quadrangular-sectioned branches with internodes, leaves toothed trilobe, tendril emerging from the opposite side of the node, racemes of small white, yellowish or greenish flowers, globular berries red when ripe. *Flowering and fruiting*: January-March. *Ecology*: planted. *Representative specimens*: B.baria, 18-07-17; Tahmina Haque, 62 (DUSH).

Family name: Malpighiaceae

Malpighia coccigera L., Sp. Pl. 2: 426 (1753). Local name: Kata mehedi.

Dwarf shrub, branches rough, leaves opposite, simple, lamina suborbicular to elliptic, flowers bisexual, axillary, pale pink, fruit a fleshy berry. *Flowering and fruiting*: October-December. Representative specimen: Tahmina Haque, 186 (DUSH)

Family name: Sapindaceae

Litchi chinensis Sonn., Voy. Ind. Or. Chine 2: 230, t. 129 (1782). Synonym: *Nephelium litchi* Cambess. (1825). Local name: Lichu.

Evergreen medium-sized tree, leaves 2-4 jugate, leaflets elliptic or obovate, flowers greenish or yellowish, fragrant, fruit globose or ovoid, juicy, bright red or purplish when ripe, variably warty or nearly smooth, 1-seeded. *Flowering and fruiting*: April-June. Representative specimen: Tahmina Haque, 81 (DUSH)

Family name: Burseraceae

Bursera serrata Wall. ex Colobr. (1827). Synonym: *Protium serratum* (Wall. ex Coelbr.) Engl. in DC., Monogr. Phan. 4: 88 (1883). Local name- Majufol

Medium-sized tree, leaves imparipinnate, leaflets ovate-lanceolate, flowers on axillary lax panicles, yellowish, drupes irregularly globose. *Flowering and fruiting*: March-September. *Ecology*: high land. Representative specimen: Simrail, 10.10.17, Tahmina Haque, 242 (DUSH).

Family name: Anacardiaceae

Anacardium occidentale L., Sp. Pl. 1: 383 (1753).

Small to medium- sized evergreen tree, leaves ovate, inflorescence terminal or axillary panicles, flowers polygamous, fruit a nut, kidney-shaped. *Flowering and fruiting*: February-June. *Ecology*: cultivated in home garden. Representative specimen: Sarail, 04.02.2016, Tahmina Haque, 73 (DUSH)

Lannea coromandelica (Houtt.) Merr., Journ. Arn. Arb. 19: 353 (1938). Synonym: *Dialium coromandelicum* Houtt. (1774). Local name: Zigar gach.

A small to medium-sized deciduous tree with thick branchelets, leaves imparipinnate, infloresence long panicles, flowers unisexual, yellowish-green, fruit drupe. *Flowering and fruiting*: February-June. *Ecology*: hillside, roadside, water edge. Status: wild. Representative specimen: B.bariasadar, 28.02.2016, Tahmina Haque, 132 (DUSH)

Mangifera indica L., Sp. Pl.: 200 (1753). Local name: Aam.

A medium to large-sized tree, crown dark green, bark grey brown, leaves green, narrowly elliptic to lanceolate, infloresence a pyramidal panicle, flowers bisexual, petals 5, stemens 1, ovary sessile, fruit a drupe. *Flowering and fruiting*: January-June. *Ecology*: Homesteads, roadsides, plain lands. Status: Cultivated. Representative specimen: B. bariasadar, 28.02.2016, Tahmina Haque, 133 (DUSH)

Spondias pinnata(L. f.) Kurz, Pegu Rep. A.: 44 (1875). Synonym: *Mangifera pinnata* L. f. (1781). Local name: Amra.

Medium-sized to large tree, leaves imparipinnate, infloresence long panicles, flowers bisexuals, polygamous, yellowish-green, scented, fruit a drupe. *Ecology*: homesteads, roadsides, plain lands. *Flowering and fruiting*: January-June. *Representative specimens*: Akhaura, 27.06.2015, Tahmina Haque, 07 (DUSH)

Family name: Meliaceae

Azadirachta indica A. Juss., Mem. Mus. Hist. Nat. Paris 19: 221, t. 13 (1832). Synonyms:

Melia azadirachta L. (1753), *Melia indica* (A. Juss) Brandis (1874). Local name: Neem.

Medium-sized to large evergreen tree, leaves imparipinnate, alternate, leaflets subglabrous, margin serrate, inflorescence many-flowered panicles, fruit capsule. *Flowering and fruiting*: March-July. *Ecology*: open places, savanna, thickets. *Representative specimens*: B.baria, 05-09-16, Tahmina Haque, 04 (DUSH).

Swietenia mahagoni Jacq., Enum. Pl. Carib. 4: 20 (1760). Local name: Mehegani.

Small to medium-sized evergreen tree with umbrella shaped crown, leaves alternate, leaflets opposite-sub opposite, inflorescence a supra-axillary panicle, flowers small, fruit capsule, brown, woody. *Flowering and fruiting*: April-November. *Ecology*: planted, also in forests. *Representative specimens*: Tahmina Haque, 42(DUSH)

Family name: Rutaceae

Aegle marmelos (L.) Corr., Trans. Linn. Soc. Lond. 5: 223 (1800). Synonym: *Cratavea marmelos* L. (1753). Local name: Bel.

Medium-sized deciduous tree, leaves alternate, 3-foliate, inflorescence axillary racemes, flowers honey-scented, fruit subglobose berry. *Flowering and fruiting*: April-December. *Ecology*: swampy lands, dry soils. *Representative specimens*: Chompoknagar 17-07-16, Tahmina Haque, 25 (DUSH).

Citrus aurantifolia (Cristm. & Panzer) Swingle. J. Wash. Acad. Sci. 3: 465 (1913). Synonyms: *Limonia aurantifolia* Christm. & Panz. (1777), *Citrus javanica* Blume (1825).

Avergreen, densely branched, small spiny tree, leaves alternate, scented, inflorescence short axillary racemes, flowers white, bisexual, fruit globose berry. *Flowering and fruiting*: March-September. *Ecology*: gardens. *Representative specimens*: Nabinagar, 18-07-17; Tahmina Haque, 11 (DUSH)

Citrus aurantium L., Sp. Pl: 782 (1753). Synonym: *Citrus bigaradia* Risso & Poiteau (1818). Local name: Tok komola

Small tree, leaves simple, alternate, flowers axillary, usually bisexual but male flowers occur (5-12%) pure white petals, fruit depressed globose hesperidium, peel yellow-orange. *Flowering and fruiting*: September-January. *Ecology*: gardens in hilly areas. Representative specimen: Tahmina Haque, 180 (DUSH)

Citrus limon (L.) Burm. f., Fl. Ind.: 173 (1768). Synonyms: *Citrus medica* L. var. limon L. (1753), *Citrus limonum* Risso (1813).

Tree with stout stiff spines, leaves petiolate, petioles marginate, lamina oblong to elliptic-ovate, flowers staminate or bisexual, purplish in bud, fruit ovoid-oblong, 8-12 locular, rind thick, yellowish when ripe, sour. *Flowering and fruiting*: March-November. *Ecology*:

gardens. *Representative specimens*: Akhaura, 08-09-16; Tahmina Haque, (DUSH).

Citrus maxima (Burm.) Merr. Interp. Rumph. Herb. Amb.: 296 (1918). Synonym: *Citrus grandis* (L.) Osbeck (1757). Local name: Jambura.

Small evergreen tree, spine blunt when present, leaves petiolate, flowers bisexual, petals oblong, glabrous, stamens 16-24, anthers apiculate, styles cylindric, fruit spherical ovoid, rind thick, pulp yellow or pink, acidic or slightly bitter. *Flowering and fruiting*: February-November. *Ecology*: roadsides, homestead gardens. *Representative specimens*: Kosba,18-11-17; Tahmina Haque, 57 (DUSH)

Glycosmis pentaphylla (Retz.) A. DC., Prodr. 1: 538 (1824). Synonym: *Limonia pentaphylla* Retz. (1788). Local name: Bonjami/FotiKgilla/Gomraila.

An evergreen small tree or shrub, leaves petiolate, leaflet opposite and rarely linear-elliptic, inflorescence axillary and terminal, flowers 5-merous, petals and sepals 5, stamens 10, fruit subglobose berry. *Flowering and fruiting*: throughout the year. *Ecology*: roadsides, village thickets. *Representative specimens*: Tahmina Haque, 68 (DUSH)

Murraya paniculata (L.) Jack, Malay. Misc. 1: 31 (1820). Synonym: *Chalcas paniculata* L. (1767). Local name: Kaminiful.

A shrub or small tree, leaves 7-foliate, leaflets alternate, ovate, variable in size, flowers medium to large, 5-merous, calyx 5-lobed, petals 5, stamens 10, anthers yellowish, styles cylindric, stigmas capitate, broader than style, fruit ovoid or ellipsoid berry, reddish when ripe. *Flowering and fruiting*: March-January. *Ecology*: gardens, evergreen, lowland and hill rain forests. *Representative specimens*: Tahmina Haque, 22 (DUSH)

Zanthoxylum rhetsa (Roxb.) DC., Prodr. 1: 728 (1825). Synonym: *Zanthoxylum budrunga* (Roxb.) DC. (1824). Local name: Bajna.

Medium-sized, deciduous, aromatic tree with pale corky bark, covered with conical prickles on trunk and branches, leaves pari- or imparipinate, flowers small, greenish-yellow, fruit small, globose, orange when ripe. *Representative specimens*: Tahmina Haque, 210 (DUSH)

Family name: Oxalidaceae

Averrhoa bilimbi L., Sp. Pl. 1: 428 (1753). Local name: Bilimbi.

Small tree, leaves imparipinnate, oblong or linear lanceolate, inflorescence a panicled cymes, springing from the trunk and branches, flowers purplish to red, fruits oblong, light yellow. *Flowering and fruiting*: October-February. Representative specimen: Tahmina Haque, 54 (DUSH)

Averrhoa carambola L., Sp. Pl.: 1: 428 (1753).

Medium-sized tree with drooping branches, leaves alternate, pinnately compound, leaflets ovate-lanceolate, flowers in axillary panicle, bisexual, fruits sharply 5-angled, ovoid to ellipsoid, grooved at both ends. *Flowering and fruiting*: September-March. *Ecology*: well-drained soil and plainland. *Representative specimens*: Nobinagar, 07-09-16, Tahmina Haque, 34 (DUSH).

Oxalis corniculata L., Sp. Pl.: 435 (1753). Synonym: *Oxalis repens* Thunb. (1781). Local name: Amrul.

A delicate-appearing, low-growing, herbaceous plant, trifoliate leaves subdivided into three rounded leaflets and resemble a clover in shape, some varieties have green leaves, while others, like Oxalis corniculata var. atropurpurea, have purple, fruit narrow, cylindrical capsule. *Flowering and fruiting*: April-September. *Ecology*: Arable land and waste places. Representative specimen: Tahmina Haque, 189 (DUSH)

Family name: Apiaceae

Centella asiatica (L.) Urban in Mart., Fl. Braz. 11 (1): 187 (1879). Synonym: *Hydrocotyle asiatica* L. (1753). Local name: Tunimankoni.

Perennial herb, leaves simple in clusters, lamina reniform, inflorescence umbel on long peduncles, flowers 3, fruit schizocarp. *Flowering and fruiting*: March-December. *Ecology*: wet moist lands and damp places on plain and foot hills. *Representative specimens*: Bijoynagar, 04-09-16, Tahmina Haque, 02 (DUSH).

Coriandrum sativum L., Sp. Pl.: 1: 256 (1753). Synonyms: *Coriandrum majus* Gouan (1762), *Selinum coriandrum* E. H. Krause (1904).

Erect, glabrous annual herb, stem solid, subterete, finely striate, leaves alternate,often in rosette, inflorescence compound umbel, bisexual flowers, fruit ovoid, yellow-brown, crowned by dry persistant calyx. *Flowering and fruiting*: December-February. *Ecology*: cultivated. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 51 (DUSH).

Cuminum cyminumL., Sp. Pl.: 254 (1753). Synonym: *Cuminia cyminum* J.F. Gmel. (1791). Local name: Zira.

A slender annual, leaves twice or thrice 3-partite, ultimate segments filiform, flowers small, white, in compound umbels, fruit cylindric, ridged, tip narrowed, aromatic. *Flowering and fruiting*: December-February. *Ecology*: river bank, canal banks and low-laying areas. *Representative specimens*: Akhaura, 10-4-17; Tahmina Haque, 302 (DUSH).

Daucus carrota L., Sp. Pl.: 242 (1753). Synonym: *Daucus gingidium* L. (1753). Local name: Gajor.

An annual or biennial erect herb, taproot thickened, elongate, reddish or yellow-orange, leaves in a rosette, flowers white, epigynous, pentamerous, fruit oblong- ovoid schizocarp. *Flowering and fruiting*: May-August. *Ecology*: cultivated. Representative specimen: Tahmina Haque, 83 (DUSH)

Eryngium foetidum L., Sp. Pl. 1: 232 (1753). Local name: Rashnapata/Boro Dhania.

A tropical perennial herb, leaves simple, subsessile to petiolate, inflorescence a terminal, spike-like head (reduced umbel), finally combined into a widely branched corymb, calyx tubular with 5 small triangular teeth, flowers greenish-white, fruit an ovoid-obovoid schizocarp. *Flowering and fruiting*: *Ecology*: in meadows, plantations, waste places, along roadsides and forest edges, *Representative specimens*: Sorail, 16-04-17; Tahmina Haque, 63 (DUSH).

Oenanthae javanica (Blume) DC., Prodr. 4: 138 (1830), Synonym: *Sium javanica* Blume (1836). Local name: Panidhainna.

Perennial, often aquatic herb, basal leaves petiolate, blade oblong-ovate, 1-2 pinnate, ultimate segments ovate or rhombic-ovate, cauline leaves gradually reduced upwards, smaller, inflorescence a compound, many-flowered umbel, flowers small, white, fruit subglobose schizocarp. *Flowering and fruiting*: June-September. Representative specimen: Tahmina Haque, 239 (DUSH)

Family name: Apocynaceae

Alstonia scholaris (L.) R. Br., Mem. Wern. Nat. Hist. Soc. 1: 76 (1811). Synonym: *Echites scholaris* L. (1767). Local name: Chatim.

Tall tree, leaves in whorl, lamina oblong-lanceolate, inflorescence umbellate cymes, many- flowered, flowers greenish-white, follicles pendulous, *Flowering and fruiting*: November-May. *Ecology*: roadsides, homestead gardens, often occurs in deciduous, evergreen or mixed forests. *Representative specimens*: Bijoynagar, 24-04-17, Tahmina Haque, 234 (DUSH)

Carissa carandas L., Mant. 1: 52 (1767). Synonym: *Carissa congesta* Wight (1848). Local name: Koromcha.

Sarmentose shrub or small evergreen tree with irritating milky sap, leaves simple, opposite, oblong-ovate, inflorescences terminal cymes bearing bisexual fragrant white or white-pink flowers, fruits globose to ellipsoid berries. *Flowering and fruiting*: throughout the year. *Ecology*: dry, sunny places. Representative specimen: Tahmina Haque, 235 (DUSH).

Catharanthus roseus L., G. Don, Gen. Hist. 4: 95 (1837). Synonyms: *Vinca rosea* L. (1759), *Lochnera rosea* (L.) Reichb. (1828). Local name: Noyontara.

Perennial herb or sub shrub, leaves glabrous, obovate, oblanceolate or elliptic-lanceolate, cymes axillary, flowers white or pink, follicles 2, cylindrical. *Flowering and fruiting*: almost all the year round. *Ecology*: cultivated in the gardens. *Representative specimens*: B.baria, 18-07-17, Tahmina Haque, 12 (DUSH).

Holarrhena antidysenterica (L.) Wall. ex Decne., Prodr. 8: 413 (1844). Synonym: *Nerium antidysentericum* L. (1753), *Holarrhena pubescens* Wall. ex G. Don (1837). Local name: Kuruz.

A small deciduous tree, leaves elliptic, oblong, ovate or ovate-oblong, white, fragrant flowers borne in corymbose cymes, fruits follicles, usually with long white spots. Flowers from April-July and fruits from August-October. *Ecology*: Tropical parts. Also cultivated on road-sides. Representative specimen: Tahmina Haque, 148 (DUSH)

Ichnocarpus frutescens (L.) R. Br., Mem. Wern. Soc. 1: 62 (1811). Synonym: *Apocynum frutescens* L. (1753). Local name: Dudhilat.

