Research Article

A Study on Exploration of Ethnobotanical Knowledge of Rural Community in Bangladesh: Basis for Biodiversity Conservation

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Received 23 April 2013; Accepted 6 June 2013

Academic Editors: A. R. Atangana, M. Tigabu, and J. Zhang

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Rural home garden is an important traditional source of medicinal plants for daily curative uses throughout Bangladesh. Such knowledge is continuing from generation to generation without documentation. An ethnobotanical investigation was conducted through focus group discussions and households' survey accompanied by field observation to document the indigenous knowledge of herbal medicines being used by the rural communities of Comilla district in Bangladesh. A total of 45 ethnomedicinal plant species belonging to 34 families were found, where trees (37.78%) were the most commonly utilized growth form. Plant resources are used to treat 31 different individual ailments ranging from simple cuts to heart disease. Plants are mainly used to treat dysentery (12 species), cold ailments, cough, and fever (6 species each). For curing ailments, the use of the above ground plant parts was higher (86.44%); particularly fruits (37.29%) and leaves (30.51%) were the most commonly used plant parts. More than half of the medicinal plants are indigenous (71.11%), being edible fruit bearer (48.89%), plants parts suitable for animals and birds (57.78%), and natural regeneration present (64.44%) indicated that medicinal plants play a vital role in biodiversity conservation in the study area.

1. Introduction

Over the past decade, there has been a dramatic increase in the demand for medicinal plants for use in traditional medicine and contemporary and alternative medicine in both developing and developed countries [1]; thus, a large number of people habitually use such medication because herbal treatment is, in some cases, considered relatively cheap [2]. However, its popularity also stems from the efficacy of the treatment in most cases and relative safety, with few or no side effects. Herbal medicines, because of their decentralized nature, are generally easily and quickly available [3]. Now, both developed and developing countries are involved in plants-based herbal medicine system, as modern pharmaceuticals are not accessible for all [4].

Bangladesh is a country that is considered rich in medicinal plants genetic resources by virtue of its favorable agro-climatic condition and seasonal diversity. With productive soils, a tropical climate, and seasonal diversity, Bangladesh contains about 6500 plants species including bryophytes,

pteridophytes, gymnosperms, and angiosperms; among them, 500 plant species have medicinal values [5] and grow in the country's forests, wetlands, homestead forests, and even roadside as indigenous, naturally occurring, or cultivated plants [6, 7]. About 75% (10 million households in over 85,000 villages) of the country's total population lives in rural areas [8], and almost 80% is dependent on natural resources (e.g., medicinal plants) for their primary healthcare [9], with herbal medication remaining a popular and accepted form of treatment [10].

Rural peoples are capable to identify many species of plants that are capable of producing various products, including food, firewood, medicine, forage, and daily needs tools [11], and the customary homestead tree production system also serves as a source of plant products and remedies [12]. Despite such a high demand of herbal medicine, medicinal plants sector is now the most promising business sector in Bangladesh [13] with the presence of more than 500 companies producing herbal medicines [14], and more than 90% of the plants and products needed to meet domestic demand

are imported from other countries, such as India, Nepal, and Pakistan [15].

The indigenous knowledge (IK) (IK develops through sharing experience and is normally passed orally between generations) concerning medicinal plants is lost owing to the change of habitats and culture of rural communities in Bangladesh. The district of Comilla is situated in the eastern part of Bangladesh, a district devoid of natural forests (out of the 64 districts of Bangladesh, 28 districts do not have any natural forests). Rajendrapur Sal forest (*Shorea robusta* C.F. Gaertn) and degraded small Sal patches in *Kotbari* and *Lalmai* hills are most notable because these were the only planted forests in the district, and Sal forest and *Lalmai* hills have historical importance. The district was chosen because it is a transitional zone between the southeastern vast hilly region (i.e., Chittagong Hill Tracts) and other plains regions in the southern and middle of the country. Although there are no significant forest areas, there is a great diversity of medicinal plants in the homestead gardens, roadsides, pond banks, and graveyards in this region. In conjunction with the increasing demand for traditional medicines in the country, research is being conducted outside the forest areas to explore the ethnobotanical documentation of the medicinal plants; for example, [9, 12, 16–27] are common to mention, but no study has been found on the utilization of plants for health-care practices by the rural people in Comilla district of the country. Therefore, the study was undertaken in Burichong Upazila (subdistrict, an administrative entity) of Comilla district of Eastern Bangladesh. Its aim was to assess plant-based ethnomedicinal practice and document IK associated with it, traditional beliefs, and biodiversity conservation related to IK.

