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DECLARATION

I, Tama Ray, hereby declares that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree, except where due acknowledgement had been made in the text.

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Dedicated

To

My beloved Family

Acknowledgement

First, I would like to the almighty God who has enabled me to complete this thesis paper.

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Finally, I would also like to express my special thanks to all professors, lecturers and classmates of my University who have helped me to complete my thesis work.

Abstract

Quantitative Ethnobotany has drawn attention of scientists all over the world to explore and generate reproducible information of traditional and cultural use of plant species. Local old people are considered as the store house of ethnobotanical knowledge. An ethnobotanical investigation was carried out in Batighata upazilla in Khulna division. Three villages named Goriardanga, Katianangla and Kismat fultala from Batiaghata upazilla were selected. Fidelity level, Cultural significance index, Plant family use value was calculated from study. In the study area, a total of 90 people were interviewed and 138 plant species were found belonging to 53 families. Among them, Fabaceae family has the highest number of species. It helped to identify which type of species is used more, which species has cultural value and how is the species composition of those areas. From the study it has been proved that all the plant species have different degree of preferences and use and people keep those plants under their custody as long as they have their usage.

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Abbreviations

F- Food Purpose

C- Construction Purpose

M- Medicine Purpose

F- Fuel Purpose

Or- Ornamental Purpose

O- Other Purpose

Chapter One

Introduction

1.1 Background of the Study:

From the ancient time, communities depend on plants for different purposes like food, forage, medicines, house construction, making household implements, firewood, sleeping mats and shade along with ritual and commercial values of plants (Dalle, et al., 2005). Traditional indigenous knowledge of communities involving the uses and management of plant resources is very important and widespread (Singh, et al., 2002).

With the passing days, different types of species are becoming extinct because of lack of transmission of knowledge of the importance of plants from age old generation to the young. As a result, the knowledge along with the species is being lost with time (Idu, 2009; Kargioglu et al., 2008).

So, the biological diversity and its associated indigenous knowledge are needed to conserve and that's why different investigation on ethnobotany have been emphasized (Singh, et al., 2002) where ethnobotany is the relationship between people and their dependency on plants (Balick and Cox, 1996).

Knowledge of the age-old people of plants is a major feature of ethnobotanical exploration because they have the information and understanding on the numerous uses of plants (Singh, et al., 2002). At the same time, they have conventional ecological knowledge that has fundamental significance in the organization and management of local plant resources (Singh, et al., 2002).

In this ethnobatanical study quantative ethnobotany approaches was taken to collect, analysis and present information because quantitative ethnobotany allocates systematic, repeatable and explicit data collection. It also provides potential variables that are needed for hypotheses testing and statistical analyses. It is also applicable to make a comparison of cultural importance and uses of different plant taxa among different communities (Avocèvou-Ayisso et al., 2011).

Batiaghata is such a place under Khulna district which was selected as study area to get ethnobotanical information. From the investigation it was found that the area is rich of

biodiversity and people are very much interested in species conservation although young people are not so conscious about that knowledge. They are conserving species in the form of food, construction, medicine, and other purposes. Knowledge transmission is not as much as it should be.

1.2 Objectives:

- To identify species composition and diversity.
- To know the uses of species.
- To examine ethnobotanical knowledge transmission from old to young.

Chapter Two

Literature Review

2.1 Ethnobotany:

Ethnobotany deals with scientific inquiry of plants as their usage in native culture for food, shelter, building, household implements, musical instruments, clothing, pesticides, medicines, rituals, fuel wood and other purposes (Kelbessa et al., 2004 and Kumbi, 2007). The word 'Ethnobotany' was first created by Harshberger in 1895 (Harshberger, 1896) for the study purpose of plants used by prehistoric and indigenous people (Trivedi, 2002). At present, it is a fast growing field of science and people with the extensively varying academic environment and interests are being attracted to it (Martin, 1995). Scientists are searching for ways to preserve this knowledge and to test them (Martin, 1995).

Ethnobotanical research contains documentation of people's way to classify and identify the plants along with taxonomic identification as well as biological and chemical analysis of the components. It investigates the relationship between plants and people and how they interact with each other (Balick and Cox, 1996).

2.2 History of Ethnobotany:

Peoples have rich culture and tradition of dependency on plants for their primary requirements viz. food, shelter, warmth, medicines, etc. To fulfill their primary requirements, they have learned are developed various uses of plants naturally and traditionally (Idu, 2009). With the passage of time, this ethnobotanical knowledge has been shared with communities and transferred from generation to generation. In this way, important knowledge regarding use of plant species has been stretched out around the world and played important role in distribution of plants (Idu, 2009).

The bounty of rich diverse environments of the world supply numerous flora having medicinal value which have been utilized by indigenous people and the indigenous uses of plants have evolved with time and have been benefited from those knowledge for centuries (Martin, 1995).

But today, Ethnobotany has become a burning topic. There are many reasons behind it. The most important is the vanishing of this important knowledge and less accessible to the present world (Martin, 1995). Thus ethnobotanical research is not only required for conserving indigenous knowledge but also for culture and tradition attached to these uses.

2.3 Importance of Ethnobotanical knowledge:

The tribal territories are considered as the store of knowledge and information on the numerous uses of different plants (Singh et al., 1991). Preservation of this knowledge is important for several reasons.

2.3.1 Food security:

Dietary habit of human is changing in all over the world. New foods are adding up and old traditional foods are replacing replaced with processed corporate ones.and According to WHO this can be disadvantageous to health and well being in the long run. As a result, loss of food stuff as well as loss of the cultural knowledge of the production, harvesting, processing, and use of the food is occurring. Overturn the tendency to get back use and to develop knowledge about food and to restore it into the diet is possible and it is potential when considered it as advantageous for health, cultural, or other reasons. For the purpose of this, combination of contemporary methods, such as publications, informational videos, and interactive multimedia is necessary in the company of traditional methods to show value for traditional food. For example, rebirth of pit-cooking as a conventional cooking technique for root vegetables and other foods (Nancy, 2008).

Different people have different taste of food. They use different plant species types of to prepare their food materials and people generally get combination them from of diverse group of species that may constitute vegetables, salads, fruits and spices. From those local communities such as pasta, olive oil, wine etc. It helps to enrich the food elements outside of its origin. These edible plants are may come from crops, wild plants and weeds (Heinrich et al., 2006). These food elements have the positive effect on health also. Such as, the Mediterranean diet is considered as valuable for high in monounsaturated fat and dietary fiber as well as being low in saturated fat. It also has high salt content (Colombo et al., 2012). This transferred knowledge helps to conserve these plants as they are used by the native people and also by the people outside of that region.