Climbing shrub, leaves ovate-elliptic, greenish-white flowers on paniculate cymes, follicle cylindrical. *Flowering and fruiting*: October-January. *Ecology*: on the forest edge. Representative specimen: Tahmina Haque, 241 (DUSH)

Rauvolfia serpentina (L.) Benth. ex Kurz, Forest Fl. Brit. Burm. 2: 171 (1877). Synonym: *Ophioxylon serpentinum* L. (1753). Local name: Sorpogandha.

Woody herb. leaves elliptic-lanceolate, flowers in terminal corymbose cymes, pinkish-white, drupe blackish-purple when ripe. *Flowering and fruiting*: April-October. *Ecology*: shaded area.*Representative specimens*: Tahmina Haque, 103 (DUSH)

Thevetia peruviana (Pers.) K. Schum., Pflanz. 4(2): 159 (1895). Synonym: *Thevetia nerifolia* Juss. ex Steud. (1841). Local name: Kobri ful.

Large evergreen shrub or small tree, leaves linear, narrowed at both ends, spirally arranged, flowers yellow or orange, fruits broadly obovate in longitudinal section. *Flowering and fruiting*: throughout the year. *Representative specimens*: Tahmina Haque,115 (DUSH).

Family name: Asclepiadaceae

Asclepias curassavica L., Sp. Pl.: 215 (1753). Local name: Bankapas.

Erect perennial herb or undershrub, leaves opposite, lanceolate or oblong-lanceolate, narrowed into a short petiole, glabrous. umbels axillary many-flowered, shortly peduncled, flowers orange-red, fruits a pair of follicles, tapering at both ends. *Flowering and fruiting*: February-May. *Ecology*: common on the hill slope. *Representative specimens*: Bijoynagar, 10-06-16, Tahmina Haque, 250 (DUSH)

Calotropis procera (Ait.) R. Br. in Ait. f., Hort. Kew. ed. 2, 2: 78 (1811). Synonyms: *Asclepias procera* Ait. (1789), Calotropis heterophylla Wall. ex Wight (1834). Local name: Akon

Large shrub, stem slightly woody and branched at base, leaves sessile, ovate-oblong, fleshy, flowers pink above and white in base, follicles not seen. *Flowering and fruiting*: in summer. *Ecology*: dry moist areas. *Representative specimens*: Kosba, 24-11-16, Tahmina Haque, 41 (DUSH).

Family name: Solanaceae

Cestrum nocturnum L., Sp. Pl.: 191 (1753). Local name: Hasnahena.

Evergreen woody shrub, leaves simple, narrow lanceolate, flowers greenish-white, inflorescences racemose or panicles, fruit a berry. *Flowering and fruiting*: throughout the year. *Representative specimens*: Bijoynagar, 04-09-16; Tahmina Haque, 155 (DUSH).

Datura metel L., Sp. Pl.: 179 (1753). Synonyms: Datura fastusa L. (1759). Local name: Dutra.

A robust herb or undershrub, minutely pubescent, leaves broad-ovate, entire, flowers solitary, calyx minutely hairy, corolla funnel shaped, white or purplish, 5 or 6- lobed, stigmas swollen, 2-lobed, fruit a globuler capsule. *Flowering and fruiting*: January-December. *Ecology*: roadsides, fallow lands, sand dumes, waste places. *Representative specimens*: Tahmina Haque, 20 (DUSH)

Lycopersicon esculentum Mill., Gard. Dict. ed. 8: no. 2 (1768). Synonym: *Lycopersicum lycopersicon* (L.) Britton & Brown (1898) Local name: Tometo.

Viscidly pubescent branched annual herb, leaves arranged spirally, imparipinnate, lyrate or sometimes only slightly lobed, ovate, pinane unequal, flowers bisexual, yellow, fruit berry, depressed-globose, smooth or furrwed, juicy, brick-red to deep red or yellowish in colour. *Flowering and fruiting*: during winter season. Representative specimen: Tahmina Haque, 128 (DUSH)

Physalis minima L., Sp. Pl.: 183 (1753). Synonym: *Physalis pubescens* Dunal (1852). Local name: Photka.

An annual herb, glabrous to glandular hairy or patent villous, stem and branches angular, leaves elliptic or ovate or toothed, flowers solitary, axillary, yellow, usually with purple spots on the inner corolla base, fruit a berry, with 5 distinct angles. *Flowering and fruiting*: January-December. Representative specimen: Tahmina Haque, 287 (DUSH)

Solanum americanum Mill., Gard. Dict. ed. 8: Solanum No. 5 (1768). Synonym: *Solanum nodiflorum* Jacq. (1789). Local name: Titbegun

Annual herb, leaves ovate-lanceolate, flowers in simple umbel, white with green base, fruit globose to ellipsoid berry, bluish-black or purplish-black when ripe. *Flowering and fruiting*: February-August. *Representative specimens*: Tahmina Haque, 169 (DUSH)

Solanum nigrum L., Sp. Pl.: 186 (1753).

Annual herb, leaves ovate or elliptic, flowers campanulate, white or rarely purple, fruit globose to ellipsoid berry. *Flowering and fruiting*: January-December. *Ecology*: moist shady places or open places. *Representative specimens*: Tahmina Haque, (DUSH)

Solanum sisymbrifolium Lamk. , Illust. 2: 25 (1797). Synonym: *Solanum balbisii* Dunal (1825). Local name: Kata huduira.

Viscoid and very prickly erect herb or undershrub, leaves sinuately lobed, flowers white to bluish-white, fruit berry. *Flowering and fruiting*: January-June. Representative specimen: Akhaura, 27.06.2015. Tahmina Haque, 111 (DUSH)

Family name: Convolvulaceae

Ipomoea aquatica Forssk., Fl. Aeg-Arab.: 44 (1755). Synonym: *Ipomoea reptans* Poir. (1814).

A glabrous trailer on mud or floating water, branchlets succulent, stems hollow, rooting at the nodes, leaves ovate, deltoid, flowers in axillary cymes, corolla funnel shaped, pink or pale lilac , filaments hairy at the base, carpels 2, syncarpous, fruit capsule, glabrous, persistant. *Flowering and fruiting*: January-December. *Ecology*: wet lowlands, tanks or ditches. *Representative specimens*: Tahmina Haque, 107 (DUSH)

Ipomoea fistulosa Mart. ex Choisy in DC., Prodr. 9: 349 (1845). Synonym: *Ipomoea crassicaulis* (Benth.) B.L. Robinson (1916). Local name: Militiry gach.

A fistular shrub, leaves ovate, orbicular, pink flowers on axillary and terminal cymes. *Flowering and fruiting*: March-August. *Ecology*: on the bank of chara (channel). Representative specimen: Tahmina Haque, 297 (DUSH)

Family name: Cuscutaceae

Cuscuta reflexa Roxb., Pl. Corom. 2: 3, t. 104 (1798). Local name: Akashlat.

A parasite, branches stout, fleshy, forming dense yellow masses on low trees and shrubs, flowers pentamerous, in lax racemes, sepals nearly distinct, ovate, corolla ampanulate, deciduous, stamens 5, corolla emarginate, fimbricate, style single, very short, stigmas wide, fruit a capsule. *Flowering and fruiting*: August-March. *Ecology*: grows on trees and shrubs. *Representative specimens*: Kosba, 25-04-19; Tahmina Haque, 48 (DUSH).

Family name: Boraginaceae

Heliotropium indicum L., Sp. Pl. 1: 130 (1753). Synonym: *Heliotropium velutinum* DC. (1845). Local name: Ayatunda.

An annual, erect, branched herb, bearing alternating ovate to oblong-ovate leaves, small white or purple flowers with a green calyx, fruits deeply lobed and beaked nutlets. *Flowering and fruiting*: throughout the year. *Ecology*: in waste places and settled areas. Representative specimen: Tahmina Haque, 113 (DUSH)

Family name: Verbenaceae

Clerodendrum viscosum Vent., Jard. Malm. 1: 25, Pl. 25 (1803). Synonyms: *Clerodendrum infortunamtum* Lour. (1790), *Clerodendrum pubescens* Wall. ex Walp. (1843). Local name: Vat.

Undershrub or shrub, leaves decussate, opposite, simple, covered with rough hairs, inflorescence terminal, flowers white, tinted with purplish-red or red, corolla white, fruit bluish- black when mature, globular. *Flowering and fruiting*: January-July. *Ecology*: roadsides, fallow lands, village thickets, railway tracts. *Representative specimens*: Champoknagar, 18-07-18; Tahmina Hauqe, 153 (DUSH).

Lantana camara L. var. **aculeata** (L.) Moldenke & Moldenke in Dassanayake & Fosberg., Rev. Handb. Fl. Ceylon 4: 225 (1985). Synonyms: *Lantana camara* L. (1753), *Lantana aculeata* L. (1753). Local name: Chutra pata.

A low shrub, leaves ovate-oblong, yellow flowers on axillary spike, fruit globose. *Flowering and fruiting*: April-September. Representative specimen: Tahmina Haque, 168 (DUSH)

Lippia alba (Mill.) Briton et Wilson, Sci. Surv. Puerto. Vergin 6: 141 (1925). Synonyms: *Lantana alba* Mill. (1768), *Lippia geminata* H.B. & K. (1818). Local name: Motka.

Gregarious strongly aromatic shrub or undershrub, leaves simple, opposite, lamina ovate-lanceolate or lanceolate, margin finely crenulate or serrate, inflorescence axillary, flowers light to rosy-pink, scented, bracts white, fruit globose. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 138 (DUSH)

Nyctanthes arbor-tristis L., Sp. Pl.: 6 (1753). Local name: Shefaliful.

A large shrub, often growing out into a small tree, hairy, bark rough, brown, greyish or greenish, leaves opposite, ovate to ovate-oblong, flowers very fragrant, sessile, opening during night, bracts broadly ovate or suborbicular, orange red in color, fruits a capsule, obovate, compressed, pericarp reticulate, leathery, seeds compressed, exalbuminous. *Flowering and fruiting*: September-January. *Ecology*: cultivated in gardens. Representative specimen: Tahmina Haque, 142 (DUSH)

Phylla nodiflora (L.) Greene, Pittonia 4: 46 (1899). Synonyms: *Verbena nodiflora* L. (1753), *Lippia nodiflora* (L.) Rich. (1803). Local name: Unknown.

A prostrate, much-branched annual herb, often rooting at the nodes, leaves cuneate-spathulate, flowers small, pinkish-purple to white, fruits ovate, enclosed by the persistent calyx. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 254 (DUSH)

Tectona grandis L. f. Suppl.:151 (1781). Synonym: *Tectona theka* Lour. (1790). Local name: Kathgach.

Large deciduous tree, leaves opposite, broadly elliptic, inflorescence large terminal panicles, flowers small, white, fruit subglobose to tetrangularly flattened drupe. *Flowering and fruiting*: July-November. *Ecology*: hilly forest areas, roadsides, gardens, parks. *Representative specimens*: Tahmina Haque, 277 (DUSH)

Vitex negundo L., Sp. Pl.: 638 (1753). Synonym: *Vitex paniculata* Lamk. (1788). Local name: Nisinda.

Large shrub to small tree, leaves aromatic, digitately 3-5 foliate, infloresence elongated terminal panicles, fruit drupe, purple black when ripe. *Flowering and fruiting*: April-February. *Ecology*: waste places, boundary margin of the houses. *Representative specimens*: Kasba- 11.03.16. Tahmina Haque,29 (DUSH).

Family name: Lamiaceae

Hyptis suaveolens (L.) Poit., Ann. Mus. Par. 7: 472, t. 29 (18096). Synonym: *Ballota suavelens* L. (1759). Local name: Tokmai.

Aromatic annual herb, leaves simple, opposite, oval, and with axillary inflorescence loose group of small blue flowers, fruit a nutlet, black. *Flowering and fruiting*: September-April. *Ecology*: Widely spread at low altitudes. Representative specimen: Tahmina Haque, 38 (DUSH)

Leonurus sibiricus L., Sp. Pl.: 584 (1753). Local name: Roktodron

Erect stout herb, leaves petiolate, lower lamina broadly ovate, truncate, palmatisect, segments linear, upper lamina narrower, lobes less divided, inflorescence of axillary whorls, dense-flowered, flowers dull red, fruit nutlet. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 132 (DUSH)

Leucas lavandulaefolia Smith (1819). Synonym: *Leucas indica* (L.) R. Br. ex Vatke in Oesterr., B. Zeits. 25: 95 (1875).

A stout, erect or diffuse annual herb, stem grooved, much-branched, leaves petiolate, lamina entire, lanceolate, inflorescence with terminal and axillary whorls, very dense

and many-flowered, corolla white, 5-lobed, nutlets obovoid, smooth, brownish-black. *Flowering and fruiting*: abundantly during winter, almost throughout the year. *Ecology*: dry sandy soil. *Representative specimens*: Tahmina Haque, 37 (DUSH)

Mentha arvensis L., Sp. Pl.: 577 (1753). Local name: Pudina pata.

A strongly scented perennial herb, stem quadrangular, grooved, leaves petiolate, lamina elliptic-lanceolate, serrate, acute, inflorescence axillary capitate, whorls, bracts entire, calyx enlarged in fruits, corolla puberulous on both surfaces, stamens 4, nutlets ovoid, brown. *Ecology*: moist soil. *Representative specimens*: Tahmina Haque, 37 (DUSH)

Ocimum tenuiflorum L., Sp. Pl.: 597 (1753). Synonym: *Ocimum sanctum* L. (1757). Local name: Tulsi

An aromatic perennial herb, stem quadrangular, patently hairy, leaves with long petiole, inflorescence whorls with 6-8 flowers, calyx 5, teeth broadly ovate, apiculate, corolla of 5 petals, purplish, filament and style slender, nutlets pale brown. *Flowering and fruiting*: throughout the year. *Ecology*: near temples, dwellings, gardens. *Representative specimens*: Tahmina Haque, 10 (DUSH)

Family name: Scrophulariaceae

Bacopa monnieri (L.) Pennel, Proc. Acad. Nat. Sci. Philadelphia 98: 94 (1946). Synonyms: *Lysimachia monnieri* L. (1753), *Herpestis monniera* Benth. (1835). Local name: Brammi.

Small, much-branched, creeping herb, rooting at the nodes, leaves, sessile, decussate, obovate-oblong or spathulate, rather fleshy, flowers axilary, solitary, pale blue, capsules narrowly ovoid. *Flowering and fruiting*: May-December. *Ecology*: fallow lands and paddy fields. *Representative specimens*: B.baria, 05-09-16, Tahmina Haque, 261 (DUSH).

Scoparia dulcis L., Sp. Pl.: 116 (1753). Synonym: *Scoparia grandiflora* Nash (1896). Local name: Chinigura gach.

Erect much-branched herb, leaves 3-nately whorled, obovate-oblong to oblanceolate, serrate, flowers white, capsule very small, subglobose. *Flowering and fruiting*: throughout the year. *Representative specimens*: Tahmina Haque, 172 (DUSH)

Family name: Acanthaceae

Andrographis paniculata (Burm. f.) Wall. ex Nees in Wall., Pl. As. Rar. 3: 116 (1832). Synonym: Justicia paniculata Burm. f. (1768). Local name: Chirota.

Annual herb, leaves lanceolate, flowers white in lax panicles, capsule linear-oblong.

Flowering and fruiting: November-February. *Ecology*: sunny hillsides, wastelands, Representative specimen: Akhaura, 28.02.2016, Tahmina Haque, 45 (DUSH).

Justicia adhatoda L., Sp. Pl.: 15 (1753). Synonym: *Adhatoda vasica* Nees in Wall., Pl. As. Rar. 3:103 (1832). Local name: Bashok

Evergreen shrub, leaves elliptic or oblanceolate, flowers white in axillary leafy bracts, capsule clavate. *Flowering and fruiting*: January-April. *Ecology*: beside home street. Representative specimen: Akhaura, 27.06.2015, Tahmina Haque, 27 (DUSH)

Justicia gendarussa Burm. f., Fl. Ind.: 10 (1768). Synonym: Gendarussa vulgaris Nees (1832). Local name: Jogmardon.