2. Materials and Methods

2.1. Study Area. Burichong Upazila with an area of 163.76 sq. km. is located at 23°55'00"N 91°12'64"E (Figure 1). This area is bounded by Brahmanpara Upazila on the north, Comilla Sadar and Barura Upazilas on the south, Tripura state of India on the east, and Debidwar and Chandina Upazilas on the west. It has 37739 units of households. The Upazila supports a population of 259,265; 133,469 male and 125,796 female (population density 1609.98 per sq. km.) with a literacy rate of 49.7%. The Upazila consists of 8 Union Parishads (last stage of administrative entity) and 171 villages. The main rivers are Gomti, Gongur, Titi, and Pagli rivers; the landscape comprises the Tripura valley of India and green agricultural fields. The Upazila is more or less flooded during the rainy season, resulting in deposition of sediments that increase the productivity of land, ultimately contributing to its botanical diversity. The main occupation is agriculture (56.64%), followed by agricultural labour (12.28%), commerce (10.23%), service (8.08%), and so forth [28]. However, Burichong Upazila is considered as one of the most densely homestead forests-covered area with plantations of both indigenous and exotic species and understory covered with rich herbs and shrubs.

2.2. Research Methods. In order to document the utilization of medicinal plants, four field surveys were carried out from early July to late October 2010 in the study area, using a multistage random sampling technique. The surveys were spread across the whole Upazila at random: one in the north (Rajapur), one in the southwest (Mokam), and the other in the middle of the Upazila (Burichong), so as to get maximum information and also to cross check the information provided by the local informants during the earlier visits. From each of the three villages, 30 households (irrespective of socio-economic condition) were selected randomly for the comprehensive study. Thus, a total of 90 households were selected. Before the household survey, casual field visits were arranged within the villages with local old people, religious leaders, and other key informants to review and document the availability of medicinal plants in the locality. Informal meetings were held in the interviewee's home using the native language (Bengali). The household heads were the key respondents, with help from other family members when necessary. In addition, six focus group discussions (FGDs), two in each village, were arranged in the tea stalls of local market where the rural people usually get together, gossip, and interact in the evening after the daylong business. Information on the local name of plant, plant part used for curing, method of dosage, and administration was recorded. After the interviews, collected information was cross-checked by the local herbal practitioners locally referred to as *kabiraj*. They had sound knowledge on medicinal plants and were therefore highly rated in the society.

Respondents were interviewed using a semistructured questionnaire and focalized interview to ascertain the plant species and the parts used, for what diseases, the sources they prefer, the reasons for cultivating any plant, and so forth. The plant species used for medicine were firstly identified by local names by the help of *kabiraj* and old-aged persons. The scientific names were obtained by consulting the literature [29, 30]. A final list of the species used for medicinal purposes was cross-checked and prepared based on the study by Dey [29].

3. Results and Discussion

3.1. Medicinal Plants Species Composition. A total of 45 ethnomedicinal plant species including herb, shrub, tree, palm, and vine distributed across 34 families were documented in the study to be used by the rural community for curing different ailments. For the utilization frequency of the plant species, *Palmae* and *Rutaceae* appear as the most prominent families (3 species each), followed by *Compositae*, *Cucurbitaceae*, *Euphorbiaceae*, *Labiatae*, *Liliaceae*, *Myrtaceae*, and *Zingiberaceae* (2 species each) (Table 1). Various researchers across the country, for example, *Leguminosae* [12, 21], *Compositae*, *Combretaceae*, *Leguminosae*, *Liliaceae*, and *Rutaceae* [9], *Fabaceae* [16, 19], *Euphorbiaceae* and *Lamiaceae* [17], *Convolvulaceae*, *Leguminosae*, *Solanaceae*, and *Sterculiaceae* [22], and *Fabaceae* and *Solanaceae* [18] also recorded that the species under these families were frequently used as medicinal plants in rural Bangladesh. Among the recorded