2.3.2 Medicine security:

From the beginning of human life, people were affected with various types of diseases and they used various components of plants, animals, insects and minerals to get rid of them.for their treatment. Since About 5000 years ago, people were aware of different medicinal properties of plants and from then this type of medicine played a important role for the treatment of human besides the introduction of allopathic medicinebeing. The discovery of some commonly used medicine like Aspirine, astropne, quinine, reserpine, morphine, ephedrine etc was the close observation of the traditional medicinal practices of on human being. Through the documentation of these medicinal plants and their practices, scientists as well as human being can gain knowledge on the isolation of bioactive constituents of different medicinal plants. So, the knowledge can aware people for the conservation efforts of these plants which are becoming endangered as well as extinct through deforestation and over use (Kabir et al., 2014).

2.3.3. Cultural diversity conservation:

People have been using plants for worshipping gods and goddesses to have protection and betterment of their lives. They try to pacify the spirit for the fear of getting attacked by them and eventually attempt to resort worship to them for the dread of getting cursed. This worshipping is closely related to vegetation. Tribal people preserve many species through their duties from birth to death. They use different plant parts like twigs, leaves, flowers, fruits, seeds and so on while carrying out their traditional rituals. So, often they plant their required species in their religious institutions. They also plant some species from which they feel scared sacred and refrain themselves from cutting down these plants. As a result they preserve many species that are needed in many ritual purposes (Sharma et al., 2011). So, by preserving cultural beliefs, it is possible to protect vast amount of trees from destruction. On the other hand, enthnobotany helps to conserve cultural diversity of tribal people.

2.3.4 Biodiversity Conservation:

Biological diversity is the result of millions of years of evolutionary process. Human race has been dependent on plants both for their material needs and emotional needs since its evolution. People have developed intimate relationship with the surrounding vegetation. Such a close interaction prevails among various tribal communities throughout the world. The ifteraction has

enabled to evolve a unique system of knowledge on the utilization and conservation species. In traditional societies, sustainable natural resource management is driven by the beliefs and behaviors of human communities, local cultures and by their intimate connections to the natural environment (Rist et al 2003). Evidence offered in support of this characterization includes culturally expressed conservation ethics, animistic religious beliefs conceptualizing other species as social beings, and the relatively higher richness of biodiversity found within sacred forests (Duming 1992; Gadgil et al 1993; Callicott 1994; Alcorn 1996; Bodley 1996; Bernbaum 2006). Traditional knowledge show prudence and ecological wisdom in resource utilization which helps to conserve biodiversity. Local people conserve traditional knowledge of agriculture and its techniques. Human, People experienced in natural resource local ecosystem management and management of plant resources of forest are dependent on these natural resources. Here agriculture and wildlife are combined and about 1.2 billion people have been using agroforestry system in the world.

Agricultural areas and their functions are at risk due to transformation of ecosystem and the rest are fragmented and degraded. As these areas are favorable for flood control, watershed recharge, biodiversity conservation, carbon storage, so their degradation is responsible not only for above importance but also affect hydrological system, water contamination and sediment increment.

People who depend on the diversity of products produced by forests became worries due to ecosystem degradation and biodiversity declination. To conserve them current societies and local people need to come forward to make a combine strategy (Vallejo et al., 2015).

2.4 Reasons behind Knowledge Declination:

There are many reasons behind the declination of ethnobotanical knowledge. One of the most important is the changing life style. Scientific rationalism often treats objective and sacred knowledge as separate sphere which accelerate the disintegration of traditional knowledge (Malhotra and Mark 1989; Joshi 1992; Kumbhojkar and Kulkarni 1998; Negi 2003, 2005). There are many reasons behind the erosion of ethnobotanical knowledge. One of the most important is the changing life style. People are changing their food habit, food materials and their management system and helping in diminishing ethnobotanical use of resources.. So, traditional knowledge is being lost (Singh et al., 2012).

Another reason is that there is Limited documentation of this knowledge and lack of knowledge diffusion from generation limiting use and practice of ethnobotanical use of plant resources. When the healers and tribal people are becoming aged and dying; their knowledge is also dying with them. So, not only a lot of the conventional methods and knowledge of medicinal flora are being lost with to time, but also people are becoming alien to these species and endangering the mere existence of these species losing the necessity of planting tree species as they are unknown of them (Idu 2009; Kargioglu et al., 2008). As a result, modern science is facing the problem of access and failing to get advantage from these implausible assets of material and information (Martin, 1995).Besides, healers follow extreme secrecy about their medicinal practices. So, people are unable to know about them and knowledge exchange hampered (Singh et al., 2012).

Ethnobotanical investigations among existing rural populations of industrialized countries have achieved ever growing focus in the last decades (Idolo et al., 2010). A large indigenous knowledge of the native people depending on the complex ecology and system of utilization in the vicinity has been accumulated over a period through observations (Sharma, et al., 2014).

Besides, healers follow extreme secrecy about their medicinal practices. So, people are unable to know about them and knowledge exchange hampered (Singh et al., 2012).

In addition, declination of knowledge is happened due to discontinuation of this knowledge between the older and younger generation. If two generations are not attached, the persistence of this knowledge will be endangered (Kargioglu et al., 2008).

So, the exploration of plants and their uses is one of the most prime concerns of human now. Ethnobotanical investigations among existing rural populations of industrialized countries have achieved ever growing focus in the last decades (Idolo et al., 2010). A large indigenous knowledge of the native people depending on the complex ecology and system of utilization in the vicinity has been accumulated over a period through observations (Sharma, et al., 2014).

2.5 Components of Common uses in Ethnobotany:

Ethnobotany is the interdisciplinary study of plant-human relationships embedded in a complex and dynamic system of natural and social components (Alcorn, 1997 and Heinrich, 2011). In the second half of the twentieth century, this discipline has been established as an academic as well as research entity activity (Trivedi, 2002). It comprises the relationship for food, shelter, building, household implements, musical instruments, clothing, pesticides, medicines, rituals, fuel wood and other purposes (Kelbessa, et al., 2004 and Kumbi, 2007).

2.5.1 Medicine:

Ethnobotany deals with the relationship of the people of indigenous culture and the plants especially for medicinal purpose (Trivedi, 2002).The World Health Organization (WHO) stated that almost 4 billion people that accounts for 80% of the world population initially use herbal therapy to resolve all of their health related issues. Additionally, 25% of the prescribed drugs which are sold in developed countries contain active ingredient of herbal source such as vinblastine, reserpine, quinine, aspirin (Farnsworth, et al., 1985). The current capacity of the medicinal plant market is anticipated to be just about 60 billion dollars (Kumar, 2009).

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Since past, historically different medicinal plants have been used as medicine for different ailments diseases. Andrographis paniculata was known for the treatment of Malaria, the high fever. It is called 'Kaalmegha' in Ayurveda. Justicia adhatoda was used in order to treating tuberculosis as well as skin infection. To treat stomach disorder Centella asiatica was used. Healers also used the fruit of Phyllanthus embelica to increase appetite. Garcinia cowa and Ocimum gratissimum were used to treat cough. Colocasia esculenta as well as Ocimum gratissimum were used for the treatment of rheumatic fever. For the treatment of tooth infection

Psidium guajava was used. Healers used the bark of Terminalia asrjuna to heal chest pain caused by heart disorders (Kabir et al., 2014).