An undershrub, leaves short petioled, lanceolate, glabrous, flowers white, capsule clavate. *Flowering and fruiting*: April-August. *Ecology*: on the forest edge. Representative specimen: Tahmina Haque, 176 (DUSH)

Family name: Pedaliaceae

Sesamum indicum L., Sp. Pl.: 634 (1753). Synonym: Sesamum orientale L. (1753). Local name: Goyal.

Eerect herb, stem with branches sulcate, leaves exstipulate, lower opposite, upper alternate, lamina subentire, flowers solitary, axillary, cream-coloured, fruits capsular, scabrous, brown or purple, seeds small, many, black or brown. *Flowering and fruiting*: February-October. *Ecology*: dry soil. *Representative specimens*: Tahmina Haque, 207 (DUSH)

Family name: Bignoniaceae

Oroxylum indicum (L.) Kurz, Fl. Bri. Burm. 2: 237 (1877). Synonym: *Bignonia indica* L. (1753). Local name: Kanaidingi.

Small to medium-sized deciduous tree, stem sparingly branched, leaves opposite, bi- or tripinnately compound, leaflets broadly ovate, inflorescence long terminal raceme, flowers bisexual, complete, fruit capsule, flat, boat-shaped, sword-like. *Flowering and fruiting*: June-March. Representative specimen: Tahmina Haque, 190 (DUSH)

Family name: Rubiaceae

Gardenia augusta (L.) Merr., Interpr. Rumph. Herb. Amboin. 50: 485 (1917). Synonyms: *Gardenia augusta* L. (1759), *Gardenia jasminoides* Ellis (1761). Local name: Gandharaj.

A shrub with greyish bark and dark green, shiny, evergreen leaves, the white flowers have a matte texture, loosely funnel-shaped, the most strongly fragrant of all flowers, small, oval fruit. *Flowering and fruiting*: summer and autumn. *Ecology*: a sunny location, and

prefers an acidic soil with a pH between 5.0 and 6.5. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 178 (DUSH)

Hedyotis corymbosa (L.) Lamk., Tab. Encycl. 1: 272 (1791). Synonym: *Oldenlandia corymbosa* L. (1753). Local name: Khet pakhra.

Diffuse or prostrate herb, leaves sessile, lamina linear or narrowly elliptic, cymes axillary, flowers minute, fruit globose to ovoid capsule. *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 89 (DUSH)

Ixora nigricans R. Br. ex Wight & Arn., Prodr. 1: 428 (1934). Synonym: *Pavetta nigricans* (R. Br. ex Wight & Arn.) Miq. (1857). Local name: Rangan.

An undershrub, leaves elliptic-lanceolate or oblanceolate, whitish flowers on short cymes, fruits pea shaped. *Flowering and fruiting*: April-August. *Ecology*: on the forest edge. Representative specimen: Tahmina Haque, 280 (DUSH)

Neolamarckia cadamba (Roxb.) Bosser, Bull. Mus. Hist. Nat. Paris, Ser. 6, Sec. B, Adans. 3: 247 (1984). Synonym: *Anthocephalus chinensis* (Lamk.) A. Rich. ex Walp. (1843). Local name: Kodom.

Medium or large-sized tree, leaves stipulate, lamina ovate to elliptic-oblong or obovate, inflorescence terminal, a solitary head, globose, flowers subsessile, fruiting heads globose, seeds very small. *Flowering and fruiting*: July-November. Representative specimen: Tahmina Haque, 293 (DUSH)

Paederia foetida L., Mant. 1: 52 (1767). Synonym: *Covolvulus fortidus* Rumph. (1750). Local name: Padrapata.

An extensive, foetid climber, leaves opposite, ovate or lanceolate, acute or cuspidate, flowers violet, shortly pedicelled, corolla funnel-shaped, fruit orbicular. *Flowering and fruiting*: flower July-October and fruit September-December. *Ecology*: plain lands. Representative specimen: Tahmina Haque, 30 (DUSH)

Family name: Asteraceae

Ageratum conyzoides L., Sp. Pl.: 839 (1753). Local name: Kurka.

Annual herb, leaves ovate, dentate, flowers white in capitulum, fruit cypsela, narrowly oblong. *Flowering and fruiting*: September-December. *Ecology*: Fallow land. *Representative specimens*: Kosba 10-12-16, Tahmina Haque, 154 (DUSA).

Blumea lacera(Burm. f.) DC. in Wight, Contr. Bot. Ind.: 14 (1834). Synonym: Conyza lacera Burm. f. (1768). Local name: Shealmotra.

Annual herb, leaves oblong-ovate, flowers yellow in terminal capitula, cypsela linear to oblong. *Flowering and fruiting*: January-March. *Ecology*: on forest edge. Representative specimen: Simrail, 10.10.17, Tahmina Haque, 86 (DUSH).

Chromolaena odorata (L.) King & Robinson, Phytologia 20: 204 (1970). Synonym: *Eupatorium odoratum* L. (1759). Local name: Assamlata.

Perennial herb or undershrub, leaves opposite, triangular to elliptical with serrated edges, inflorescence capitulum, flowers bluish-white, fruit cypsela. *Flowering and fruiting* November-May. *Representative specimens*: Bijoynagar, 04-09-16; Tamina Haque, 276 (DUSH).

Eclipta alba (L.) Hassk, Pl. Jav. Rar.: 528 (1753). Synonyms: *Verbesina alba* L. (1753), Verbesina prostrata L. (1753), Cotula alba L. (1767). Local name: Kemotra.

A diffuse or erect, much branched or rarely unbranched annual herb, stem reddish or brick red, leaves elliptic-lanceolate, ovate or obovate, subsessile, inflorescence capitulum, bracts ovate, covered by hairs, ray and disc florets white, fruit cypsela. *Flowering and fruiting*: throughout the year. *Ecology*: damp waste lands, hill slopes, cultivated fields, roadsides and drains. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 92 (DUSH).

Enhydra fluctuans Lour., Fl. Cochinch.: 511 (1790). Local name: Titradangi.

A branched, repand, aquatic annual herb, leaves elliptic, margin distantly dentate, inflorescence capitulum, heterogamous, involucral bracts, corolla of ray florets, white lobes, glabrous, fruit a cypsela with ray florets, triangled with many hyaline ribs, with few hairs at the tip. Flowering andfruiting: January-April. *Ecology*: aquatic in ditches, ponds, beels. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 92 (DUSH).

Gynura nepalensis DC., Prodr. 6: 300 (1838). Local name: Diabetes pata

Perennial herb, leaves petiolate, lamina narrowly elliptic, ovate, or rhombic or oblong-lanceolate, capitula numerous, usually in terminal elongate lax corymbs, flowers yellow, achenes cylindric, 10-ribbed. *Flowering and fruiting*: May-August. *Ecology*: plain lands. *Representative specimens*: Nabinagar, 5-1-2-04-16; Tahmina Haque, 262 (DUSH)

Lactuca sativa L. (1753). Synonym: *Lactuca scariola* var. **sativa** Hook. f., Fl. Brit. Ind. 3: 404 (1881). Local name: Lettuce pata.

An annual plant, leaves colorful, mainly in the green and red color spectrums, inflorescences composed of multiple florets, each with a modified calyx called a pappus, fruits have 5-7 ribs on each side and tipped by two rows of small white hairs. *Flowering and fruiting*: flower from July to August, and the seeds ripen from August to September. *Ecology*: in semi-shade (light woodland) or no shade. It prefers moist soil. Representative specimen: Tahmina Haque, 56 (DUSH)

Mikania cordata (Burm. f.) Robinson, Contr. Gray Herb. 104: 65 (1934). Synonym: Eupatorium cordatum Burm. f. (1768). Local name: Refugelata.

Twining perennial herb, leaves petiolate, lamina usually cordate, sometimes deltoid-ovate, inflorescence a capitulum, cylindrical, numerous, flowers white, fruit a cypsela. *Flowering and fruiting*: October-February. Representative specimen: Tahmina Haque, 195 (DUSH)

Spilanthes calva DC. in Wight, Contrb.: 19 (1834). Local name: Sonamukhi.

Erect annual herb, stem and branches more or less hairy, leaves opposite, ovate, inflorescence a capitulum, flowres yellow, fruit a cypsela. *Flowering and fruiting*: throughout the year. *Representative specimens*: Tahmina Haque, 173 (DUSH)

Tagetes erecta L., Sp. Pl: 887 (1753). Local name: Ganda

Ribbed, hairy, annual herb, leaves pinnately divided, inflorescence capitulum, large, rayed, heterogamous, corolla of outer florets orange or canary yellow, that of disc florets yellow, fruit a cypsela. *Flowering and fruiting*: During winter season. *Ecology*: Gardens and nurseries. *Representative specimens*: Tahmina Haque, 116 (DUSH)

Vernonia cinerea(L.) Less., Linnaea 4(1): 291 (1829), Synonym: *Conyza cinerea* L. (1753). Local name: Kukshim.

Erect annual weed about a metre high, stem stiff, striate, slightly branched, leaves variable in shape, flowers pinkish-violet. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 206 (DUSH).

Wedelia chinensis (Osbeck) Merr., Philip. J. Sci. 12: 111 (1917). Synonym: *Wedelia calendulacea* (L.) Less. (1832). Local name: Keshoraj.

Perrenial herb, stem procumbent at the base and rooting at the lower nodes, terate, more or less appressed hairy, leaves opposite, subsessile, oblong, scabrous with short white hairs, flowers yellow. *Flowering and fruiting*: February-August. *Representative specimens*: Tahmina Haque, 279 (DUSA).

Xanthium indicum Koenig. ex Roxb., Fl. Ind. 3: 601 (1832). Synonym: *Xanthium strumarium* L. (1753). Local name: Ghagra.

Coarse annual herb c a metre or more high, leaves numerous, fruit ovoid, thickly clothed with usually hooked prickles. *Representative specimens*: Tahmina Haque, 55 (DUSH)

Family name: Arecaceae

Areca catechu L., Sp. Pl.: 1189 (1753). Local name: Supari.

Solitary, erect, tall palm, leaves pinnatisect, broad, leaflets soft, glabrous, inflorescence

below crownshaft, much-branched, green, branches with filiform tips, bearing male and female flowers at base and axils, male flowers fragrant, white, female flowers larger, broad, green, fruit olive-shaped berry. *Flowering and fruiting*: mainly in early summer. *Ecology*: saline soil of coastal zones, hilly areas, also found in a wide variety of soils. *Representative specimens*: Sorail, 05-09-16, Tahmina Haque, 15 (DUSH).

Borassus flabelliffer L., Sp. Pl.: 1187 (1753). Local name: Taal.

Solitary, erect, unbranched palm, leaves fan-shaped, blade rigid, flowers globose, green, few, fruit large, obovoid drupe, dark brown when ripe, very fibrous inside, glabrous outside. *Flowering and fruiting*: January-December. *Ecology*: highlands, floodplains. *Representative specimens*: Kosba, 17-07-17, Tahmina Haque, 119 (DUSH).

Cocos nucifera L., Sp. Pl.: 1189 (1753). Local name: Naroil.

Tall perennial palm, trunk single, leaves green on both sides, leaflets sword-shaped, leathery, inflorescence slender, male flowers asymmetric, perianth segments 2-seriate, outer series 3, valvate, small, female flowers larger than male ones, perianth greatly accrescent, style short, fruit obovoid. *Flowering and fruiting*: March-July. *Ecology*: sandy beaches, coastal zones, wide variety of soils including hill soils. *Representative specimens*: Sorail, 19-11-17; Tahmina Haque, 47 (DUSH).

Phoenix sylvestris Roxb., Fl. Ind. 3: 787 (1832). Local name: Khejur.

A tall graceful palm, trunk rough from the persistant base of the leafstalk, leaves pinnate, pinnules very numerous, densely fascicled, fruit orange, oblong-ellipsoid, scattered on long pendulous similarly colouered spikes. *Flowering and fruiting*: December-July. Representative specimen: Tahmina Haque, 281 (DUSH)

Family name: Pandanaceae

Pandanus foetidus Roxb., Fl. Ind. 3: 742 (1832).

Clump-forming bushy shrub, stem slender, leaves very compactly arranged, margin strongly spinous, male inflorescence in pale yellow spathe, flowers white, female inflorescence mostly solitary in long spathe, fruits syncarpous, compactly attached, globose to subglobose on distinct peduncle. *Flowering and fruiting*: June-December. Representative specimen: Tahmina Haque, 248 (DUSH)

Family name: Araceae

Alocasia cucullata (Lour.) G. Don in Sweet, Hort. Brit. ed. 3: 631 (1839). Synonym: Arum cucullatum Lour. (1790).

Perennial herb, leaves heart-shaped, the plant rarely flowers, the infloresence may be

solitary or paired. *Flowering and fruiting*: February-April. *Ecology*: moderately high land with light loamy soil for cultivation. *Representative specimens*: B.baria, 05-09-17, Tahmina Haque, 117 (DUSH).

Alocasia macrorrhizos (L.) G. Don in Sweet, Hort. Brit. Ed. 3: 631 (1839). Synonym: *Arum macrorrhizon* L. (1753). Local name: Mankochu/fenkochu

Evergreen herb, leaves petiolate, inflorescence 2 or more in each axil, spathe constricted, persistant, green, spadix sessile, pistillate flowers naked, fruits berry, orange, 1-few seeded. *Flowering and fruiting*: July-Ocober. *Ecology*: village shrubberies, banks of flowering streams, shades of tree plantations. *Representative specimens*: Birampur, 22-11-18, Tahmina Haque, 66 (DUSH).

Amorphophallus paeoniifolius (Dennst.) Nicolson var. **campanulatus** (Decne.) Sivadasan, Taxob 32: 130 (1983). Synonym: *Amorphophallus campanulatus* Decne. (1834). Local name: Ol kochu.

Annual erect herb, with large, depressed-globose corm, leaves solitary, 3-partite, segments pinnatisect, appearing long after the flowers, female inflorescence cylindric, male subturbinate, appendage dark-purple, berries ovoid. *Flowering and fruiting*: throughout the year. *Ecology*: cultivated in home garden. Representative specimen: Nobinagar 28.02.2016, Tahmina Haque, 275 (DUSH)

Colocasia esculenta (L.) Schott in Schott & Endl., Melet. Bot.: 18 (1832). Synonyms: *Arum esculanta* L. (1753), *Arum colocasia* L. (1763). Local name: Kochu.

Perennial herb, with underground tubers, leaves petiolate, inflorescence with axillary peduncle, male and female zones separated by a flat elongate neuter, female flowers naked, crowded at the base of spadix, stigma sessile, male flowers numerous, fruit a berry, seeds elongate. *Flowering and fruiting*: May-October. *Ecology*: side of ditches, streams, water logged low-lying areas, shady secondary forest and plantations, paddy fields. *Representative specimens*: Bancharampur, 10-09-16; Tahmina Haque, 65 (DUSH).

Pistia stratiotes L., Sp. Pl.: 963 (1753). Synonyms: *Zala asiatica* Lour. (1790), Pistia minor Blume (1836). Local name: Molahena.

A floating, stemless, stoloniferous herb, leaves variable in breadth, obovate-cuneate, rounded or retuse at the apex, densely pubescent on both surfaces, spathe light yellowish-green to white-tomentose, fruit a berry. Flowering fruiting: October-March. Representative specimen: Tahmina Haque, 291 (DUSH)

Pothos scandens L., Sp. Pl.: 968 (1753). Synonym: *Pothos angustifolius* Presl (1849). Local name: Por gach.

Extensive climber, clothing trees like ivy, stem leafy, leaves very variable, obovate, elliptic

or lanceolate, spadix yellow, as long as the spathe, stipitate, globose, ovoid or shortly oblong, berries oblong, scarlet on ripening. *Flowering and fruiting*: January-December. *Representative specimens*: Tahmina Haque, 171 (DUSH)

Family name: Commelinaceae

Commelina benghalensis L., Sp. Pl.: 41 (1753). Synonym: *Commelina pyrrhoblepharis* Hassk. (1867). Local name: Jhol kanda/ Dhol pata/ Kanchira/ Kando loar.

Spreading annual herb, leaves ovate, shiny, pale apple-green, very attractive small flowers with deep ink-blue petals, inflorescences subsessile spathes, capsules 5-seeded. *Flowering and fruiting*: August-June. *Ecology*: humid regions, but is typically found in forests and grasslands. *Representative specimens*: Bancharampur, 10-09-16; Tahmina Haque, 122 (DUSH).