FIGURE 1: Location map of the study area.

plants, trees were the most frequent growth form (37.78%), followed by herbs (24.44%), shrubs (22.22%), vine (8.89%), and palms (6.67%). A similar trend was also observed that trees were the most used growth form of medicinal plants in Bangladesh [2, 9, 31–36], but with a few exceptions [12, 37] where they found that herbs were mainly used as medicinal plants.

3.2. Indigenous Ethnobotanical Knowledge, Pattern, and Ailments. The survey revealed that rural people used various parts of the plants as medicine. The diverse pattern of various parts of medicinal plants (Table 1) reflected greater possession of IK regarding their health care practices by the people. Most of the medicinal plant parts are consumed after macerating, squeezing, grinding, blending, soaking, or boiling, and some are taken raw. Some are applied externally to different body parts for cuts and wounds, scabies, joint pain, piles, skin diseases, and so forth. Fifteen species like *Adhatoda vasica*

Nees., *Artocarpus heterophyllus* Lamk., *Azadirachta indica* A. Juss., *Centella asiatica* (L.) Urban, *Cocos nucifera* L., *Lawsonia inermis* L., *Phoenix sylvestris* Roxb., *Phyllanthus emblica* L., *Piper betle* L., *Plantago ovate*, *Psidium guajava* (L.) Bat., *Ocimum sanctum* L., *Swertia chirata*, *Tamarindus indica* L., and *Terminalia chebula* (Gaerth.) Retz. were used against up to four ailments. One unusual use of fresh mango leaf and piece of branches is as a toothbrush, without any toothpaste, to keep teeth healthy; another is the sun-dried seed of *Syzygium cumini* (L.) Skeel., which, after grinding into powder, is taken with salt as a regular treatment for diabetes. Another frequently used medicinal plant is the vine *Momordica charantia* L., where both the leaf and fruit are used against diabetes. Similarly, used patterns of these plant parts are recorded in rural areas of Bangladesh [9].

Medicinal plants are generally used to treat fever, coughs, cuts and wounds, cold ailments, toothache, hair loss, dandruff, skin diseases, joint pain, stomach problem, dysentery

TABLE 1: Composition, parts used, and ailments of recorded medicinal plants in the study area.