2.5.2 Food:

Numerous plants are currently consumed by which ethnic groups in a definite geographical and cultural context. There are many diverse aspects behind the choice of a specific species as a food Abundance, accessibility, cultural fondness, processing knowledge of species, capability to collect it in the most favorable period and, also inherited features of the consumers is important considerations for a plant to be used as food. Those permit the safe consumption of the plant. The surprising matter is that most abundant edible plants are not sometimes actually consumed in localities where they are present. Sometimes they are used as 'famine food' in the restrictive group or fodder only. Sometimes they are simply neglected. Ethnobotany illustrates this choosy local food profile which is found at different balances. It happens from local to regional (Rivera et al., 2005; Heinrich et al., 2005).

2.5.3 Clothing and dyeing:

Plants Dyes have a widespread history of use in colouring food and clothing in different communities like Dong communities and other indigenous areas. Dye plants have also been utilized for enhancing the nutritive, medicinal and preservative properties of foods (Liu et al., 2014).

Plant dye was well accepted because of its non hazardous characteristics to human, wild life and environment. It sustained its popularity until Parkin discovered synthetic dye in 1856. The reasons behind the popularity of synthetic dye were its diverse colour shades and long lasting capability. But at present natural dye is obtaining its lost place due to having awareness among the new generation (Mongkholrattanasit et al., 2010). In the past, natural dye was used in cave painting (Siva, 2007). It was considered as symbol of culture by reflecting the status, class and region. Some people used pigments on their body to have environmental adaptation as well as ritual purposes (Samanta and Konar 2011). Since the past, people have been using Maddar, Indigo, Woad, Tumeric (Samanta and Konar, 2011), Henna (Dweck, 2002).

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Since the past, people have been using Maddar, Indigo, Woad, Tumeric (Samanta and Konar, 2011). Henna (Dweck, 2002) for producing plants.

2.5.4 Construction:

Different native people used different plant species for making house depending on their utility. One of such example is the usage of A. donax by Egyptians to line the floor and walls of underground grain stores (Gücel, 2010). It was also used as roofing material in North America (Robbins, et al., 1951)

2.5.5 Shelter:

For shelter purpose tribal people have used different suitable species from the ancient period such as A. donax was grown in Cyprus around riverbeds and lakes especially around citrus groves as a shelter for wind to protect flowers (Gücel, 2010).

In past, aboriginal people used different types of species for making musical instruments such as Arundo donax L. is to the genus Arundo. This species is considered as native to the Mediterranean Basin. The Pan Pipe wood wind musical instrument was made from A. Donax and is still being produced (Güce, 2010).

2.5.6 Household Implement:

A. donax was used for making basket-work, garden fences and trellises, chicken pens, crude shelters, fishing rods, arrows. A. donax was used by Egyptians to line the floor and walls of underground grain stores. The culm is still used in building a structural support for grape vines. It was also used as pulp and ornamental plants. The leaves were used as stuffing for pillows or mattresses. The culm and rhizomes are still used for walking sticks and the woven culm was used to build a "poor man's" grain bin (Güce, 2010).).

2.5.7 Musical Instrument:

In past, aboriginal people used different types of species for making musical instruments such as Arundo donax L. is to the genus Arundo. This species is considered as native to the Mediterranean Basin. The Pan Pipe wood wind musical instrument was made from A. Donax and is still being produced (Güce, 2010).

2.5.8 Ritual purpose:

Ritual faith is closely associated with sign of spiritual purity (Quiroz et al., 2015). People use different plant parts like twigs, leaves, flowers, and fruits for offering goddess to be protected from forest spirits and for the betterment of themselves (Sharma et al., 2011). Plants vary from region to region and also from people to people for ritual purpose. One of the excellent examples can be Mummies of the fourth century A.D. which were wrapped in Arundo leaves (Güce, 2010). Mising people believe that if they eat Centella asiatica as vegetable they'll not be disturbed by any spirit (Sharma et al., 2011).

2.5.9 Agrochemicals:

Local botanical and ecological knowledge often expose an outline that shows the peasantry is influenced by "great traditions" from the ancient period (Heinrich et al., 2006). In cultural history, insect species have always played important role such as Ectoparasitic insect. In the pre-modern North, having fleas and lice was really considered healthy. An extensive approach in northern Europe, including Estonia, was the use of a wooden board in which there were many small holes drilled into it in order to reduce bedbugs. According to human history, people also used many plant taxa as repellents and insecticides. Synthetic chemical insecticides were discovered in the 1930s. Until then, these plants were essential in fighting parasites (Sõukand et al., 2010).

2.5.10 Other purposes:

There are many other purposes of plants regarding Ethnobotany. Some examples are Arundo were used as fodder in past (Robbins, et al., 1951) and it was also used for horticultural propagation. Besides, it was used in gardens or for erosion control (Güce, 2010).

2.6 Revisit of Ethnobotany:

Around 6000 BC in India Ancient Ayurveda texts were originated in which more than 2000 medicinal plant species were described (Thatte and Dahanukar 1986; Narayana et al., 1998; Mukherjee and Wahile, 2006). Botanical study that is well known now started documenting the use of plants by humans after the work of Theophrastus in 375 BC (Kokwaro, 1995). Around 77 AD, a Greek surgeon named Pedanius Dioscorides wrote De Materia Medica where there was medicinal information about 600 plant species from the Mediterranean region (Osbaldeston, 2000). After that, exhaustive ethnobotanical data was collected in the 19th century. This data was accumulated through determined botanical explorations (Davis, 1995; Mauro, 1997). Then in the 20th century, the necessity of ethnobotanical studies was being diminished (Cox, 2000) and traditional knowledge worldwide was being lost (Turner, 1995; Cox, 2000) because of the advancement in different areas such as molecular pharmacology (Cox, 2000). Actually, traditional knowledge is unequally distributed like uneven distribution of biodiversity (Chavan and Krishnan, 2003). They are inaccessibleunaccessible and are accumulated in heterogeneous arrangement (Chavan et al., 2004). Some of them are stored in museums and herbaria in developed countries such as the Royal Botanic Gardens, Kew, UK. But recently curiosity in ethnobotanical studies has been rejuvenated. One of the important reasons is the successful innovation of novel drugs following an ethnobotanical approach (Fabricant and Farnsworth, 2001). For example, the detection of the antiviral drug originated from Homalanthus nutans (Cox, 2000). So, Ethnobotanical studies have been regenerated to collect diminished traditional knowledge as well as biodiversity and interest has also been renewed due to growing drug resistance in infectious agents (Singh, 2007). But a vast amount of ethnobotanical data is needed to be collected which is still scattered in different languages and formats with limited accessibility and application (Buenz, et al., 2004). According to statistics, there are more than 300,000 plants in the world (Govaerts, 2001) and among them approximately 25000 to 30000 plants are used in traditional medicines (Heywood, 1995). But the surprising thing is that less than 90 plant species are being used for acquiring drugs worldwide (Farnsworth, 1988). For complete accumulation of ethnobotanical data, there should be efficient conservation, judicious sharing of knowledge and technology for digitization.