Family name: Poaceae

Cynodon dactylon (L.) Pers., Syn. Pl: 1: 85 (1805). Synonyms: *Panicum dactylon* L. (1753), Cynodon occidentalis Willd. ex Steud. (1840). Local name: Dengi

A stoloniferous mat-forming perennial grass, leaves lanceolate, inflorescence flattened racemes, spikelets elliptic- lanceolate, overlapping, 1-flowered, purple or green. *Flowering and fruiting*: July-December. *Ecology*: open moist or dry waste places, roadsides, lawn, riversides, crop fields, light or sandy soils. *Representative specimens*: B.baria.18-11-16; Tahmina Haque, 06 (DUSH)

Eleusine indica (L.) Gaertn., Fruct. 1: 8 (1788). Synonym: *Cynodon indicus* L. (1753). Local name: Jolpai

A tufted annual grass with glabrous green leaves, inflorescence consists of 3-8 racemes, the narrow rachis, has two dense rows of almost glabrous spikelets. *Flowering and fruiting*: June-August. *Ecology*: in full sunlight and wet areas. *Representative specimens*: Sorail, 16-04-17; Tahmina Haque, 98 (DUSH)

Eriochloa procera (Retz.) C.E. Hubb., Kew Bull.: 256 (1930). Synonyms: *Agrostis procera* Retz. (1786), Eriochloa polystachya Duthie (1888). Local name: Aryle gash

Terrestrial, tufted, erect herb, roots fibrous, white or brown, stems rounded, hairy, leaves alternate, spiral, sessile, linear, flowers bisexual, grouped together in a terminal spike, sessile, green, petals not visible, fruit a nut. *Flowering and fruiting*: September-March. *Ecology*: in wetlands, roadsides, paddy fields, plains near damp areas. Representative specimen: Nabinagar, 5-1-2-04-16; Tahmina Haque, 92 (DUSH).

Imperata cylindrica (L.) P. Beauv., var. **latifolia** (Hook. f.) C.E. Hubb., Imp. Agri. Bur. Jt. Pub. no. 7: 14 (1944). Synonym: *Imperata arundinacea* var. latifolia Hook. f. (1896). Local name: Premkata.

Perennial rhizomatous herb, leaves lanceolate, ligule ciliate, spikelets lanceolate, grain linear to oblong. *Flowering and fruiting*: April-June. *Ecology*: common on open area of forest. Representative specimen: Tahmina Haque, 100 (DUSH)

Oryza sativa L., Sp. Pl. ed. 1, 1: 333 (1753). Synonym: *Oryza nivara* Shastry & Sharma (1965). Local name: Dhan.

An annual or perennial grass, leaf blades linear-lanceolate, flat, acuminate, ligules pointed, membranous, inflorescence a laxly panicle, upper leaf sheath erect in flowers, nodding in fruits, spikelets ovate, glumes reduced, petals oblong-lanceolate, caryopsis oblong, angular, enclosed by lemma and palea. *Flowering and fruiting*: September- June. *Ecology*: stagnant water, areas which are seasonally wet, at low elevations. *Representative specimens*: Tahmina Haque, 271 (DUSH)

Pasplum scrobiculatum L., Mant. Pl. 1: 29 (1767). Synonym: *Paspalum distachyon* Poit. ex Trin. (1834). Local name: Dhan durba.

Annual or perennial grass, culms tufted, leaf blades linear-lanceolate, lanceolate or linear, inflorescence composed of 2 (rarely 3 or 4) racemes, spikelets slightly overlapping, paleas ovate-orbicular. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 123 (DUSH)

Saccarum officinarum L., Sp. Pl.: 54 (1753). Synonym: Local name: Kushar.

Perennial grass, tufted, culms erect, leaf blades linear-lanceolate, inflorescence a large panicle, spikelets pale or brownish. *Flowering and fruiting*: August-October. *Ecology*: lowlands. *Representative specimens*: Tahmina Haque, 85 (DUSH)

Family name: Bromeliaceae

Ananas comosus (L.) Merr., Interpr. Herb. Amboin.: 133 (1917). Synonym: *Bromelia comosa* L. (1754), Ananas sativus (Lindil.) Schult. f. (1830). Local name: Anarosh.

Perennial herb, stem short, fleshy, thick, leaves narrow, long, spiny, parallel-veined, fibrous, closely spaced in a rosette near stem ,inflorescence a condensed spike, flowers cone-like, bluish, bisexual, forming a cone-like fleshy syncarp. *Flowering and fruiting*: February-July. *Ecology*: in dry climate in sheltered situation, also in moist hot areas with high rainfall, well-drained land. *Representative specimens*: Bijoynagar, 10-09-16, Tahmina Haque, 50 (DUSH).

Family name: Musaceae

Musa paradisiaca L., Sp. Pl.: 1043 (1753) Synonyms: *Musa sapientum* L. (1759), *Musa paradisiaca* L. subsp. sapientum (L.) K. Schum. (1900). Local name: Attya kola.

Tree-like herb, leaves petiolate, blade oblong, usually ragged in appearance, splitting between the transverse parallel veins, inflorescence a drooping spike, bracts opening in succession, dark red, fruit oblong, fleshy. *Flowering and fruiting*: throughout the year. Representative specimen: Tahmina Haque, 67 (DUSH)

Family name: Zingiberaceae

Alpinia conchigera Griff. in Notul, Pl. As. Rar. 3: 424, t. 354 (1851). Synonym: *Alpinia laosensis* Gagnep. (1906). Local name: Bonalach.

Rhizomatous herb with high slender leafy stem, leaves oblong-lanceolate, flowers small, fruit globose. *Flowering and fruiting*: September-December. Representative specimen: Bijoynagar, 08.05.2016, Tahmina Haque, 233 (DUSA).

Curcuma longa L., Sp. Pl. 1: 2 (1753). Synonyms: *Amomum curcuma* Jacq. (1776), *Curcuma domestica* Valet. (1918). Local name: Kacha holud.

Rhizomatous herb, leafy, strongly aromatic, rhizome orange-yellow, lamina glabrous, green, fertile bracts white to light green, apex hairy, calyx white with few hairs, corolla tube light yellow, petals 3, white, stigmas bilobed, anthers with recurved tip. Flowering: August-October. *Ecology*: highlands both in open sun and partial shade. *Representative specimens*: Ashuganj, 09-09-17; Tahmina Haque, 167 (DUSH).

Curcuma zedoaria (Christm.) Rosc., Trans. Linn. Soc. Lond. 8: 354 (1807). Synonym: *Amomum latifolia* Lamk. (1692), *Amomum zedoria* Christm. (1779).

A rhizomatous herb, leaves oblong-lanceolate, spikes appearing before leaves, coma bracts light pink, lowers exerted. *Flowering and fruiting*: April-May. *Ecology*: on the hill top. Representative specimen: Bijoynagar, 04-09-16; Tahmina Haque, 164 (DUSH).

Kaempferia galanga L., Sp. Pl. 1: 2 (1753). Synonym: *Kaempferia sessilis* Koen. (1783). Local name: Unknown.

A stemless rhizomatous herb, leaves sessile, flat on the ground, flowers many, white. Flowering: June-July. *Ecology*: forest floors in partial shade. Representative specimen: Tahmina Haque, 288 (DUSH)

Zingiber officinale Rosc., Trans. Linn. Soc. Lond. 8: 348 (1807). Synonym: *Amomum zingiber* L. (1753). Local name: Ada.

Small rhizomatous herb, aromatic, pale yellow, pungent taste, leaves sessile, spike radical, flowers creamy yellow. *Flowering and fruiting*: September-November. *Ecology*: high lands. *Representative specimens*: Tahmina Haque 105 (DUSH)

Family name: Cannaceae

Canna indica L., Sp. Pl.: 1 (1753). Synonym: *Canna orientalis* Rosc. (1824). Local name: Kolaboti.

Perennial rhizomatous herb, leaves simple, spirally arranged, blade very large, elongated or oval, red, yellow or occasionally red and yellow flowers borne in pairs (monochasial cymes), capsules oval to almost rounded. *Flowering and fruiting* flowering occurs during spring and summer and fruiting occurs during summer and early autumn. *Ecology*: swamp and wetland edges, stream banks and other moist areas. Representative specimen: Tahmina Haque, 282 (DUSH)

Family name: Marantaceae

Schumannianthus dichotomus (Roxb.) Gagnep., Bull. Soc. Bot. Fr. 51: 176 (1904). Synonyms: *Phrynium dichotomum* Roxb. (1810), *Clinogyne dichotoma* (Roxb.) Salisb. ex Benth. (1883). Local name: Patigach.

Arect shrub. leaves ovate-oblong, flowers white, fruit pear-like. *Flowering and fruiting*: December-March. *Ecology*: wet area of forests near ditches. Representative specimen: Tahmina Haque, 290 (DUSH)

Family name: Pontederiaceae

Echhornia crassipes (Mart) Solms in A. DC., Mon. Phan. 4: 527 (1883). Synonym: *Pontederia crassipes* Mart. (1843). Local name: Kochdi.

An aquatic free floating herb, leaves emerged,radical, with petioles short, very much swollen, leaf blades ovate or rhomboid, flowers very showy, perianth tube curved lobes ovate-oblong, lilac, posterior lobe yellow, blue bordered median notch, fruit capsule. *Flowering and fruiting*: all the year round. *Ecology*: stagnant or slow moving fresh water. Representative specimen: Tahmina Haque, 204 (DUSH)

Family name: Liliaceae

Allium cepa L., Sp. Pl. 1: 300 (1753). Local name: Peaz.

Annual herb, stem underground, modified into a small disc, called bulb, leaves radical, simple, long cylindrical, fistular, flowers in umbel inflorescence, bisexual, complete, fruit membranous capsule, seed compressed, black. *Flowering and fruiting*: February-June. *Ecology*: cultivated in fertile land. *Representative specimens*: Kosba, 22-11-17, Tahmina Haque, 202 (DUSH)

Allium sativum L., Sp. Pl. 1: 297 (1753). Local name: Rosun.

Erect herb, stem very small, disc-like known as bulb with many adventitious roots at base, leaves radical, simple, flowers in umbel inflorescence, fruit seedless. *Flowering and fruiting*: February-April. *Ecology*: moderately high land with light loamy soil for cultivation. *Representative specimens*: B.baria, 05-09-17, Tahmina Haque, 117 (DUSH).

Asparagus racemosus Willd., Sp. Pl. 2: 152 (1799). Local name: Chattayn bio

Perennial, slender shrub with reflexed spines, root tuberous, leaves minute, scale-like, inflorescence racemes, flowers bisexual, bracteate, pedicillate, white, sweet scented, fruit globose berry. *Flowering and fruiting*: November-March. *Ecology*: scrub jungles. *Representative specimens*: B. baria, 26-04-19, Tahmina Haque, 43 (DUSH).

Gloriosa superba L., Sp. Pl.: 305 (1753). Local name: Ulatchandal.

A climbing herb, underground rootstalk white, solid, fleshy, covered with a thin brown layer, aerial stem green, leaves sessile, scattered or opposite, lanceolate, venation parallel, flower solitary, large, tip deflexed, perianth segments with crispy wavy margin, stamens 6, anther versatile, pollen grain oval, yellow, stigma 3-lobed, fruit capsule. *Flowering and fruiting*: July-November. *Ecology*: in high lands, hill slopes, in gardens as ornamental plant. *Representative specimens*: Tahmina Haque, 287 (DUSH).

Family name: Aloaceae

Aloe vera (L.) Burm. f., Fl. Ind.: 83 (1768). Synonyms: *Aloe perfoliata* L. var. vera L. (1753), Aloe barbadensis Miller (1768). Local name: Gitikanchon.

Xerophytic perennial herb, succulent, stem short, leaves sessile, crowded, narrowly lanceolate, surface green with few to many spots, inflorescence a raceme, flowers shortly pedicelled, fruit capsule. *Flowering and fruiting*: September-December. Representative specimen: Bijoynagar, 08.05.2016, Tahimina Haque, 39 (DUSH).

Family name: Smilacaceae

Smilax macrophylla Roxb. (1832). Synonym: *Smilax ovalifolia* Roxb., Fl. Ind. ed. 3: 794 (1832).Local name: Kumarilata.

Large climber, stems straight or slightly zigzag, leaves alternate, petiole stout, always narrowly sheathing below the middle, flowers small, fruit a globose berry, size of a large pea, red when ripe. *Flowering and fruiting*: November-March. *Representative specimens*: Tahmina Haque, 36 (DUSH)

Family name: Orchidaceae

Acampe papillosa (Lindl.) Lindl., Fol. Orch.: 2 (1853). Synonym: *Saccolabium papillosum* Lindl. (1841). Local name: Porgacha.

Epiphytic herb, stem woody, sheathed, leaves thick, fleshy, infloresence tall, compact, flowers creamy-yellow with dark brownish stipes. *Flowering and fruiting*: September-December. Representative specimen: Bijoynagar, 08.05.2016, Tahimina Haque, 235 (DUSH).

Family name: Agaricaceae

Agaricus campestrisL., Sp. Pl. 2: 1171 (1753).

The cap is white, fine scales. The gills are dark brown, The thick-walled, elliptical spores measure 5.5-8.0 µm by 4-5 µm. *Flowering and fruiting*: Rainy season. *Ecology*: Edge of the road, planted as ornamental plant. *Representative specimens*: Simrail, 10-12-16, Tahmina Haque, 58 (DUSH).

Family name: Athyriaceae

Diplazium esculentum (Retz.) Sw., Schrad. J. Bot. 1801 (2): 312 (1803). Synonyms: *Hemionitis esculentum* Retz. (1791). Local name: Dheki shak.

Rhizome, widely creeping, branched, scales dark brown, acuminate, lamina simply pinnate, edge more or less deeply lobed, rachis pubescent, sori linear, spores monolate, exine brown, perine absent, indusium produced at both sides of the vein (diplazoid). *Ecology*: moist shady places. *Representative specimens*: B. baria,24-04-17; Tahmina Haque, 300 (DUSH)

Family name: Polypodiaceae

Drynaria quercifolia (L.) J. Sm. in Hook., J. Bot. 3: 398 (1841). Synonyms: *Polypodium* quercifolia L. (1753). Local name: Por gacha

An epiphytic dimorphic fern, frond 2 types, foliage and nest leaves, lamina shortly acuminate, sori in regular row on each side of main vein, round in shape. *Ecology*: tree, grows as epiphyte. Representative specimen: Tahmina Haque, 301 (DUSH)

Family name: Cycadaceae

Cycus pectinata Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5(2): 322 (1826). Synonym: *Cycas circinalis* L. var. pectinata (Buch.-Ham.) J. Schust. (1932). Local name: Cycus.

An evergreen palm-like tree, leaves recurved, leaflets ending in minute spines, megasporophyllus densely tawny, silky, male cone cylindric-ovoid, seeds ovoid to globose. *Flowering and fruiting*: November-January *Ecology*: exposed slopes of hills. *Representative specimens*: Tahmina Haque, (DUSH)

Abroma augusta (L.) L. f.

Abrus precatorious L.

Achyranthes aspera L.

Adhatoda zeylanica Medukus.

Aegle marmelos (L.) Corr.

Aerva sanguinolenta (L.) Blume

Plate 21: Photographs of important ethnomedicinal plants (to be continued)

Amaranthus spinosus L.

Allium sativum L.

Aloe vera (L.) Burm.

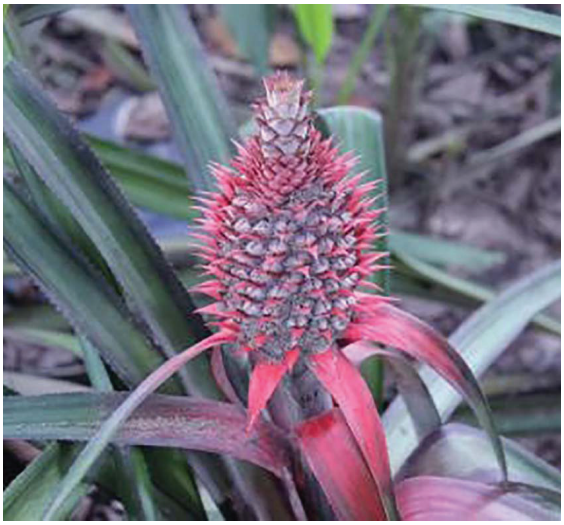
Alternanthera sessilis (L.) R. Br. Ex Roem. & Schult.