Local name	Scientific name	Habit	Family	Frequency (%) ¹	Parts used	Ailments	I/E ²	F/NF ³	N/A ⁴
Aam	<i>Mangifera indica</i> L.	Tree	Anacardiaceae	85	Leaves, tender twig, fruit	Teeth disease, wounds	I	F	N
Ada	<i>Zingiber officinale</i> Roxb.	Herb	Zingiberaceae	61	Rhizome	Cough, cold ailments	I	NF	N
Akanda	<i>Calotropis gigantea</i> (L.) Ait. f.	Shrub	Asclepiadaceae	42	Leaves, latex	Joint pain, cut and wounds	I	NF	N
Amloki	<i>Phyllanthus emblica</i> L.	Tree	Euphorbiaceae	33	Fruit	Dysentery, skin diseases, hair fall, indigestion	I	F	N
Anarosh	<i>Ananas comosus</i> (L.) Merr.	Shrub	Bromeliaceae	36	Fruit	Jaundice, worm	E	F	A
Aorboroi	<i>Phyllanthus acidus</i> (L.) Skeels	Tree	Euphorbiaceae	29	Fruit	Hair fall, indigestion	E	F	A
Assampata	<i>Eupatorium odoratum</i> L.	Shrub	Compositae	47	Green leaves	Antihemorrhoid	E	NF	N
Bashok	<i>Adhatoda vasica</i> Nees.	Shrub	Acanthaceae	51	Green leaves	Cough, cold ailments, asthma, dysentery	I	NF	A
Bel	<i>Aegle marmelos</i> (L.) Correa.	Tree	Rutaceae	64	Fruit	Weakness, constipation, diarrhea, dysentery	I	F	N
Boroi	<i>Zizyphus mauritiana</i> Lamk.	Tree	Rhamnaceae	66	Fruit	Cough, cold, lethargy to food	I	F	N
Chirata	<i>Swertia chirata</i> Ham.	Herb	Sapindaceae	13	Whole plant	Gastric pain, diabetes, stomach trouble, fever	E	NF	A
Dalim	<i>Punica granatum</i> L.	Tree	Punicaceae	40	Leaves, fruit	Worms in intestine	E	F	N
Durba grass	<i>Cynodon dactylon</i> (L.) Pers.	Herb	Poaceae	69	Tender leaves	Toothache, cuts and wounds	I	NF	N
Holud	<i>Curcuma longa</i> L.	Herb	Zingiberaceae	54	Rhizome	Skin diseases	I	NF	N
Haritoki	<i>Terminalia chebula</i> (Gaerth.) Retz.	Tree	Combretaceae	15	Fruit	Constipation, fever, heart disease, cough, urinary problems, loss of appetite	I	F	N
Isabgol	<i>Plantago ovata</i>	Herb	Compositae	15	Seed	Heat stroke, gastric pain, constipation, male sexual weakness	I	F	N
Jam	<i>Syzygium cumini</i> (L.) Skeel.	Tree	Myrtaceae	71	Fruit, seed	Blood purification, diabetes	I	F	N
Jambura	<i>Citrus grandis</i> (L.) Osb.	Tree	Rutaceae	59	Fruit	Jaundice, lethargy to food	I	F	A
Jolpai	<i>Elaeocarpus robustus</i> Roxb.	Tree	Elaeocarpaceae	52	Fruit	Lethargy to food	E	F	A
Kamranga	<i>Averrhoa carambola</i> L.	Tree	Averrhoaceae	66	Fruit	Hair fall, jaundice, weakness	I	F	N
Kanthal	<i>Artocarpus heterophyllus</i> Lamk.	Tree	Moraceae	83	Fruit, seed	Wound, diarrhea, constipation, stomach trouble	I	F	N
Khejur	<i>Phoenix sylvestris</i> Roxb.	Palm	Palmae	22	Fruit, juice	Constipation, jaundice, weakness	E	F	N
Kachu	<i>Colocasia esculenta</i> Schott.	Herb	Araceae	47	Whole plant	Cuts and wounds	I	NF	N
Kola	<i>Musa sapientum</i> L.	Shrub	Musaceae	68	Fruit	Dysentery	I	F	N
Korola	<i>Momordica charantia</i> L.	Vine	Cucurbitaceae	42	Leaves, fruit	Diabetes, dysentery	I	F	N
Lebu	<i>Citrus limon</i> (Linn.) Burm. f.	Tree	Rutaceae	60	Fruit, leaves	Dysentery, indigestion and lethargy to food, weakness	I	F	A
Lajjabati	<i>Mimosa pudica</i> L.	Herb	Mimosoideae	39	Root	Dysentery, piles	E	NF	N
Maya lata	<i>Mikania cordata</i> (Burm. F.) Roxb.	Vine	Compositae	38	Green leaves	Cuts and wounds	E	NF	N

TABLE 1: Continued.