Chapter Three

Methodology

3.1 Study Area:

3.1.1 Location:

The study was conducted in Batiaghata upazilla under Khulna district. Batiaghata is located at 22.7417°N 89.5167°E . Batiaghata upazilla has seven unions named Amirpur Union, Baliadanga Union, Batiaghata Union, Bhandarkote Union, Gangarampur Union, Jalma Union and Surkhali Union. It has 40779 units of house hold and total area 248.31 km^2. Total population of Batiaghata is about 171691. Among them male is 70169 and female is 69157. Muslim population of Batiaghata is about 109591, Hindu is about 61708, Christian is 386 and Buddhist is around 6. Batiaghata upazilla has seven unions named Amirpur Union, Baliadanga Union, Batiaghata Union, Bhandarkote Union, Gangarampur Union, Jalma Union and Surkhali Union. Three villages named Kismat Fultala, Katianangla and Goriardanga were selected from three unions purposively respectively Baliadanga Union, Gangarampur Union and Surkhali Union (District Statistics 2011, 2013).

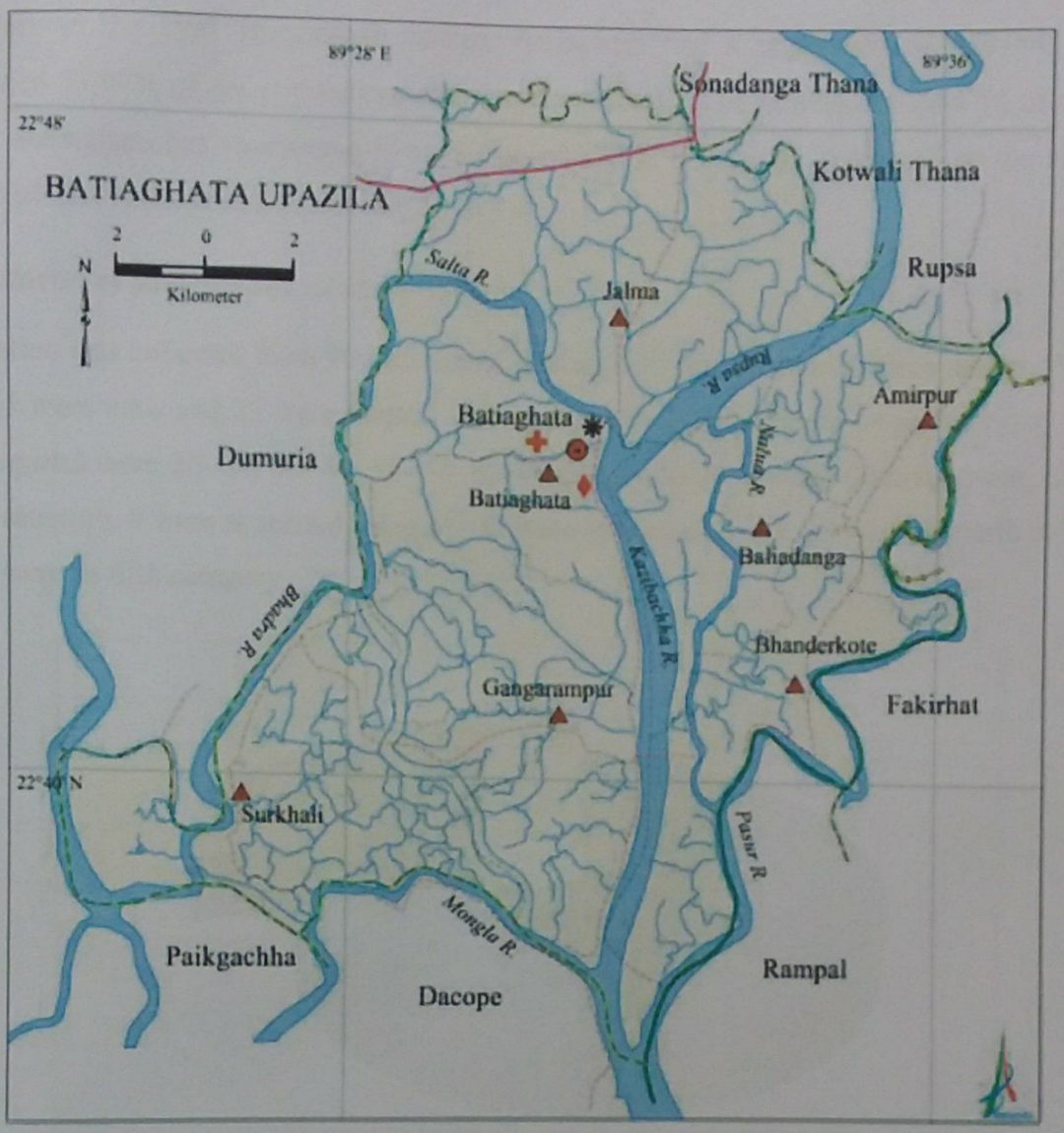

Fig 3.1: Location of Batiaghata Upazilla

3.1.2 Demograhic Structure of Batiaghata:

According to the 1991 Bangladesh census, Batiaghata had a population of 128184. Males constituted 51.07% of the population, and females 48.93%. The population aged 18 or over is 71,463. Batiaghata has an average literacy rate of 37.7% (7+ years), compared to the national average of 32.4% (District Statistics 2011, 2013).

3.1.3 Informant Information of study area:

Information was collected from 90 informants of three different villages of three unions. Among them, 65 were male and 25 were female. Informants were selected based on age category where the categories were 20- 34, 35- 49, 50- 64, 65- 79 and above 79. Among 90 informants, 13 were in first category, 9 were in second category, 12 were in third category, 39 were in fourth category and 17 were in fifth category.