Alstonia scholaris L. R. Br.

Annona reticulata L.

Plate 21(continued): Photographs of important ethnomedicinal plants

Asparagus racemosus willd.



Ananas sativus (Lindil.) Schult. f.

Andrographis paniculata (Burm. f.) Wall.*ex* Nees

Averrhoa carambola L.

Averrhoa bilimbi L.

Azadirachta indica A. Juss

Plate 21 (continued): Photographs of important ethnomedicinal plants

Bacopa monnieri (L.)

Blumea lacera (Burm. f.) DC. Wight

Bombax ceiba L.

Boerhaavia diffusa L.

Butea monosperma (Lam.) Taub

Cajanus cajan (L.) Millsp.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Calotropis procera (Ait.) R. Br

Cassia fistula L.

Carissa carandas L.

Catharanthus roseus L.

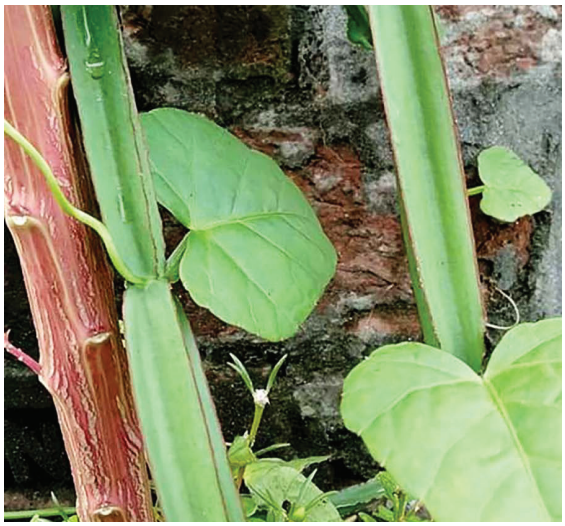
Centella asiatica (L) Urban

Celosia cristata L. r

Plate 21 (continued): Photographs of important ethnomedicinal plants

Citrus aurantifolia (Cristm. & Panzer) Swingle

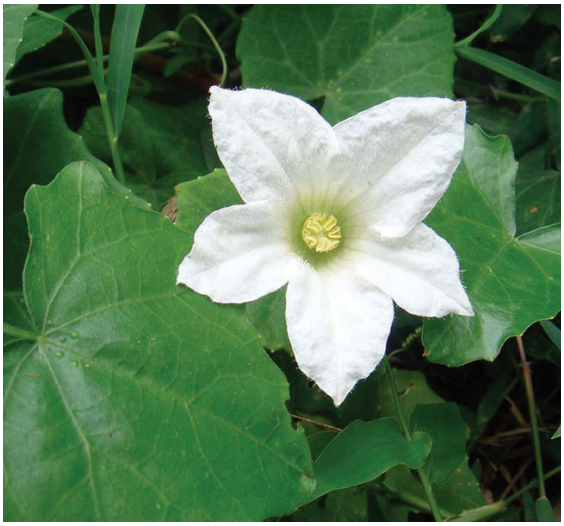
Chenopodium album L.



Cissus quadrangularis L.

Camellia sinensis (L.) O. Kuntze

*Clerodendrum viscosum*Vent.



Coccinea grandis (L.) Voigt

Plate 21 (continued): Photographs of important ethnomedicinal plants

Citrus grandis (L.) Osbeck

Coriandrum sativum L.

Colocasia esculenta (L.) Schott

Commelina benghalensis L.

Crataeva magna (Lour.) DC

Cocos nucifera L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

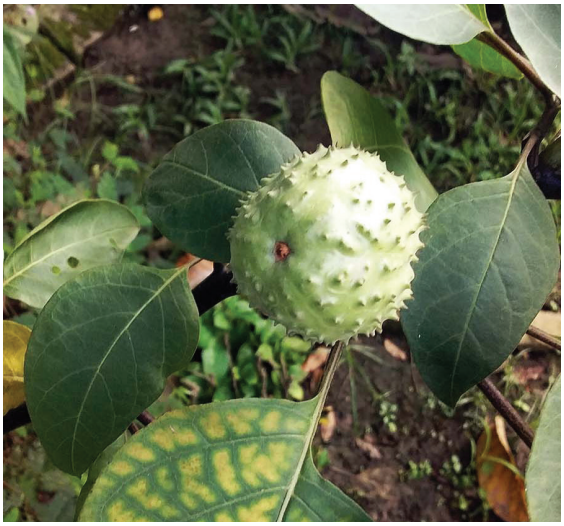
Clitoria ternetea L.

Curcuma longa L.

Curcuma zedoaria (Christm.) Rosc.

Cynodon dactylon L. Pers.

Dalbergia sissoo Miq.

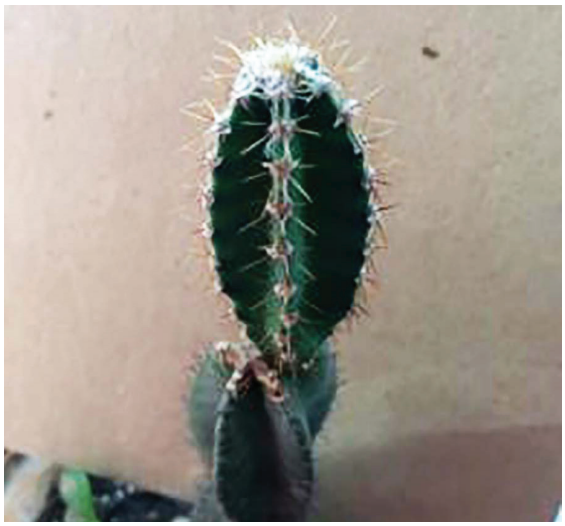


Datura metel L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

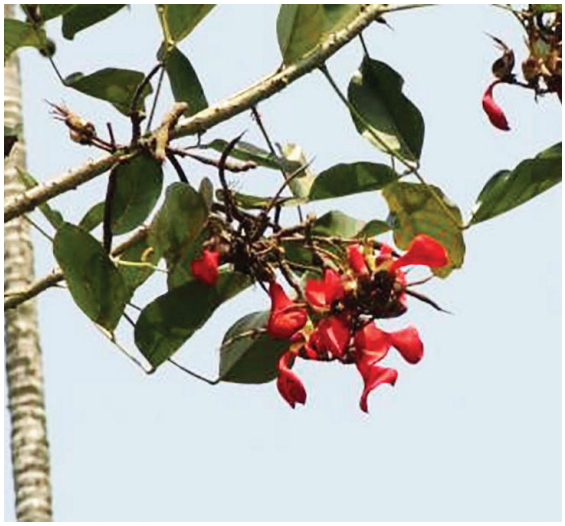
Dillenia indica L.

Eclipta alba (L.) Hassk.



Echinopsis peruviana (Britton & Rose)

Euphorbia hirta L.



Erythrina indica Lamk.

Ficus benghalensis L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Ficus hispida L.

Frageria chiloensis (L) Mill.

Gynura nepalensis DC.

Gloriosa superba L.

Glycosmis pentaphylla (Retz.) A. DC.

Hibiscus rosa-sinensis L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Hibiscus sabdariffa L.

Holarrhena antidysenterica (L.) Wall. ex Decne.

Hyptis suaveolens (L.) Poit.

Ipomoea fistulosa Mart. ex Choisy

Jatropha gossypifolia L.

Kalanchoe pinnata (Lamk.) Pers.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Kalanchoe serrata Mann. & Boit

Justicia gendarussa Burm. f.

Lannea coromandelica (Houtt.) Mers.

Lagenaria vulgaris Seringe

Lawsonia inermis L.

Litsea glutinosa (Lour.) Robinson

Plate 21 (continued): Photographs of important ethnomedicinal plants

Leucas lavandulaefolia Smith.

Lippia alba (Mill.) Briton *et* Wilson

Mangifera indica (L.) sw

Musa paradisiaca L.

Mentha arvensis L.

Melastoma malabathricum L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Mikania cordata (Burm. f.) Robinson

Momordica indica L.

Mimosa pudica L.

Moringa oleifera Lamk.

Murraya paniculata (L.) Jack

Nigella sativa L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Nelumbo nucifera Gaerthn.

Nyctanthes arbortristis L.

Ocimum sanctum L.

Oenanthae javanica (Blume) DC

Oroxylum indicum (L.) Kurz

Paederia foetida L.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Pedilanthus tithymaloides Poit.

Piper betel L.

Phyllanthus embelica L.

Pandanus foetidus Roxb. Fl.

Phyllanthus niruri L.

Phyllanthus reticulatus Poir.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Pothos scandens L.

Plumbago zeylanica L.

Punica granatum L.

Psidium guajava L.

Phyllanthus acidus (L.) Skeels.

Rauvolfia serpentina Benth.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Ricinus communis L.

Rosa damascena Mill.

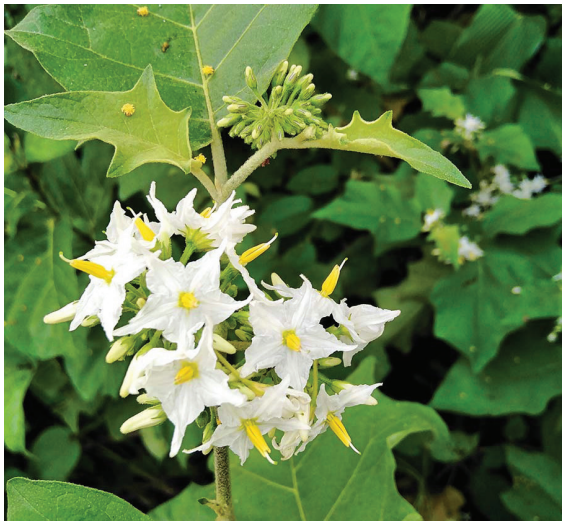
Saraca asoca (Roxb.) d Wild.

Schumannianthus dichotomus (Roxb.)

Scoparia dulcis L.

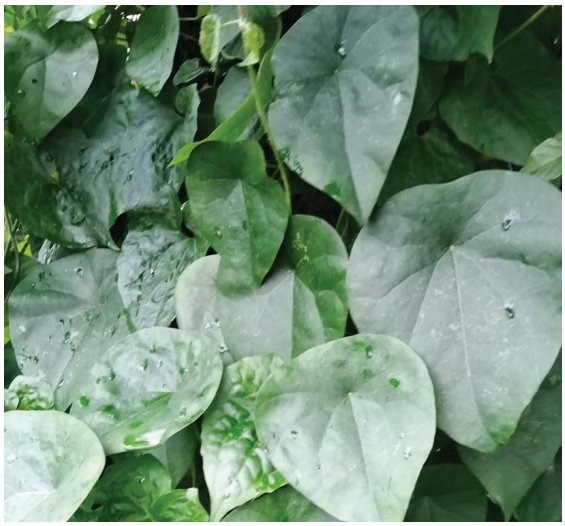
Spondias pinnata (L. F.) Kurz

Plate 21 (continued): Photographs of important ethnomedicinal plants



Solanum sisymbrifolium Lamk.

Swietenia mahagani Jacq.



Stephania japonica (Thunb.) Miers.

Sterculia villosa Roxb. *ex* Smith

Streblus asper Lour.

Syzygium cumini (L.) Skeels

Plate 21 (continued): Photographs of important ethnomedicinal plants

Syzygium samarangense (Blume)

Tagetes patula L.

Tamarindus indica L.

Terminalia bellirica (Gaertn.) Roxb.

Trewia nudiflora L.

Terminalia arjuna (Roxb. ex DC.) Wight &Arn.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Terminalia chebula Retz.

Tinospora crispa (L.) Hook. F. &Thoms

Thevetia peruviana (Pers.) K. Schum

Urena lobata L.

Vitex nigundo L.

Zingiber officinale Rosc.

Plate 21 (continued): Photographs of important ethnomedicinal plants

Chapter-4
Discussion

Discussion

4.1. Ethnomedicinal survey

The present survey documented the ethnographic data of Brahmanbaria district for the first time. The analysis of ethnomedicinal plant list showed that people living around the study area had a good knowledge of ethonomedicinal plants. A total of 247 plant species under 217 genera from 89 families used by local people have been documented in study area. Among the medicinal plants, 206 species belonged to dicotyledones, 36 species are monocots, two species are pteridophytes and one species each of fungi and gymnosperm. Among the 89 families, Fabaceae was best represented in terms of the number of species, followed by Asteraceae, Euphorbiaceae, Rutaceae, Amaranthaceae, Apocyanaceae. Similar result found in different area of Bangladesh. An ethnomedicinal survey carried out in Durgapur (Khan *et al*. 2015) and Cox's bazar (Uddin *et al*. 2013) where majority reported medicinal plants belong to Fabaceae family. The family Fabaceae and Asteraceae reportedly has the highest number of species, more than any other plant family in the world (Randrianarivony *et al*. 2017, Chandra 2005, Lulekal 2008, Chassagne *et al*. 2016). Different secondary metabolites presenting antibacterial activity (Murphy 1999) have been found in Asteraceae (Heinrich *et al.* 1998), justifying the medicinal use of this family (Canales *et al*. 2005).

Among the ethnomedicinal plants, 42% has been represented by herbs, 33% by trees, 14% by shrubs and 11% by climbers. Herbaceous plant constituted the highest proportion of ethnomedicinal plants. A similar trend was also observed that herbs were the most used growth form of ethnomedicinal plants in Bangladesh found in other recent investigations (Uddin *et al*. 2015, Uddin *et al*. 2014. Uddin *et al*. 2015). The common use of herbaceous medicinal plants was also reported in other parts of the world (Addo-Fordjour *et al*. 2008) and attributed to their wide range of bioactive ingredients (Gazzaneo *et al*. 2005). Trees and herbs enjoy a higher usage in ethnomedicinal practice because of their greater availability (Uniyal *et al*. 2006, Sanz-Biset *et al*. 2009). A majority of the rural and ethnic communities of Bangladesh still rely on the kavirajes for their primary health care (Rashid *et al*. 2017). There is a huge diversity of knowledge about the uses of medicinal plants. Such knowledge has been inherited orally from generation to generation. No written document is found during survey. Local people know the useful medicinal plants from local medicine men (kabiraj), old aged people or personal experience. They collected medicinal plant or plant based medicine from kabirajbari, home garden, roadside, fallow land, railway side and hilly region. The study area located adjacent to the Tripura State of India so that knowledge of two regions cross connected from ancient time. As a result there is huge diversity of medicinal knowledge found in the study area.

Leaves (0.389%) are mostly used part for majority of the ethnomedicinal plants, followed by fruits (0.155%), root (0.09%), seeds (0.09%), stems (0.086%), bark (0.081%), whole plant (0.073%) and flowers (0.024%). Similar trend of using leaves for ethnomedicinal use has also been reported from Lawachara National Park (Uddin *et al*. 2012) and Remakalenga forest (Uddin *et al*. 2014), Chittagong hill tracts (Bishwas *et al*. 2010), Cox's bazar (Uddin *et al*. 2013), Feni (Uddin *et al*. 2015). In the present study area threat to the species is minimal as leaves are the leading plant part used for ethnomedicinal purposes. The reason why leaves were used mostly is that they are collected very easily than underground parts, flowers and fruits (Giday *et al*. 2009) and in scientific point of view leaves are active in photosynthesis and production of metabolites (Ghorbani 2005). It was observed that the collection of bark as medicinal part from the wild were not sustainable. People often collecting plant parts in an unsustainable way. They uprooted herbaceous plant like *Asparagus racemosus*, *Mimosa pudica*, *Ocimum sanctum* and debarked many trees like *Litsea glutinosa, Terminalia aurjuna, Bombax ceiba* in an unsustainable way.

Among 485 formularies, 372 (77%) were of oral application and rest 113 (24%) of external applications. It has been observed that local people in the study area follow various ways of remedy preparation which depend on type of disease treated. The major modes of remedy preparations were juice and decoction. Plant ingredients were collected by the local people from wild and cultivated or home garden of the habitat in the study area and other ingredients were procured from the commercial sources. In the present study a number of important ethnomedicinal plant species have been found very important from calculated the Factor of informant consensus (F_{ic}), Fidelity level (Fl), Citation frequency (Cf), Relative frequency of citation (RFC) and Use values (UV). At individual species level, *Centella asiatica* was widely cited (Cf = 51%) followed by *Litsea glutinosa* (Cf = 41%), *Azadirachta indica* (Cf= 26%), *Ocimum sanctum* (Cf = 22%), *Aloe vera* (21%), *Cynodon dactylon* (Cf = 26%), *Leucas lavandulaefolia* (Cf = 26%) and *Aerva sanguinolenta* (Cf = 26%).