Local name	Scientific name	Habit	Family	Frequency (%) ¹	Parts used	Allments	I/E ²	F/NF ³	N/A ⁴
Mehendi	<i>Lawsonia inermis</i> L.	Shrub	Lythraceae	62	Leaves	Dandruff, hair color, skin diseases	I	NF	A
Narikel	<i>Cocos nucifera</i> L.	Palm	Palmae	72	Fruit, juice	Hair fall, burns, dysentery, weakness	I	F	A
Neem	<i>Azadirachta indica</i> A. Juss.	Tree	Meliaceae	69	Green leaves and seed	Skin diseases, chicken pox, fever, dysentery, intestinal worm	I	NF	N
Paan	<i>Piper betle</i> L.	Vine	Piperaceae	17	Green leaves	Dysentery, loss of appetite, indigestion, stomach trouble	I	NF	A
Papaya	<i>Carica papaya</i> L.	Shrub	Caricaceae	72	Fruit	Stomach trouble	I	F	N
Pathor kuchi	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Herb	Crassulaceae	17	Leaves	Cough	E	NF	N
Peyara	<i>Psidium guajava</i> (L.) Bat.	Tree	Myrtaceae	74	Green leaves, fruit	Diarrhea, fever, cuts and wounds	I	F	N
Piaj	<i>Allium cepa</i> L.	Herb	Liliaceae	39	Whole plant	Cold ailments, dandruff	I	NF	A
Roshun	<i>Allium sativum</i> L.	Herb	Liliaceae	26	Whole plant	Heart disease, urinal problem	I	NF	A
Sajna	<i>Moringa oleifera</i> Lamk.	Tree	Moringaceae	31	Fruit, leaves, bark	Joint pain, sexual diseases	E	F	A
Shewra	<i>Streblus asper</i> Lour.	Shrub	Urticaceae	44	Green leaves	Skin disease, joint pain	E	NF	N
Supari	<i>Areca catechu</i> L.	Palm	Palmae	69	Seed	Vomiting	I	F	A
Telakucha	<i>Coccinia cordifolia</i> L.	Vine	Cucurbitaceae	19	Green leaves	Cold ailments, diabetes	E	NF	N
Tetul	<i>Tamarindus indica</i> L.	Tree	Leguminosae	63	Fruit, tender leaves	Loss of appetite, fever, dysentery, lethargy to food	I	F	N
Thankuni	<i>Centella asiatica</i> (L.) Urban	Herb	Umbelliferae	38	Whole plant	Dysentery, diarrhea, gastric pain, piles	I	NF	N
Tokma	<i>Hyptis suaveolens</i> Poit.	Shrub	Labiatae	14	Seed	Gastric pain, fever, burning	I	F	A
Tulsi	<i>Ocimum sanctum</i> L.	Shrub	Labiatae	19	Green leaves, seed	Cough, cold ailments, cuts and wounds	I	NF	A

Note: ¹Frequency: number of household reported medicinal plants found in relation to the total number of species that a particular species was cited.

²I/E: I indicates indigenous, and E indicates exotics.

³F/NF: F indicates edible fruit/seed bearing plants, and NF indicates non fruit-seed bearing plants.

⁴N/A: N indicates natural regeneration found, and A indicates natural regeneration absent.

TABLE 2: Habit-wise distribution of medicinal plants for different ailments.

Name of ailments	Number of species reported					Total species*
	Tree	Herb	Shrub	Vine	Palm	
Antihemorrhoid	—	—	1	—	—	1 (2.22)
Asthma	—	—	1	—	—	1 (2.22)
Blood purification	1	—	—	—	—	1 (2.22)
Burning	—	—	1	—	1	2 (4.44)
Chicken pox	1	—	—	—	—	1 (2.22)
Cold ailments	1	2	2	1	—	6 (13.33)
Constipation	3	1	—	—	1	5 (11.11)
Cough	2	2	2	—	—	6 (13.33)
Cuts and wounds	1	1	2	1	—	5 (11.11)
Dandruff	—	1	1	—	—	2 (4.44)
Diabetes	1	1	—	2	—	4 (8.89)
Diarrhea	3	1	—	—	—	4 (8.89)
Dysentery	5	2	2	2	1	12 (26.67)
Fever	4	1	1	—	—	6 (13.33)
Gastric pain	—	3	1	—	—	4 (8.89)
Hair fall and color	3	—	1	—	1	5 (11.11)
Heart disease	1	1	—	—	—	2 (4.44)
Indigestion	3	—	—	1	—	4 (8.89)
Jaundice	2	—	1	—	1	4 (8.89)
Joint pain	1	—	2	—	—	3 (6.67)
Lethargy to food	5	—	—	—	—	5 (11.11)
Loss of appetite	2	—	—	1	—	3 (6.67)
Piles	—	2	—	—	—	2 (4.44)
Sexual problem	1	1	—	—	—	2 (4.44)
Skin diseases	2	1	2	—	—	5 (11.11)
Stomach trouble	1	1	1	1	—	4 (8.89)
Toothache	1	1	—	—	1	3 (6.67)
Urinal problem	—	1	—	—	—	1 (2.22)
Vomiting	—	—	—	—	1	1 (2.22)
Worms	1	—	1	—	—	2 (4.44)
Weakness	2	—	—	—	2	4 (8.89)