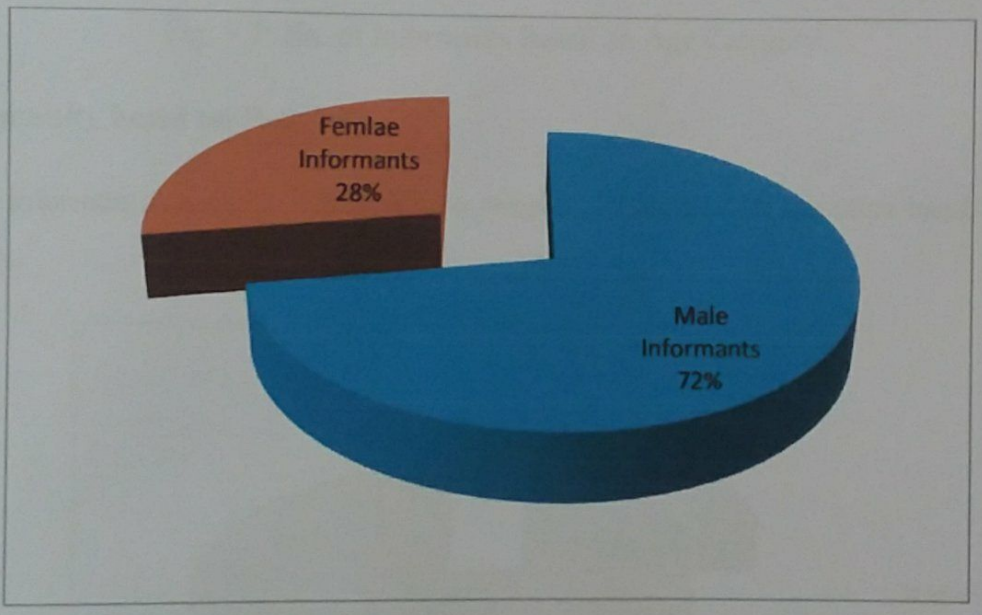

Fig. 3.2: No. of male and female informants

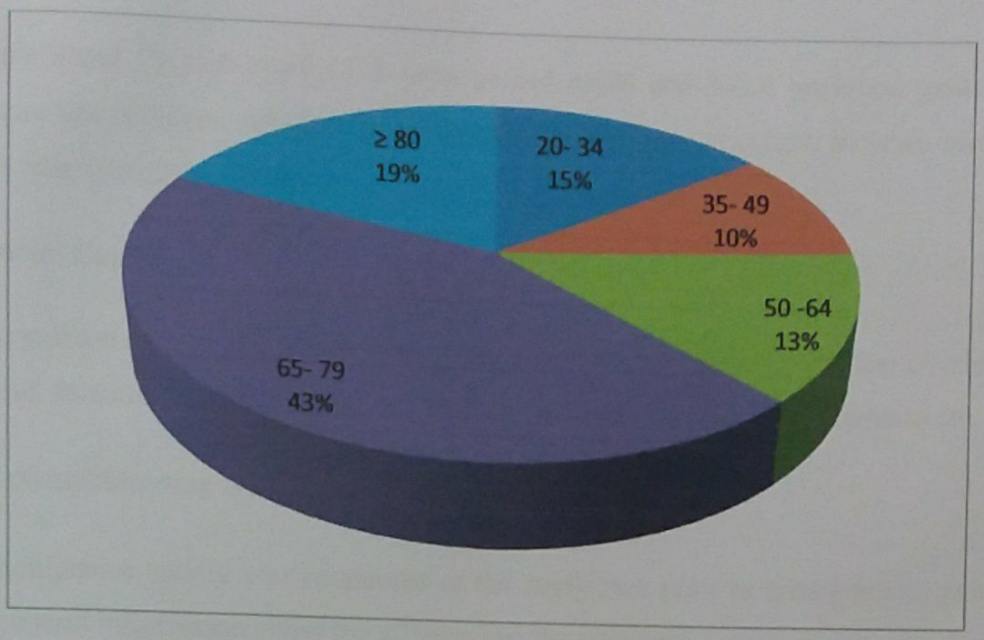

Fig. 3.3: No. of Informants Based on Age Category

4.1.4 Community based on Religion:

Among 90 informants, majority is from Hindu religion, 69 people. On the other hand, 21 people are Muslim.

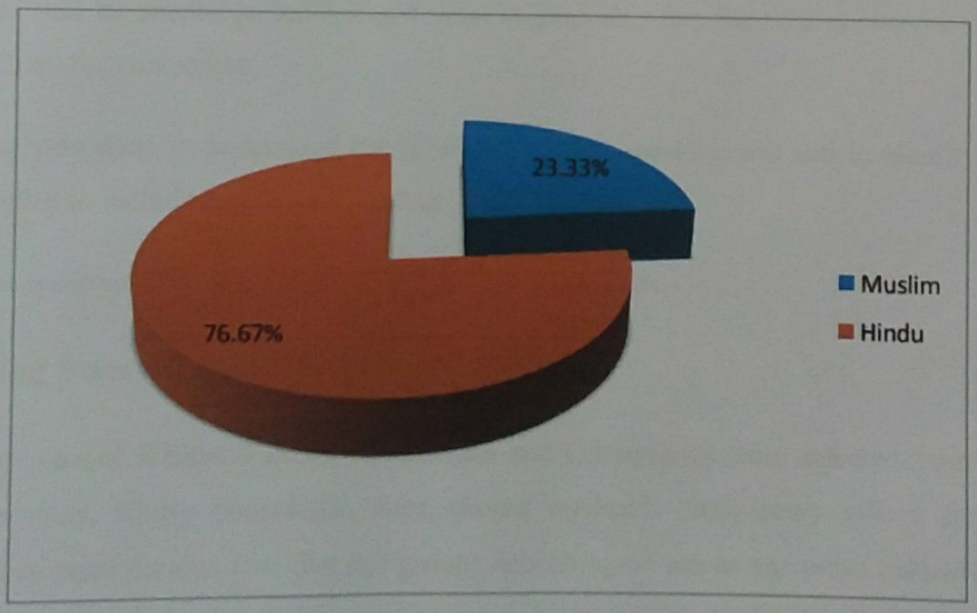

Fig. 3.4: Community based on Religion

3.1.5 Communication:

There are about 79 pich roads, 135 semi piched roads and 343.4 unpiched roads. People of Batiaghata use different vehicles for transportation like ban, rickshaw, bicycle, motor bike etc (District Statistics 2011, 2013).

3.1.4 Social Condition:

Social condition of Batiaghata upazilla is good and peaceful. Social interaction of inhabitants are very good. Inhabitants of Batiaghata are teacher, businessman, farmers, fisherman etc.

3.2 Reconnaissance Survey:

A reconnaissance survey was conducted in the study area prior to questionnaire preparation to obtain general information about the villages and the villagers.

3.3 Preparation, Testing and finalizing of Questionnaire:

A semi structured questionnaire was prepared based on reconnaissance survey and required information about Ethnobotany. It included the basic questions like name, property and profession. A test survey was done to understand the problems of that questionnaire and to identify what will be needed to include and what to exclude.After that, the questionnaire was finalized with all the corrections

A test survey was done to understand the problems of that questionnaire and to identify what would be needed to include and what to exclude.

After that, the questionnaire was finalized with all the corrections.

3.4 Sampling Selection of Interviewees:

Three villages named Kismat Fultala, Katianangla and Goriardanga were selected from three unions purposively. Thirty households were chosen randomly from every village for data collection. They were divided into five age groups depending on age as age plays distictive role in ethnobotanical knowledge The age groups were will be 20-34, 35- 49, 50- 64, 65-79, 80 and to above.