According to the Use value *Centella asiatica* (UV = 0.58), *Litsea glutinosa* (UV = 0.47), *Azadirachta indica* (UV = 0.30), *Aloe vera* (UV = 0.23), *Mimosa pudica* (UV=0.24), *Coccinea grandis* (UV = 0.22) were the most used medicinal plants by local people of the study area. These ethnomedicinal species used for various purposes for the treatment of respiratory tract disorder, Diarrhoea and dysentery, diabetes and gynoecological problems. Faruque *et al*. 2018 recently conducted an ethnomedicinal survey in Bandarban districts of Bangladesh. They obtained the five most commonly used ethnomedicinal plant species were *Duabanga grandiflora* (0.43), *Zingiber officinale* (0.41), *Congea tomentosa* (0.40), *Matricaria chamomilla* (0.33), and *Engelhardtia spicata* (0.28) which was not matched with the present data. So the use value of ethnomedicinal plant species

may vary in different parts of the country depending the vegetation type and nature of the people.

Informant consensus factor was used to analyze the agreement degree of the informants' knowledge about each category of ailments (Heinrich *et al*. 1998). The F_{ic} values ranges 0-1, where increasing values of this factor indicate a higher rate of informant consensus among the illness category (Song *et al*. 2014). For the analysis of the use of plants, Factor informant consensus (F*ic*) was used to highlight plants of particular cultural relevance and agreement in the use of plants. Informants' consensus within a community and between cultural groups indicates which plants are widely used and thus aids in the selection of plants for pharmacological and phytochemical studies. In the present study F_{ic} values varied from 0.95 to 0.79.

In ailment category diarrhoea & dysentery attained the maximum F_{ic} value of 0.95, followed by respiratory tract disorders (0.94), diabetics (0.93), gynecological (0.93), dermatological (0.91), sexual problem (0.91), gastrointestinal (0.90), musculoskeletal (0.90), helminthiasis (0.90) mental disorder (0.89), cardiovascular (0.88), fever and pain (0.87), dental problem (0.87), jaundice (0.79) and others including snake bite, anti-aging, weight loss etc (0.79). Such values indicated that maximum informants agreed to treat diseases related to these ailment categories than the other seven ailments using ethnomedicinal plants in Brahammanbaria. Most cited species for the treatment of such ailment categories are *Litsea glutinosa*, *Scoparia dulcis*, *Kalanchoe pinnata*, *Ocimum sanctum*, *Abroma augusta*, *Alternanthera sessilis*, *Aloe vera*, *Cissus quandragularis*, *Azadirachta indica*, *Achyranthes aspera*, *Coccinia grandis*, *Andrographis paniculata*, *Ananas sativus*, *Hyptis suaveolens*, *Terminalia arjuna*, *Eclipta alba*, *Cajanas cajan*, *Asparagus racemosus*, *Kalanchoe serrata*, *Commelina benghalensis*, *Holarrhena antidysenterica* and *Echinopsis peruviana.* High F_{ic} values also indicate that the species traditionally used to treat these ailments are worth searching for bioactive compounds.

4.1.1. Diarrhoea and dysentery

The present results revealed that the highest informant consensus factor value was obtained for dairrhoea and dysentery ailments category (F_{ic} = 0.95) where cuts and wounds category recently reported highest F*ic* values from the ethnomedicinal study from Feni districts with F_{ic} values 0.93 (Uddin *et al*. 2015) and Lawachara national park of Bangladesh with F_{ic} values 0.80 (Uddin *et al*. 2017). Faruque *et al.* (2018) found F_{ic} value of the cut and wound ailment category as 0.59 among indigenous communities in Bandarban district of Bangladesh. They reported the highest F_{ic} value in the digestive system disorders including gastritis, diarrhoea which was similar with the present study. Similarly Uddin *et al.* (2014) reported that the ailment dysentery obtained the highest F_{ic} value in Kalenga forest area

of Bangladesh. They reported that the high F_{ic} 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. Maximum plant species used for cough and diarrhoea in the Chakma community of Khagrachari district, Bangladesh (Uddin *et al*. 2015). In an ethnomedicinal survey at Lusai community of Bandarban, Bangladesh where report showed that 20.16% of total plant species were used to treat dysentery, 13.95% species for diarrhoea, and 78% for other diseases (Uddin *et al*. 2015). Like numerous reports on medicinal plants in Madagasker and Mexico, revealed that digestive system disorders like diarrhoea were the most cited by informants (Randrianarivony *et al*. 2017). In the present study 45 medicinal plant species were mentioned by the informants and the species responsible for this high consensus for this category were *Centella asiatica*, *Litsea glutinosa*, *Holarrhena antidysenterica*, *Dalbergia sissoo*, *Scoparia dulcis*, *Paederia foetida*, *Clerodendrum viscosum*, *Stephania japonica*, *Phyllanthus reticulatus*, *Mangifera indica* and *Glycosmis pentaphylla.* Among them *Centella asiatica* and *Holarrhena antidysenterica* were two known medicinal plants has many uses with scientific validation (Kaundal and Sagor 2016, Nasution *et al*. 2018). *Centella asiatica* used for treatment of various diseases like jaundice by the Hodi tribe (Rahmutullah *et al*. 2011); dysentery by the Bauri tribe (Das *et al*. 2013); fever, pain by folk medicinal practices in Tangail district (Goswami *et al*. 2013).

Litsea glutinosa cited by 34% local people with second highest use value (UV = 0.43) and low fidelity level (Fl = 72%) was widely used medicinal plant in the study area for the cure of diarrhoea and dysentery. The paste from the bark usually applied on chest to reduce the chest pain as informed by the informants in Brahmanbaria was not referred by any other study from Bangladesh. This plant species also has been used both by local and ethnic people to treat many ailments including diarrhoea, dysentery, wounds and bruises (Ghani 2003). The ethanol and aqueous extracts of leaves showed antibacterial activity (Haque *et al*. 2014). The bark has effective antibacterial activities against *Pseudomonus aeroginosa, Staphylococcus aureus* and *E.coli.* The bark showed also antifungal activities against *Aspergillus fumigates* and *Candida albicans* (Hosamath 2011). Uddin *et al*. (2014) suggest that *Litsea glutinosa* might be used for the development of new, cheap, effective, and eco-friendly herbal formulations for health-care management. The illegal and unsustainable collection of bark from this tree by the local crude drug traders considered as major causes of its depletion from nature. *Dalbergia sissoo* cited by 6.85% of local people with lower use value (UV = 0.068) but 100% Fidelity level in the current study. This plant species also used for diarrhoea in Feni districts with a high Citation (Cf = 64.3%) (Uddin *et al*. 2015) and diarrhoea and inflammation in Bandarban districts (Uddin *et al*. 2015).

4.1.2. Respiratory tract disorder

Respiratory tract disorder is a common disease in the study area which possesses second highest F_{ic} values (0.94) and has a high number of use reports (506). Most mentioned species of this category are *Ocimum sanctum*, *Adhatoda zeylanica* and *Leucas lavandulaefolia*. Leaves of *Ocimum sanctum* and *Adhatoda zeylanica* are usually used while leaves and flowers were used for *Leucas lavandulaefolia.* In India *Ocimum sanctum* has been recommended for the treatment of bronchitis, bronchial asthma, malaria, diarrhoea, dysentery, skin diseases, arthritis, painful eye diseases, chronic fever and insect bite (Prakash and Gupta 2005). Most of the formularies showed that extracts of *O. sanctum* are used for the treatment of children's cold & cough, bronchitis, asthma in the study area. Because the local people believes that the uses of allopathic medicines may be bad for their child's health and the fresh extract or juice of medicinal plant were safe for their children.

4.1.3. Gynecological Problem

The illness group of gynecological was the third highest according to the informant consensus factor value (F_{ic}= 0.93), the most important species for gynecological use are *Abroma augusta, Lawsonia inermis, Mimosa pudica, Hibiscus rosa-sinensis, Tamarindus indica. Alternenthera sessilis, Plumbago zeylanica* were used mostly for fever category. *Abroma augusta* showed the UV of 0.18 with a low Fidelity level (Fl= 27%) and about 18% of informants mentioned various uses of this medicinal plant species in the study area. The roots of this plant species was uses for menstrual regulation in Joypurhat (Rahman 2014) which support present study, leaves juice used as tonic and digestive in Swandip (Sajib and uddin 2013), leaves juice taken for Diabetic in Brahmanbaria (Haque *et al*. 2017), boiled leaf extract is taken during taking meal to control hiccup in Cox's Bazaar (Uddin *et al*. 2013) but not mentioned any uses from Feni (Uddin *et al*. 2015), Rema Kalenga (Uddin *et al*. 2014) and Marma community of Bandarban (Faruque and Uddin 2013) from Bangladesh. In the present study decoction of the stem was taken every day for the treatment of jaundice was not reported from other studies from Bangladesh.

4.1.4. Diabetes category

The illness category Diabetes also obtain same F_{ic} value as gynecological category (0.93), 44 medicinal plant species cited for this category. Among them most important species were *Coccinea gandis* (Cf = 26.3%), *Gynura nepalensis* (Cf = 5.33%), *Syzygium cumini* (Cf = 9.20%) and *Momordica indica* (Cf = 9.83%), *Andrographis paniculata* (Cf = 6.63%), *Swietenia mahagoni* (Cf = 4.49%). The mode of preparation of major portions of the plant species is juice which is used internally. Most of the plant species were very common and were cultivated or planted in homestead or roadsides which in agreement with to other study (Kadir 2012). From the most cited species some were similarly reported from

other ethnomedicinal studies from Bangladesh viz: *Coccinea grandis*, *Momordica indica*, *Moringa oleifera*, *Azadirachta indica*, *Syzygium cumini, Terminalia arjuna, Andrographis paniculata*, *Ficus racemosa, Swietenia mahagani, Trigonella foenum-graecum* (Alam 2007, Orvic *et al*. 2013, Uddin *et al*. 2014, Uddin *et al.* 2015, Sajib and Uddin 2013, Uddin *et al*. 2015, Kabir *et al*. 2015, Kadir 2012, Rahman 2015, Yusuf 2009).

Medicinal plants *viz. Citrus aurantinum, Citrus grandis, Dillenia indica, Gynura nepalensis, Syzygium sammargenes, Zizipus mauritiana* were reported from present study as antidiabetic but these were not commonly mentioned in the following studies as antidiabetic plant (Alam 2007, Orvic *et al*. 2013, Uddin *et al*. 2014, 2015, Sajib and Uddin 2013, Uddin *et al*. 2015, Kabir *et al*. 2014, Kadir 2012, Rahman 2015, Yusuf 2009).

Medicinal plant having highest Fl value and Cf value (highest citation frequency) of the present survey was discussed here comparing with the other related literature. *Coccinea grandis* was reported from Bangladesh as an anti-diabetes plant (Kadir 2012, Ocvirk *et al*. 2013, Uddin *et al*. 2015, Uddin and Sajib 2013). This plant is easily available in the study area and people were well known about this medicinal plant. Leaves of *Coccinia grandis* showed hypoglycemic effects in several animal studies (Shibib *et al*. 1993, Hossain 1992, Venkateswaran and Pari 2003). *Swietenia mahagoni* was reported to be used for the treatment of diabetes in Bangladesh (Orvic *et al*. 2013) but not mentioned in other recent studies (Rahman 2015, Uddin *et al*. 2015).

In the present study seed of *Swietenia mahagoni* was dried and taken internally for treatment of diabetes. Recent report also emphasize the hypoglycemic and anti-oxidant activity of *Swietenia mahagoni* bark and seed extracts (Panda 2010, De *et al*. 2011). *Syzgium cumini*, one of the seasonal fruit in Bangladesh and popularly used for treatment of diabetes. Seed powder usually internally taken by the local people of Brahmanbaria. Kabiraj provided tablet to the diabetic patient which is made by the mixing the seeds of *Syzgium cumini* and *Azadirachta indica*. Hypoglycemic activity of ethanolic crude extract of leaves in diabetic rats (Schoenfelder *et al*. 2010); aqueous leaf extracts showed hypoglycemic activity in hyperglycemic patients (Bopp *et al.* 2009), hypoglycemic activity attributed to cuminoside from seeds, *Andrographis paniculata*, a herbaceous medicinal plant which is used for diabetes from other areas from Bangladesh (Orvic *et al*. 2013, Akber *et al*. 2011, Rahman 2015). Kabiraj said that they collect this plant material from local market and sold it to the local people for the treatment of diabetes. An edible vegetable *Momordica indica*, locally known as titkona is popularly used for the treatment of diabetes in Bangladesh (Orvic *et al*. 2013, Uddin 2015, Sajib and Uddin 2013, Rahman 2013, 2015, Yusuf *et al*. 2009, Ghani 2003).

4.1.5. Cardiovascular

In the present study 43 medicinal plant species have been found to be used for the treatment of cardiac disease. The most cited species are *Terminalia aurjuna*, *Terminalia bellirica*, *Alternanthera sessilis*, *Rauvolfia serpentina*, *Tamarindus indica, Allium sativum and Achyranthes aspera*. In present study *Allium sativum* (garlic) is also used for the treatment of heart disease management. This plant is also used for gastric, cold, fever, chest pain, reduced pressure and ringworm (Uddin *et al*. 2015, 2017). In present study *Alternanthera sessilis* is highly cited species, also used for the treatment of pox (Uddin *et al.* 2017) and snake bite (Khan *et al.* 2002).

Terminalia aurjuna is used for the treatment of heartache which is also used for the same purpose as reported from different area from Bangladesh (Uddin *et al.* 2012, 2014, 2015 and 2017). This plant is also used for stomachache, cough, diabetes, menstruation, gastric pain, dysentery (Uddin *et al*. 2015, 2017, 2019, Islam *et al*. 2014, Uddin *et al*. 2012, 2006). *Terminalia arjuna* is a popular medicinal plant with its bark been used for over centuries as cardiotonic. The bark contains several bioactive compounds including saponins and flavonoids (Navjot *et al.* 2014). The cardio protective effects, particularly bark of *Terminalia arjuna* are well known. Such effects include reported protective effects of plant bark against doxorubicin induced cardio toxicity reported significant inotropic and hypotensive effect of bark, also increased coronary artery flow and protection of myocardium against ischemic damage (Sing *et al.* 2008, Dwivedi 2007). *Terminallia bellirica* is used for the treatment of heart disease and also reported for stomachache, dysentery, appetizer, anemia, fever, bronchitis, constipation, asthma, vomiting, eye and menstrual disorder (Uddin *et al*. 2006, 2012, 2014, 2015 and 2017). *Tamarindus indica* is used to reduce blood pressure which is also reported from others studies from Bangladesh (Uddin *et al*. 2015, 2017).

Rauvolfia serpentina (L.) Benth. Ex Kurz. is used for controlling high blood pressure. Also used for hypertension, mental disorder, stomach ache, gastric (Islam *et al.* 2014, Roy *et al.* 2008, Uddin *et al.* 2004). *Tamarindus indica* L. is reported to be used for controlling high blood pressure. This plant is also reported for the treatment of diarrhoea, dysentery, appetizer, constipation, impotence, abscess, Jaundice (Uddin *et al.* 2012, 2015, 2017, Khan *et al.* 2002). Different parts of plant affects the LDL oxidation and macrophage inflammatory response and also nephrotoxic effects and also having antipsychotic potential helpful in preventing delaying clot formation and have immune stimulant activity (Narendra and Khurana 2018). Compare with previous research (Ghani 2003, Uddin *et al*. 2006, 2008, 2012, 2014, 2017, Sajib and Uddin 2013, Uddin *et al.* 2015) *Lactuca sativa* L. was seem to be newly reported medicinal plant for the cardiovascular activities. Among the three plant species *Lactuca sativa* is used by the local people for cardiovascular disease.