* Parenthesis shows the percentage value.

and diarrhea (Table 2). Twelve species (26.67%) are used against dysentery (five trees, two herbs, shrubs and vine, and one palm species). Cold ailments, cough, and fever are treated with six species (13.33%); constipation, cuts and wounds, hair fall and color, lethargy to food, and skin diseases are treated with five species (11.11%) each. More than four species (8.89%) are used for treating common conditions of diabetes, diarrhea, gastric pain, indigestion, jaundice, stomach trouble, and weakness. In some cases, a mixture of several species is also used for treating one disease.

For curing ailments, the use of the above ground plant parts was higher (86.44%) than the whole plants (8.47%) and under ground plant parts (5.08%). Out of the above ground plant parts, fruits (37.29%) and leaves (30.51%) were used in the majority of cases, followed by seeds (11.86%) (Table 3). In most cases, the juice from leaves, root, rhizome, and bark is used as medicine, while fruits are eaten raw.

TABLE 3: Utilization of plant parts of the medicinal plant species.

Plants parts used	Individual species	Percentage
Fruits	22	37.29
Leaves	18	30.51
Seed	7	11.86
Whole plant	5	8.47
Root/rhizome	3	5.08
Bark	1	1.69
Juice	2	3.39
Latex	1	1.69

3.3. Traditional Sources of Medicinal Plants. Home gardens in the study area are generally maintained for household consumption like supplying fruit, timber, fuel wood, and

fodder. Additionally, due to the availability of medicinal plants in their home gardens, they are also dependent on home gardens for their daily herbal medicine. The medicine is generally prepared by elder family members who have good knowledge on the medicinal value of plants, of which those species are usually used to treat common diseases such as cough, cold ailments, and cuts and wounds, all from the plants available in the surrounding home garden, roadside, ponds and canal bank, graveyards, jungle, fallow land, hinterland, and so forth. The villagers prefer graveyards mainly covered by herbs and shrubs, to reduce the problems arising from large tree roots disturbing graves. Hinterlands behind homesteads are usually kept fallow and unproductive; in some cases, they are used for household waste disposal and as space for domestic poultry, with some herbaceous species planted. Stepp and Moerman [38] and Gazzaneo et al. [39] found a similar trend of collecting medicinal plants from anthropogenic habitats by the Maya communities of Mexico and the local herbal specialists of northeastern Brazil, respectively. A study in West Africa showed that, among the harvested species, local community used 90% of the species for medicinal purposes [40]. During the study, the respondents only buy medicinal plant parts, for example, fresh or dried forms from village markets when the species are not prevalent in their home garden. Plants, which have multiple uses, such as vegetables and spices, were cultivated in the homestead and agriculture field. Respondents also shared parts and fruits from plants with each other, so that the demands of neighbors as well as people living further away can easily be met.

3.4. Traditional Beliefs. Study found that most of the plant parts used for curing ailments are gathered from home gardens, but the people of the study area are destroying the medicinal plants resource due to lack of proper harvesting techniques and lack of awareness about this resource. Conversely, some rural people raise certain species with medicinal properties, particularly *Areca catechu* L., *A. indica*, *Citrus grandis* (L.) Osb., *C. limon* (L.) Burm. f., *C. nucifera*, *L. inermis*, and *O. sanctum* which are usually planted surrounding the homestead especially on the southern side (*A. indica*) that air from the south is purified by its foliage; this is believed and noticed by the local people from the study area.