3.5 Data Collection:

Data were collected through face to face conversation with the interviewees with appropriate isolation from other interviewees. They were asked questions about the local name of plants, their collection time, parts of plants used and uses of them (Nawash et al., 2014). The conversation was recorded with prior permission of the interviewee and kept for future references. Plants used were checked physically, photographed and voucher specimen were collected for further identification. Photographs and voucher specimens were brought in Khulna University, and identified at species level with the help of Experts and secondary sources, viz. with Encyclopedia of flora and fauna of Bangladesh and taxonomic documents published by National herbarium Bangladesh.

3.6 Data Categorization:

After collecting data, they were categorized according their specific use. Specific use categories are food value category, medicine value category, Construction value category, fuel value category, ornamental value category and other value category.

3.7 Ethnobotanical Indices:

After categorization, these data were used to determine use value, use totaled, cultural significance index, corrected fidelity level and family use value where the equations of them are-

Use totaled (Researcher- Tally) = $\sum$ Uses $_{Species}$

Here, a simple sum of all known uses for each species. The uses can be categorized by utility, plant taxon or vegetation type.

Use Value Subjective allocation (Researcher- score)

$$UV_S = \sum \text{Value}_{\text{Use Category}}$$

Here, the species use value is a sum of the researcher generated scores for each of its uses.

Cultural significance index, CSI = $\sum$ (i*e*c)*CF

Here, I-= species management where 1 indicates non- managed and 2 indicates managed.

E = Use preference where 1 indicates non- preferred and 2 indicates preferred.

C = Use frequency where 1 indicates rarely used and 2 indicates frequently used.

And Correction factor, CF =Number of citations for a given species divided by the number of citations for the most mentioned species.

Corrected fidelity level, $FL = I_p - I_u * 100\%$

Here, I_p = Number of informants who cited the species for the particular use.

I_u = Total number of informants that mentioned the plant for any use.

Family use value, $FUV = UV_S / n_s$

Here, UV_S = Sum the use values for all the species within a given family.

n_s = Total number of species within a given family.

In case of use totaled (researcher- tally) specific use, total no. of informants who told that they use the species for particular use was indicated. But in case of use totaled (researcher- tally) category limited, 1 was used to indicate the specific use of that species and 0 was used for a particular use to indicate there is no use of that species in that category. Use value (subjective allocation) is different from above two where 1 was used for major use and 0.5 was used for minor use.

3.8 Data Processing and Analysis:

After collecting the data, they were reviewed and sorted. All the plants were identified and their scientific names were assembled. Information on life forms and the conservation status of the collected plants were gathered from the published papers of IUCN. Then they were input and analysed (Hoffman and Gallaher, 2007).

Chapter Four

Result

From the study, 138 species were found in that region. This number of species belongs to 53 families. Informants are traditionally using those species for construction, food, fuel, medicine, ornamental and other purposes.

4.1 Result of the study:

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
Acanthaceae	2	Andrographis paniculata	3	Kalomegh	M	1	100	0.31
		Adhatoda vasica	2	Basok	M	1	100	0.20
Amaranthaceae	4	Alternanthera philoxeroides	19	Helencho	F	4	100	1.54
		Celosia cristata	7	Morog Phul	O	7	100	0.73
		Amaranthus tricolor	45	Laal shak	F	45	100	4.70
		Amaranthus lividus	48	Data shak	F	48	100	3.90
Anacardiaceae	2	Spondias dulcis	37	Amra	F	37	100	3.87
		Mangifera Indica	86	Aam	F	86	100	13
Annonaceae	2	Polyalthia	6	Debdaru	O	6	100	0.56

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
		racemosus						
Asteraceae	3	Chrysanthemum coronarium	7	Chandra Mollika	M	1	100	0.57
		Helianthus annuus	2	Surjomukhi	FO	3	100	0.21
		Eupatorius odoratum	18	Asamlata	M	18	100	1.88
Basellaceae	1	Basella alba	36	Puishak	F	36	100	3.77
Berberidaceae	1	Berberis asiatica	1	Daruharidra	M	1	100	0.08
Cactaceae	1	Opuntia cylindrica	29	Fonimonosha	OM	29	100	2.36
Calophyllaceae	1	Mesua ferrea	3	Nageshor	M	1	100	0.31
Caricaceae	1	Carica papaya	53	Pepe	F	53	100	8.01
Combretaceae	4	Terminalia arjuna	25	Arjun	M	25	100	3.78
		Terminalia chebula	33	Haritoki	M	33	100	3.45
		Terminalia catappa	43	Kant badam	F	43	100	4.5
		Terminalia bellirica	34	Bohera	FM	62	100	4.74
Convolvulaceae	2	Cuscuta reflexa	1	Swarnolata	M	1	100	1.15
		Ipomoea aquatic	7	Kolmishak	F	8	87.5	0.73
Crassulaceae	1	Kalanchoe pinnata	2	Pathor Kuchi	M	2	100	0.16
Cucurbitaceae	4	Trichosanthes	3	Potol	F	3	100	0.31

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
		Sesbania grandiflora	3	Bokphul	O	1	33.33	0.31
		Clitoria ternatea	5	Nilkonthi	O	3	60	0.52
		Cassia siamea	11	Minjiri	C	9	75	1.15
		Leucaena leucocephala	16	Teli Kadam	C	16	100	1.49
		Vigna sinensis	16	Borboti	F	16	100	1.67
		Cassia fistula	36	Sonalu	C	56	62.5	5.44
		Pithecellobium dulce	42	Khoye Babla	FU	68	61.76	4.39
		Delonix regia	17	Krishnachura	C	17	100	1.78
		Butea monosperma	16	Palash	C	16	94.11	1.67
		Erythrina ovalifolia	29	Mandar	C	29	100	2.36
		Dolichos lablab	49	Shim	F	49	100	5.13
		Albizia richardiana	55	Raj Koroi	C	55	100	7.67
		Dalbergia sisso	58	Sisso	C	58	100	6.07
		Albizia lebbeck	69	Shirish	C	69	100	10.43
		Tamarindus indicus	55	Tetul	FC	102	54	8.95
Juglandaceae	1	Juglans regia	1	Akh Rut	M	1	100	0.10

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
Lamiaceae	4	Vitex negundo	1	Nishinda	M	1	100	0.08
		Mentha viridis	2	Pudina	F	2	50	0.16
		Clerodendrum fragrans	4	Vaat Phul	O	4	100	0.42
		Ocimum tenuiflorum	73	Tulsi	MO	120	100	13.58
Lauraceae	1	Cinnamomum zeylanicum	2	Daruchini	FM	2	100	0.21
Liliaceae	2	Aloe indica	1	Ghrito Kumari	M	1	100	0.10
		Allium cepa	3	Peyaj	F	3	66.67	0.31
Lythraceae	3	Sonneratia apetala	7	Keora	F	7	100	0.73
		Lawsonia inermis	24	Mehedi	O	24	100	3.35
		Punica granatum	31	Dalim	F	31	100	3.24
Malvaceae	5	Abroma augusta	1	Ulot Kombol	M	1	100	0.10
		Hibiscus esculentus	4	Dherosh	F	4	100	0.56
		Gossypium arboretum	49	Karpas Tula	O	49	100	6.84
		Hibiscus rosa-sinensis	55	Golapi Joba	O	55	94.54	5.76