4.1.6. Dermatological:

In the present study 46 medicinal plant species have been identified for the treatment of dermatological diseases. The most cited species used to treat such ailment are *Azadirachta indica*, *Heliotropium indicum*, *Phyllanthus acidus*, *Solanum sisymbrifolium.* These plants also have many other medicinal and ethnobotanical uses which have been reported in previous ethnobotanical study in Bangladesh (Hassan and Khan 1986, Uddin and Hassan 2004, Uddin *et al.* 2008, Uddin *et al*. 2012, Uddin *et al*. 2014, Uddin *et al*. 2015, Yusuf *et al*. 2009, Ghani 2003).

Aloe vera is widely used in the preparations of skin care lotions and in shampoo as hair tonic (Yusuf *et al*. 2009). Small tablets are made from leaves of *Azadirachta indica* and taken internally for the treatment of allergy (Uddin *et al.* 2014), juice is taken internally for dermatological problems (Uddin *et al.* 2015, 2017).

The mixture of *Azadirachta indica* and *Curcuma longa* are used for curing skin ailments and for cosmetics in Assam (Saikia *et al.* 2006). The *Azadirachta indica* have the properties of a Blood purifier, beauty enhancer and skin cleanser (Shweta *et al*. 2011, Yusuf *et al*. 2009). In the present study it was found that the paste of leaves of *Lawsonia inermis* is applied externally for hair colour, hair fall treatment and dandruff and as a natural hair dye (Hazra and Panda 2013). This plant also used by the local people in Bangladesh as hair tonic (Uddin *et al*. 2017). It has a natural affinity with the proteins in our hair, making it able to "stain" the colour onto the hair shaft (Oomah *et al.* 2000).

4.1.7. Sexual problem:

The illness group of sexual problem was scored the same informant consensus factor value (F_{ic}= 0.92) as dermatological ailment category and the most important species for this category were *Aloe vera, Hyptis suaveolens*, *Mimosa pudica*, *Litsea glutinosa, Bombax ceiba* and *Asparagus racemosus.* Nearly similar F_{ic} value (0.89) found from the study in remakalenga forest (Uddin *et al*. 2014) and in Feni district (Uddin *et al*. 2015) of Bangladesh for impotence category.

Aloe vera was cited by more than 21% informants with a use value 0.28. Mucilage of this plant was taken by the local people for the treatment of impotence. This plant is popular medicinal plants used for menstrual disease (Rahman 2014), impotence (Uddin *et al*. 2014, to reduce tiredness (Sajib and uddin 2015), skin care (Uddin *et al*. 2013). *Aloe vera* help to soothe skin injuries affected by burning, skin irritations, cuts and insect bites, and its bactericidal properties relieve itching and skin swellings (Rajeswari *et al*. 2012).

4.1.8. Masculoskeletal:

This category cited the highest number of ethnomedicinal species (50 ethnomedicinal plant species) with a F_{ic} values 0.90. Among the 50 medicinal plant species most cited medicinal plants were *Cynodon dactylon* (Cf = 21.84%), *Cissus quadrangularis* (Cf= 11.56%), *Aerva sanguinolenta* (10%), *Calotropis procera* (Cf = 31%), *Mikania cordata* (Cf = 7.70%), *Pedilanthus tithymaloides* (Cf=4%). This category of ailments displays the highest factor informant consensus (0.94) in an ethnomedicinal survey from Northeast Cambodia (Chassagne *et al*. 2016), (0.66) in Karnataka state of India (Bhat *et al*. 2012), (0.98) in Gayasen National park of Korea and (0.93) and from Feni district of Bangladesh (Uddin *et al*. 2014). The use of *Cynodon dactylon*, *Cissus quadrangularis*, *Calotropis procera*, *Mikania cordata* for the treatment of cut and wound, rheumatic pain have already been reported in other surveys from Bangladesh (Uddin *et al*. 2014) but the use of *Aerva sanguinolenta and Pedilanthus tithymaloides* for this category not found from other studies.

4.1.9. Gastrointestinal category:

In the present study 48 ethnomedicinal plant species have been found for the treatment of gastrointestinal disease category (F_{ic} = 0.91). Among them most cited species were *Kalanchoe pinnata* (Cf =12.3), *Hibiscus sabdariffa* (Cf = 8.31), *Phyllanthus embelica* (Cf = 7.65), *Pithecellobium dulce* (Cf = 5.03), *Hyptis suaveolens* (Cf = 5.68). This disease category included abdominal pain, constipation, gastric pain, digestion and appetizer. *Kalanchoe pinnata* was a popular ethnomedicinal plant in the study area and also used for the same purposes from other area of Bangladesh (Uddin and Faroque 2013, Islam and Rahman 2018). This ethnomedicinal pant was also used for the treatment of cough, pneumonia, menstruation and diabetes (Rahman 2015, Uddin and Faroque 2013). *Hibiscus sabdariffa* was popularly used to facilitate evacuation of the bowels (laxative) and as an appetizer in the study area. In Bandarban, fruits of this plant is also used for the treatment of Diarrhoea and dysentery. *Phyllanthus emblica* is also reported for the gastrointestinal diseases from other ethnobotanical surveys from Bangladesh (Uddin *et al*. 2012, 2013). This plant is also used for the treatment of diabetes (Rahman 2015, Haque *et al*. 2017).

4.1.10. Helminthiasis:

The Category was scored the informant consensus factor value (F*ic* = 0.90) and 13 ethnomedicinal species were cited for this ailment category. Among them most cited species were *Cuscuta reflexa, Ananus sativus* and *Glycosmis pentaphylla*. Mixer was made from same proportion of turmeric and *Cuscuta reflexa* which again mixed with the juice from the twig of *Ananus sativus* and taken twice a day for seven for the prevention of helminthiasis of the children. This formularies was also popularly used throughout the study area. *Glycosmis pentaphylla* was reported for the treatment of jaundice and dysentery in Rajshahi district (Rahman 2014).

4.1.11. Mental disorder:

Eleven species recorded for this ailments category with a F_{ic} value 0.89 and the most cited species of this category were *Asparagus racemosus* (Cf = 7.65), *Datura metel* (Cf = 6.56), *Bacopa monneiri* (Cf = 2.62), *Asparagus racemosus* used as tonic (Sajib and Uddin 2015), Labor problem, Leucorrhoea (Faruque and Uddin 2011) and also possesses remarkable thrombolytic, antimicrobial and antioxidant activity (Karim *et al*. 2017).

4.1.12. Fever and pain: Twenty three species recorded for this ailments category and the most cited species of this category were *Echinopsis peruviana* (Cf = 8.09), *Andrographis paniculata* (Cf = 7.01) and *Plumbago zeylanica* (Cf = 6.78). The use of *Echinopsis peruviana* was not found in other ethnobotanical surveys from Bangladesh. *Andrographis paniculata* used for fever (Sajib and Uddin 2015).

4.1.13. Dental problem

Twenty four species recorded for this ailments category and the most cited species of this category were *Kalanchoe serrata*, *Psidium guajava*, *Ricinus communis* and *Jatropha gossypifolia.*

4.1.14. Jaundice

Twenty three species recorded for this ailments category and the most cited species of this category were *Ageratum conyzoides*, *Blumea lacera*, *Achyranthes bidentata* and *Oenanthae javanica.*

Maximum plants used for gastrointestinal (50 species), followed by musculoskeletal pain & inflammation category (48 species.), dermatological (46 species), diarrhoea and dysentery (45 species), diabetics (44 species), gynecological (32 species), sexual problem (32 species) and respiratory tract disorder (30 species). A large number of species are used for gastrointestinal illnesses by two or more of the indigenous groups in Mexico (Heinrich *et al*. 1998).

The medicinal plants that are widely used by the local people have higher Fl values than those that are less popular. The percentage of informants claiming the use of a plant species for the same major purpose was estimated using the Fidelity level index. Among the listed most important ethnomedicinal plants in each category with major agreements, 24 species have the highest Fl of 100% most of which were used in the single ailment category with several informants. Plants with highest Fl of 100% were *Adhatoda zeylenica, Ananas sativas, Calotropis procera, Dalbergia sissoo, Hibiscus sabderiffa, Holarrhena antidysenterica, Mikania cordata, Paederiea foetida, Scoparia dulcis, Swietenia mahegani, Syzyium cumini, Clerodendum viscosum, Thevetia peruviana, Catharanthus roseus* and *Cissus quadrangularis*.

Some plants also showed highest Fl value (upto 90%) like *Centella asiatica, Azadirachta indica, Ocimum sanctum, Mangifera indica, Hyptis suaveolens, Psidium guajava, Cajanus cajan, Cynodon dactylon, Coccinea grandis, Trewia nodiflora, Abroma augusta, Eclipta alba* and *Glycosmis pentaphylla.* The maximum Fl for the above plants indicated 100% choice of the interviewed informants for treating specific ailments and this could be an indication of their healing potential.

4.2. New reports

Bangladesh, due to its location and favorable climate, is exceptionally endowed with a vast variety of flora, including medicinal plants (Mukul *et al*. 2009). Bangladesh possesses more than 5700 angiosperms, more than 740 are supposed to have medicinal properties (Yusuf *et al.* 2009). At least three different types of plants reported in ethnobotanical studies are appropriate candidates for research addressed to the development of new drugs: (i) Plants with new or uncommon uses (Table 3.7); (ii) plants with uses cited by several informants (Table 3.4); (iii) plants with identical or similar uses in different areas. Obviously, plants sharing two or three of these conditions are the most promising for further studies (Bonet *et al*. 1990). Based on literature survey among the 485 formularies recorded in the study area, 96 formularies using 77 species seemed to be new record for Bangladesh. Among the 247 ethnomedicinal plants, four ethnomedicinal plants recorded as giving new ethnomedicinal information confirmed by consulting the published literature. *Kalanchoe serrata* used for toothache*, Achyranthes bidentata* used for jaundice*, Lippia alba* (Mill.) Briton *et* Wilson used for diarrhoea and dysentery and *Echinopsis peruviana* (Britton & Rose) used for cold and cough have been found as new ethnomedicinal record in Bangladesh. The local people also used plants in combination to effectively treat human diseases and disorders. *L. glutinosa* was mostly used for the treatment of dysentery and also reported for chest pain by the local people which is a new formularies. Leave extract of *Commelina benghalensis* was applied externally on eye often for the treatment of eye complain. Two to three spoonful dried powder of root of *Bombax ceiba* mixed with one glass of water than taken internally to decrease blood sugar was another new formularies reported by the local people of the study area. Same proportion of root of *Pandanus foetidus* mixed along with the leaves of *Azadirachta indica* and seeds of *Curcuma longa* to form paste which is applied externally for 7-14 days for the treatment of fractured bone and this formularies was also reported as new.

4.3 Threats to ethnomedicinal plants

Based on our own observation and local people opinion, a good number of medicinal species were found to be very rare in the study area because of over harvesting. Among the species, *Abroma augusta* (L.) L. f., *Asparagus racemosus* L., *Adhatoda zeylanica* Medikus, *Bombax ceiba* L., *Centella asiatica* L., *Cissus quadrangularis* L., *Datura metel*

L., *Glycosmis pentaphylla* (Retz.) A. DC., *Gloriosa superba* L., *Hyptis suaveolens* (L.) Poit., *Litsea glutinosa* (Lour.) Robinson, *Manilkara zapota* (L.) P. Royen, *Mimosa pudica* L., *Ocimum sanctum* L., *Oroxylum indicum* (L.) *Pandanus foetidus* Roxb. Fl., *Rauvolfia serpentina* (L.) Benth ex Kurz, *Sterculia villosa* Roxb. ex Smith, *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Phyllanthus emblica* L., *Terminalia chebula* Retz. and *Tinospora crispa* (L.) Hook. F. & Thoms are noteworthy. Lack of awareness among the local people about the importance of medicinal plants is the main threat to medicinal plants.

Some noticeable threats of the medicinal plants were modern agricultural practice, Industrialization, brick field, rapid urbanization & extension of household area, roads & highways construction, overpopulation, over harvesting, illegal and unsustainable collection, habitat degradation of wild plants, over exploitation of firewood, climate change and globalization, river erosion are also great threats to the different medicinal plants in the study area. The most serious threats are exotic timber species plantation in and around homestead, fallow lands, roadsides and even in cultivated lands. This exotic species in ecosystem also create great problem to native flora. Highest number of roadside plantation were *Acacia mangium* followed by *Acacia auriculiformis*, *Samanea saman*, *Swietenia mahagoni*. *Leucaena leucocephala*, *Dalbergia sissoo* and *Eucalyptus* spp.

Sometimes this species cause environmental harm to medicinally important plants. Social forest department provides the seedling of those plant species to the local people and these seedlings were also available at local nursery in the study area. As a result these seedlings were available for tree plantation programme in the area rather than other native important plant species. These exotic species were not eco- friendly birds or other animals. Based on our observation and opinion of the local people the chirping of the local birds became disappeared day by day.

One of the traditional healer said that 80% primary disease can be recover by the use of native plant species. These can be possible if the local government took the necessary steps to conserve and promote the medicinal plants. Water pollution and decrease of number of water body were another threat for the medicinal plants and their conservation. A polluted canal was seen in the Akhaura border area which was coming from the neighboring country. This water canal mixed into the awaragang and cross over into the mogra and debogram union of akhaura upazila which ultimately fall into the titas river. Wastage including polybags, plastic pot, bottl, food wastage, canes comes with the dark blackish water flow. Mosquitoes and odor from this polluted water cause the harmful impact to the people live around this area. The polluted water flow also responsible for the death of plant species. During the flash flood the situation get more dangerous. The polluted water mixed with cultivated land and which causes great problem for the growth of crops and medicinal plants. Not only medicinal plant these polluted water also cause of soil

pollution, increase the toxicity of soil and drinking water. Aquatic medicinal plant species such as (*Ipomoea* spp. *Ludwigia* spp.) highly effected by the water pollution. One of the main causes for decrease of number of medicinal plant species were the decrease of water body in the study area. Rain fall of the study area gradually decrease and temperature became increased. As a result total ecosystem becomes broken up.

One of the positive traditional agriculture system was observed that the local people use the *Lannea coromandelica* (zigagach) to make fence for many climbing unisexual plant species such as Potato, Cucumber, sweet pumkin for quick pollination. But sometimes ponds are digging middle of the cultivated land and Acacia plants were planted around the pond which is very much harmful for the environment.

The establishment of community clinic is in many rural areas and that may change gradually the existing pattern of indigenous knowledge based system of healthcare. But women and people are preferred to use plant based medicine. Recently, they are losing their precious heritage of plant use indigenous knowledge because of, industrialization and urbanization. At present younger generation lost the interest to continue their parental tradition because it does not provide them proper financial support for their livelihood. If these conditions continue, their traditional knowledge of plant uses will be lost rapidly.

Now, it is a burning necessity to document their ethno-medicinal use information to protect them from disappearing. This information can be the source and help the modern researchers in the discovery of new drugs. Bangladesh is a developing country with the vast majority of people living in rural areas with inadequate access to modern doctors and clinics. Moreover, such doctors, clinics and allopathic medicine are not affordable to these people. As such, any scientific studies carried out with medicinal plants used traditionally and involving pharmacological activity studies, isolation and identification of bio-active components, followed by clinical trials can go a long way in mitigating the sufferings of these poor illiterate communities, for these plants are still to some extent available and easily affordable. From that view point, ethnomedicinal studies like this can support scientific interest leading to scientific validation of traditional uses of medicinal plants. The other relevant point in such studies and findings can be useful for conservation efforts in preserving both plants and knowledge of their uses, for both are fast disappearing because of rapid deforestation caused from increases in population, and rural people forgetting their traditional knowledge because of the introduction of ‘city culture and habits’. Plants have always a good source for many efficacious allopathic medicines and thorough documentation of traditional ways of using medicinal plants to cure various diseases can provide a modern day scientist with important research material and ideas to conduct relevant disease alleviating reason.

The present study in Brahmanbaria district is the first attempt to record and document ethnomedicinal plant species which can serve as a basis for the future investigation of new medicinal plant resources. The record of total 247 medicinal plant species under 89 families is the indication of rich medicinal floral diversity of the district. The record of total 73 ailments and 485 formularies are another indication of diversity of traditional health care knowledge using medicinal plants of the district. Among the 247 medicinal plant species, four species are new for Bangladesh. Among the 485 formularies recorded in the study area, 96 formularies using 77 plant species seemed to be new for Bangladesh, both cases further studies are needed. Available scientific research validates the use of a number of plants by the local people. Many people in the study area are very knowledgeable informed about medicinal plant especially elderly men and women. Recently, they are losing their precious heritage of plant use indigenous knowledge because of, industrialization and urbanization. Some of the reported plants were found extinct and rare in the study area. Unsustainable collection of medicinal plants by the local people and drugs traders considered as major causes of reduction of medicinal plants from nature. Lastly, Plant species with high citation, F_{ic} and Fl values could be subjected to over harvesting need to be under conservation programs in the district.