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
		Bombax ceiba	33	Shimul	CO	60	100	3.45
Meliaceae	4	Aphanamixis polystachya	2	Pitraj	M	1	100	0.16
		Xylocarpus mekongensis	12	Dhundol	C	12	100	1.26
		Azadiracta indica	59	Neem	M	59	100	6.17
		Swietenia mahogany	73	Mehogony	C	73	100	11.03
Moraceae	5	Ficus religiosa	4	Assottho	M	4	100	0.41
		Ficus bengalensis	12	Bot	C	12	100	1.26
		Artocarpus lacucha	37	Deoa	C	39	94,87	4.30
		Artocarpus heterophyllus	51	Kanthal	F	51	100	7.71
		Ficus roxburghii	53	Dumur	F	53	100	5.55
Moringaceae	1	Moringa oleifera	64	Sojina	F	64	100	9.67
Musaceae	2	Musa Paradisiaca	17	Kach Kola	F	17	100	1.78
		Musa spp.	48	Kola	F	48	100	7.26
Myrtaceae	6	Syzygium fruticosum	7	Khudijam	M	1	100	0.57

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
		Syzygium jambos	1	Golap Jam	F	1	100	0.10
		Syzygium aromaticum	2	Lobongo	FM	3	100	0.28
		Syzygium samarangense	51	Jarmul	F	51	100	5.34
		Syzygium cumini	63	Jam	F	63	100	9.52
		Psidium guajava	66	Peyera	F	66	100	9.98
Nyctaginaceae	1	Boerhavia diffusa	1	Punornova	M	1	100	0.10
Orchidaceae	1	Arundina graminifolia	7	Ghash phul	O	7	100	0.57
Oxalidaceae	2	Averrhoa carambola	41	Kamranga	F	41	100	4.29
		Oxalis corniculata	44	Amboli Shak	F	46	95.65	4.60
Phyllanthaceae	1	Phyllanthus emblica	49	Amloki	FM	90	54.44	9.12
Piperaceae	4	Piper longum	2	Pipul	M	1	100	0.16
		Piper betle	2	Paan	FM	3	100	0.16
		Piper nigrum	3	Golmorich	FM	6	100	0.24
		Piper chaba	56	Chui	F	56	100	5.86
Plantaginaceae/	1	Bacopa monnieri	5	Bhrammi Shak	FM	5	100	0.52

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
Scrophulariaceae								
Poaceae	3	Arundo donax	4	Nol	M	4	100	0.42
		Bambusa Tulda	18	Mitinga Bash	C	18	100	1.67
		Cynodon dactylon	55	Durba Ghash	M	98	56.12	5.76
Rhamnaceae	1	Zizyphus mauritiana	47	Boroi	F	47	100	7.10
Rosaceae	2	Prunus bokharensis	3	Aloo Bokhra	M	1	100	0.24
		Rosa damacena	13	Golap	O	13	100	1.36
Rubiaceae	2	Anthocephalus chinensis	2	Kadam	C	3	66.67	0.30
		Gardenia jasminoides	5	Gandhoraj	O	5	100	0.52
Rutaceae	4	Feronia limonia	8	Kodbel	F	8		0.84
		Aegle marmelos	35	Bel	F	35		3.66
		Citrus grandis	39	Batabi Lebu	F	39		4.08
		Citrus aurantifolia	57	Kagoji Lebu	F	83		8.62
Santalaceae	1	Santalum album	6	Shetchandan	M	2	100	0.84
Sapindaceae	1	Lichi chinensis	45	Lichu	F	45	100	6.80
Sapotaceae	2	Mimusops ellengi	9	Bokul	O	9	100	0.94

Family Name	Number of Species	Species Name (Scientific)	Informant Citation	Local Name	Main Use	Use Totaled	FI % (Fidelity Level)	CSI (Cultural Significance Index)
		Manilkara zapota	63	Sobeda	F	63	100	9.52
Smilacaceae	1	Smilax zeylanica	3	Kumarilata	M	1	100	0.31
Solanaceae	5	Datura metal	1	Dhutura	M	1	100	0.15
		Cestrum nocturnum	2	Hasna Hena	O	2	100	0.21
		Solanum tuberosum	26	Aloo	F	26	100	2.72
		Solanum melongena	47	Begun	F	47	100	4.92
		Capsicum annum	57	Morich	F	57	100	5.97
Sterculiaceae	1	Heritiera fomes	3	Sundri	C	3	100	0.31
Zingiberaceae	3	Elettaria cardamomum	1	Elach	F	2	50	0.10
		Zingber officinale	7	Ada	F	8	87.5	0.73
		Curcuma domestica	5	Holud	FM	8	100	0.52

(F- Food, M- Medicine, F- Fuel, C-Construction, Or- Ornamental and O- Other)

Table 4.1: Summary of the study

4.2 Analysis of Species Use Value and Use Totaled:

Species use value is highest for *Mangifera indica* (0.955555556) and use totaled is also high for it (86) that means highest number of people use this for their purpose. And it is lowest for *Cuscuta reflexa* (0.011111111) which means this species are used by lowest number of people.

4.3 Analysis of Family Use Value:

Total 52 families have been found through investigation. Among them, Fabaceae has the largest number of species (16 species) that indicates people of this region mostly use the species of this family. Then, Arecaceae and Myrtaceae are represented by 6 species. After that, Solanaceae, Moraceae and Malvaceae are represented by 5 species; Amaranthaceae, Apocynaceae, Cucurbitaceae, Lythraceae, Meliaceae, Piperaceae and Rutaceae are represented by 4 species and left 39 families have 3, 2 and 1 species.