4.4. Conservation of potential ethnomedicinal plants

Conservation approaches should be applied to the study area for sustainable use of ethnomedicinal plants. Some possible suggestions were as followed-

- Government and non-government organizations should be participated in awareness raising programme to minimize the loss of important ethnomedicinal knowledge.
- The traditional medicine practitioners must be encouraged and protected.
- Sustainable conservation strategies should be taken to avoid depletion of naturally growing ethnomedicinal flora.
- Rare and threatened medicinal plants should be brought under *ex situ* conservation plan.
- Social forest department should take appropriate program for plantation of important ethnomedicinal plant
- Commercialization of the production of suitable medicinal plant species and primary processing will need to be developed
- Necessary steps should be taken by government to reasoning the threats of aquatic ethnomedicinal plants due to polluted water at the border area.
- Widely used and potential medicinal plant species should be brought under social and government plantation programs

- For the renewable natural resource conservation, potential plants can be increased using nursery and propagation techniques

4.5. Antibacterial activity

Based on the ethnomedicinal survey the important plant species which attained the highest F_{ic}, Fl and Cf values were further selected for antibacterial activity to validate their traditional use in the study area. Over the last five years, more than 800 ethnobotanical studies have quantitatively analyzed data; nearly 90% of these studies are about medicinal plants (Andrade-Cetto and Heinrich 2011). King *et al*. (1996) mentioned that it is possible to obtain at least 50% of success with the medicinal plants collected by consensus analysis. In order to identify the most important ethnomedicinal plants in the study area, Factor of informant consensus (F_{ic}), Fidelity level (Fl) and Citation frequency (Cf) of medicinal plants have been calculated. Maximum F_{ic} value was found in case of diarrhoea and dysentery category. This disease category was treated by 51 ethnomedicinal plant species by the local people of Brahmanbaria district. Among 51 ethnomedicinal plant species, most cited species were *Litsea glutinosa*, *Scoparia dulcis*, *Dalbergia sissoo*, *Clerodendrum viscosum*, *Holarrhena antidysenterica*, *Phyllanthus reticulatus*, *Paederia foetida* and *Stephania japonica.* Though *Centella asiatica* was frequently mentioned for diarrhoea and dysentery category but was not selected for antibacterial activity tests, as this was studied earlier (Ferdous *et al*. 2017). Previous antimicrobial studies (Hoque *et al*. 1986, Rahman and Anower 2007; Rahman *et al*. 2008, Yasmin *et al*. 2009, Molla *et al*. 2010, Chowdhury *et al*. 2013, Ismail *et al*. 2013, Haque *et al*. 2014, Mostafa *et al.* 2014, Hossain *et al*. 2014, Oly *et al*. 2014, Tahia *et al*. 2016) were carried out with a number of medicinal plants in Bangladesh. But those studies were not done by selecting ethnomedicinal plants through consensus analysis with those selected ethnomedicinal plants.

In the present study both the aqueous and ethanol extracts of leaves of selected plants were screened for antibacterial activity through disc diffusion assays (Bauer *et al*. 1966) against eight clinical strains belonging to Grampositive bacteria *Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus cereus* and Gramnegative bacteria *Escherichia coli, Pseudomonas aeruginosa, Salmonella paratyphi*, *Shigella dysenteriae* and *Shigella boydii. Litsea glutinosa* was the most effective in retarding clinical bacterial growth followed by *Dalbergia sisso*, *Scoparia dulcis*, *Holarrhena antidysenterica* against 3 and *Clerodendrum viscosum* against 2 tested bacterial strains. *Paederia foetida* and *Phyllanthus reticulatus* were effective only against *E. coli* and *S. aureus* respectively and *Stephania japonica* did not showed any antibacterial activity.

Maximum zone of inhibition was found in case of aqueous leave extract from *Litsea glutinosa* against *E. coli* (21.6 ± 0.33mm) at 10mg per disc and minimum zone of inhibition found for aqueous leave extract from *Holarrhena antidysenterica* against

B. subtilis (9.4±1.05 mm). The species showed antibacterial activities, the MICs were higher than 4mg/ml. In this research *Litsea glutinosa* occupied the highest antibacterial activity (against 5 bacterial strains) of the total selected plants. In this particular study aqueous extract displayed a better MIC when compared to aqueous against both Gram positive and Gramnegative bacteria and this could have attributed to its potent extraction capacity. Haque *et al*. (2014) reported more or less same result from the bark and leave extracts where the best result was found against *S. aureus* and *E. coli*. Hosamath (2001) reported the petroleum ether extract, ethanolic extract and aqueous extracts of the *Litsea glutinosa* bark have the antibacterial against *S. aureus*, *E. coli*, *S. typhi* and *P. aeroginosa*. Antibacterial activity have been found against *B. cereus* and *S. dysenteriae* has not yet been found in previous study.

The crude extracts of *Dalbergia sissoo* showed significantly the highest mean zone of inhibition against *B. cereus* followed by *E. coli* and *S. aureus*. Bahera *et al*. (2013) reported the hexane extracts of *Dalbergia sisoo* exhibited activities showed no activity against *S. aureus* at 40 µl but showed good activity against *E. coli.* Subedi *et al.* (2017) also reported the anti-bacterial activity of methanol extracts of leaves was found to be more as compared to other extracts. *S. aureus* was found to be more susceptible to *D. sissoo* plant extracts than *E. coli.*

Scopria dulcis possesses a good antibacterial activity against *S. aureus* and *E. coli* which was significantly highest (p <0.001) than *B. cereus*. Uma *et al.* (2014) found that the phytochemical investigation showed the presence of alkaloids, carbohydrates, flavonoids, phenolic compounds, resin, saponins, steroids, tannins, terpenoids, protein and volatile oils. The antibacterial activity of the different concentrations of different extracts of *Scoparia dulcis* against *Klebsiella pneumonae* and *E. coli*. Wankhar *et al*. (2014) reported the antimicrobial activity of the plant were tested by broth dilution method ranging from 8-256mg/mL and the minimum inhibitory concentration (MIC) were determined when there is positive or negative growth of the tested microorganism on the nutrient agar plates. Thus, justifying its efficacy as a potential broad spectrum antimicrobial agent which matched with the present result.

Holarrhena antidysenterica showed better antibacterial activity than *Clerodendrum viscosum* in the present study. The bark of *H. antidysenterica* is a popular used plant parts and has been thoroughly studied (Ballal *et al*. 2001). Niraj and Varsha (2015) reported the antibacterial activity form extracts of seed of *H. antidysenterica*. In the present study people of the Brahmanbaria cited the uses of leaves for diarrhoea and dysentery. So that extracts of leaves were tested for antibacterial activity and result obtained that the ethanolic and aqoueos extracts showed mean inhibition zone against *E. coli* followed by *S. aureus* and *B. subtilis* which was not co-related with previous studies (Kundal and Sagar 2016).

In case of *Clerodendrum viscosum* leave extract showed activity against *E. coli* and *S. boydii* which matched with previous studies (Ashoor *et al.* 2018, lobo *et al*. 2010 and Islam *et al.* 2014). However, the *Litsea glutinosa* extract acted against more bacterial strains and had lower MIC values than that of *Scoparia dulcis*. The extracts with the least MIC values were from *Litsea glutinosa* (4 mg/ml), *Dalbergia sissoo* (4mg/ml) and *Scoparia dulcis* (8mg/ml). MBC value was found only from ethanolic extracts of leaves of *Dalbergia sissoo* at 32 mg/ml against *E. coli*.

Phyllanthus reticulatus and *Paederia foetida* showed less antibacterial activity against *S. aureus* and *E. coli* respectively. Islam *et al*. (2008) conducted antibacterial activity test for *P. reticulatus* and the result obtained antibacterial activity against *S. aureus* which matched with present study but antibacterial activity against *P. aeruginosa* did not matched with the present study. Morshed *et al*. (2012) showed that the methanol extracts of whole plants of *Paederia foetida* not possess antibacterial activity but, the n-hexane, chloroform & ethyl acetate fraction of the plant have moderate to less antibacterial functions against some strains and the methanol extracts have cytotoxic activity which support the present result also.

It was found that about 85% of the selected species presented antibacterial activity. This result is an evident of the effectiveness of the ethno-directed method (Canalesa *et al*. 2005). The information of the uses of the leaves of *Litsea glutinosa*, *Dalbergia sissoo, Scoparia dulcis, Holarrhena antidysenterica* and *Clerodendrum viscosum* provided by the people of Brahmanbaria is an agreement of the present results found in antibacterial activities.

Cytotoxicity test of *Litsea glutinosa*, *Dalbergia sissoo* and *Scoparia dulcis* were demonstrated in Vero cell line. Cytotoxicity was not found from extracts at 10mg/ml concentration which indicate that the plants part using by local people are safe. Further and more specific studies, *in vivo*, are recommended to determine the efficacy of these ethnomedicinal plants.

It was observed that there is a positive co-relation between the citation frequency and antibacterial activity of ethnomedicinal plants in the study area. Important species obtained by quantitative analysis showed highest antibacterial activity which scientifically validate the traditional uses of ethnomedicinal plants in the study area. The results of the present study increment the ethnomedicinal uses of the studied plants which possess antibacterial properties. By isolating and identifying bioactive compounds from these plants new drugs can be formulated to treat various infectious diseases. Further phytochemical and pharmacological studies are necessary to utilize these ethnomedicnally important plants successfully. Ethnomedicinal plants with high antibacterial activities are always vulnerable

to extinction in nature because of over harvesting. The ethnomedicinal plants showed antibacterial activity that could be subjected to over harvesting needed to bringing them under conservation programs in the district. Almost all parts of the *Litsea glutinosa* are used traditionally but only the bark has high commercial value and in fact it is over-harvested unscientifically causing the death of the trees throughout its distribution range including India, especially in the northeastern region. Medicinal plants, habitat and local healthcare knowledge are in jeopardized condition due to so many threats like lack of awareness, climate change, illegal and unsustainable collection, urbanization. Appropriate policy should be taken and applied in ethnomedicinal plants management for sustainable local resource conservation, economic growth, primary healthcare, community development and drug discovery research.

4.6. Conclusion

The present study is the first time effort to evaluate antibacterial activity of ethnomedicinal plants of Brahmanbaria district. The results indicated that the study area is rich in ethnomedicinal plants and diversity of knowledge of medicinal uses in the primary health care. Based on literature survey among the recorded 247 ethnomedicinal plant species, four species recorded new for Bangladesh. Among the 484 formularies, 96 formularies using 77 species appeared with new use for Bangladesh. The ethnomedicinal plants *Litsea glutinosa*, *Dalbergia sissoo* and *Scoparia dulcis* (used for diarrhoea and dysentery), *Adhatoda zeylanica*, *Echinopsis peruviana* and *Leucus lavandulaefolia* (used for respiratory tract infection), *Coccinea grandis* and *Ficus racemosa* (used for diabetic), *Eclipta alba* and *Butea monosperma* (used for Gyenoecological), *Cissus quadrangularis* and *Aerva sanguinolenta* (used for masculoskeletal disease), *Cuscuta reflexa* and *Ananus sativus* (used for Helminthiasis), *Bacopa monneiri* and *Streblus asper* (used for mental disorder), *Terminalia arjuna and Achyranthes aspera* (used for cudiovascular disease), *Andrographis paniculata and Cajanus cajan* (used for fever and pain), *Kalanchoe serrata* and *Ricinus cuminis* (used for dental problem), *Ageratum conyzoides* and *Achyranthes bidentata* (used for jaundice) are most preffered, popular and with highest fidelity (Fl) values which proved culturally important species. The ethnomedicinal plant species those attained high values of citation, F_{ic} and Fl further subjected to ethnopharmacological research to validate the effectiveness and efficacy of traditional and herbal health care knowledge of the district.

The ethno-directed method help us to select potential ethnomedicinal plants for the study of antibacterial activity. Among the tested ethnomedicnal plants 85% were demonstrated antibacterial activity. The ethnomedicinal plant species with major consent values showed biggest antibacterial activity that validate the traditional use of ethnomedicinal plant species in Brahmanbaia. The best antibacterial activity was found in *Litsea glutinosa* followed by *Dalbergia sissoo*, *Scoparia dulcis*, *Holarrhena antidysenterica* and *Clerodendrum*

viscosum. These ethnomedicinal plant species could be the potential source of new antibacterial agents. Most of the cases aqueous extractives showed highest antibacterial activity also validate the the traditional mode of administration of the ethnomedicinal plants. Further and more specific studies, *in vivo*, are recommended to determine the efficacy of these ethnomedicinal plants. This research work was also affirming that interdisciplinary studies including ethnobotanical, pharmacological, ecological and ethnomedicinal data are required to redound the benefits for the traditional medicine.

Ethnomedicinal plants with high antibacterial activity are always vulnerable to extinction in nature because of over harvesting. The present analysis of ethnomedicinal data of the district have been brought into focus a good number of economic potential ethnomedicinal plants those need to be care for commercialization and conservation. Ethnmedicinal plants, habitat and local healthcare knowledge are in endangerment condition due to so many threats like lack of awareness, climate change, illegal and unsustainable collection, urbanization. So sustainable conservation strategies should be taken to avoid depletion of naturally growing ethnomedicinal plants. This work is significant as it helps the conservation of medicinal plants knowledge and constitutes a written document for the next generation. Results of this study will ease decision making for the conservation of the study area. Local people will be aware of known plant in properties which exist in the area. They could benefit traditional knowledge they reveal to the scientific community especially regarding the discovery of new medicines. Lastly, In order to save important ethnomedicinal plants of Brahmanbaria district, conservation program is highly recommended. Further and more specific studies, *in vivo*, are recommended to determine the efficacy of these ethnomedicinal plants. The ethnomedicinal plants showed antibacterial activity that could be subjected to over harvesting needed to be under conservation programs in the district.

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Appendix

Data sheet development: For the ethnobotanical data collection suitable questionnaire and data sheet have been developed. The sample forms given below**:**

Questionnaire data sheet

Data sheet

Informant name: Mohiuddin Date: 27.07.2016 Age: 50 Gender: male

Location: Akhaura Religion: Islam Education: Class five

Profession: Farmer

Local/scientific/ bangle name	Family	Part used	Ailment name	Treatment mode
Menda	Lauraceae	Leaf	Dirrhoea	Juice taken internally
Adamoni	Apiaceae	Leaf	Dirrhoea	Juice taken internally
Borun gach	Capparaceae	Leaf, Seed	Dirrhoea	Paste taken internally
Pathor kuchi	Crassulaceae	Leaf	Dysentery	Paste taken internally
Neem	Meliaceae	Leaf	Skin disease	Paste applied externally

Cultivated/ Wild .....

If cultivated, cultivated for…….....

If wild, availability in natural resources (easy/ difficulty/ very difficult)…….....

Conservation needs……..…….....

Factors responsible for the degradation of medicinal plants…….....

What is your suggestions for conservation.....…….....

Conservation efforts made by Government and local residents…….....

Remarks:

Plant identified as …… (Botanical name and family)

Voucher specimens number: ……

Apparatus and Reagent

Autoclave	**Sterile forceps**
Sterile cotton	Test tubes
Mueller Hinton agar medium	Mortal & Pestle
Micropipette	Inoculating loop
Laminar air flow	Spirit burner
Refrigerator	Incubator
Ethanol (70%)	Petri dishes
Distilled water	sterile glass container

Disc (ADVANTEC, Disc for antibiotic Assay;

Toyo Roshi Kaisha, Ltd. Japan).

Composition of medium

Composition of Mueller Hinton Agar Medium

Ingredients	**Amount**
Beef extract	300 gm
Peptic digest of animal tissue	17 gm
Agar	17 gm
Starch	1.5 gm
Distilled water	1000 ml
pH	7.3-0.2 at 25^0C

(Titan Biotech LTD. Bhiwadi-301019, Rajasthan, India)