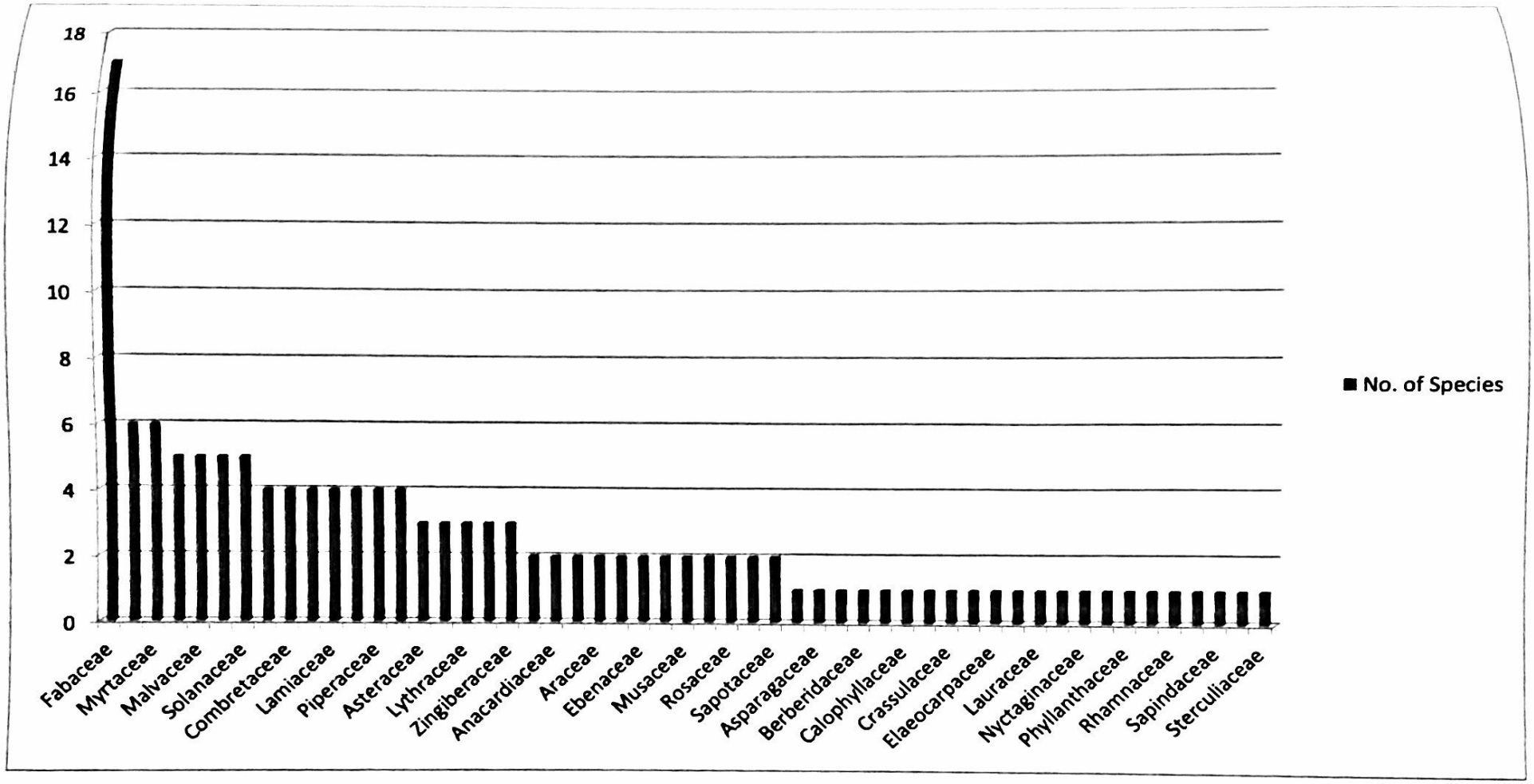

Fig. 4.5: No. of Species of Families

4.4 Analysis of Fidelity Level:

Almost 90% species has the highest fidelity (100%) which indicates. *Sesbania grandiflora* has the lowest fidelity (33.33%) among them. Almost all the species that has fidelity level lower than 100% has multiple uses.

4.5 Analysis of Cultural Index:

Cultural index is highest for *Ocimum tenuiflorum* and *Mangifera indica*. Another 4 species have the cultural index above 10.

4.6 Analysis of Species citation:

From the investigation it was found that highest number of species (66) was cited by lowest range of people (1-10), followed by 17 species cited by 11- 20 range of people. Lowest number of species citation was found from large number of range of people 111- 120.

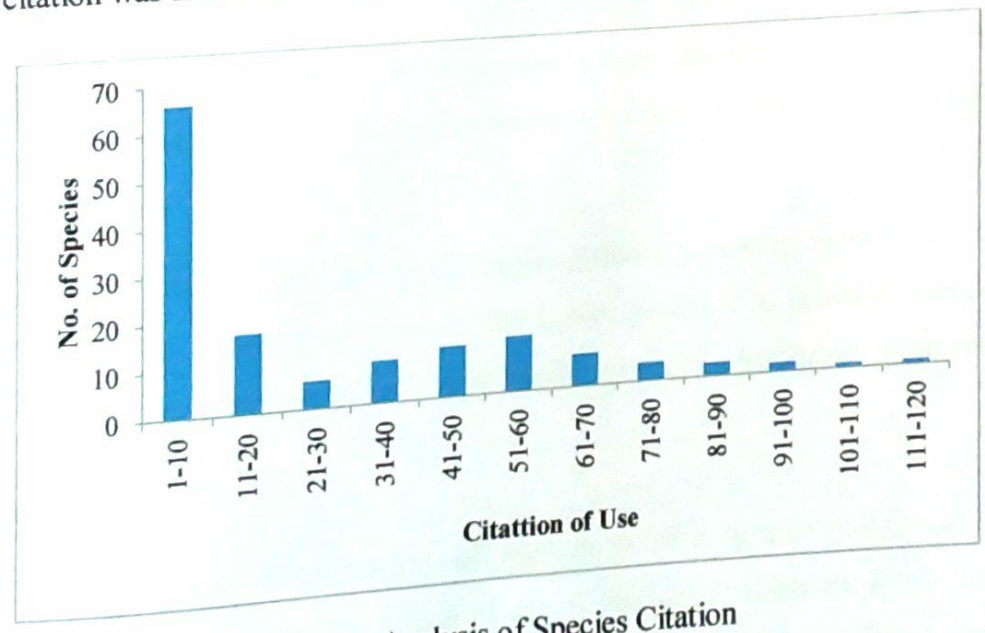

Fig. 4.6: Analysis of Species Citation

Chapter Five

Discussion

5.1 Use Totaled:

Use value indicates total number of uses of a specific species. It is two types- Used Total (Researcher Tally) Specific Uses and Use-Value (Subjective Allocation). In researcher tally, the uses are recorded, ranked and summed. In this study, food, fuel, medicine, construction, ornamental and other categories were used. In case of Subjective Allocation, value 1 is used for a specific use and 0 for non use. Total use is ignored here (Hoffman and Gallaher, 2007).

5.2 Fidelity Level:

Fidelity level is useful for measuring the importance of the species for a specific purpose. Actually it helps to identify the most preferable species used by key informants for a certain treatment. Species having high fidelity level means these are widely used by local people. It illustrates the number of informants in percentage who state the use of certain species for the same major purpose (Fouad et al., 2015).

But in this study, fidelity level has been used quite differently. Species those have higher fidelity level is used for one purpose by the people. But Lower fidelity level indicates multiple uses of a species. For example, *Alocasia indica* has the fidelity level 100% having one main purpose food.

5.3 Cultural Index:

Cultural index indicates the versatility of application of a species along with number of informants use it which means the spread of use of the species (Prthiban et al., 2015). In this study, *Ocimum tenuiflorum* has the highest cultural index value having different uses culturally like medicinal and veneration purpose.

Chapter Six

6.1 Conclusion:

From the study it is obvious that the area is rich with biodiversity. 138 species were found from 52 families. Some of them are used for purpose and some have multipurpose. And it was proved that the inhabitants of this region has interest to conserve species and they have a long experience of their uses.

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