Aegle marmelos (L.) Correa., *A. indica*, *L. inermis*, *Mangifera indica* L., *O. sanctum*, *P. betle*, *Zizyphus mauritiana* Lamk., and fruit of *C. nucifera* are viewed as sacred and culturally important plants by the Hindu and Muslim religious communities. The leaf of *L. inermis* L. is often used in dyeing the hand palms of bridal couples, women and children on cultural, ceremonial, and religious occasions. While Chowdhury et al. [41] reported the livelihood potential of the commercial farming of *L. inermis* L. in the central part of the country, Cartwright-Jones [42] noticed that *L. inermis* leaf paste is popular as an adornment for weddings and other celebrations in South Asia, the Middle East, and Africa. The orange dye obtained from the leaves is also used for dyeing hair, beards, eyebrows, fingernails, and palms.

The paste made from rhizome of the *Curcuma longa* L. is used in dyeing the full body of bridal couples for both communities. In the Hindu community, leaves of *O. sanctum*

are used commonly in their worship. *T. indica* is planted either in the periphery of homesteads or in fallow lands of the backyard with a belief that evil spirits take shelter on its crown. Miah and Rahman [43] also reported on these plants and their cultural, ceremonial, and religious uses having positive effects on the flora of the Muslim and Hindu homestead forests in Bangladesh. In the study area, more than half of the medicinal plants (tree species) are being edible fruit bearers as they are planted purposively by the local people for the seasonal fruit not for the medicinal purposes.

3.5. Ethnobotanical Knowledge Regarding Biodiversity Conservation. Home gardens have long been the most effective and widespread measure for biodiversity conservation in Bangladesh due to anthropogenic pressure and land-use change affecting the natural forest which has been decreasing day by day both in explicit and implicit ways leading to threats to future productivity. Among the identified species, about 71.11% of plants are indigenous species, and 28.89% of plants are exotic species. To get a quick cash return now, the largest part of home garden owners are interested in the plantation of exotic plant species although it has a negative effect on biodiversity. It was found that 48.89% of plants produce edible fruits and seeds, 28.89% of the plants parts are used as vegetables and spices for daily cooking purposes by the people. Generally, rural communities preferred cultivated and planted multipurpose species that can be served as fruits, vegetables and spices that also can be used as timber. Such kind of choice is the most important factor to home gardens conservation in Bangladesh. This clearly plays a significant role in forest biodiversity conservation since all the wood and other nontimber products that are harvested in the home gardens do not need to be collected from natural forests. Some species (e.g., *P. ovate*, *Kalanchoe pinnata* (Lam.) Pers., *Hyptis suaveolens* Poit., and *O. sanctum* L.) are grown in earthen pots and kept in front of dwelling houses, serving for beautification purposes. About 57.78% of plants are suitable for animals' and birds' conservation because the fruits and seeds of these plants are widely used as food for birds and animals. At this time, dispersal of seeds also occurs and helps in natural regeneration of plants species. In the present study, 64.44% of species are found to be naturally regenerated, and most of these are indigenous (Table 4).

The conservation of plants in home gardens not only preserves a vital resource for humankind but also provides significant economic and nutritional benefits for the rural poor [44]. During the study, it was found that collecting and selling the whole plant of *Allium cepa* L., *Allium sativum* L., *C. asiatica*, *Colocasia esculenta* Schott., and *S. chirata*; the fruit of *M. indica*, *Phyllanthus emblica* L., *A. comosus* (L.) Merr., *Phyllanthus acidus* (L.) Skell., *A. marmelos*, *Z. mauritiana*, *Punica granatum* L., *T. chebula*, *S. cumini*, *C. grandis*, *Elaeocarpus robustus* Roxb., *Averrhoa carambola* L., *A. heterophyllus*, *P. sylvestris*, *Musa sapientum* L., *C. limon*, *M. charantea*, *C. nucifera*, *Carica papaya* L., *P. guajava*, and *T. indica*; the leaves with rhizome of *C. esculenta* and *Zingiber officinale* Roxb.; moreover the seeds of *P. ovate*, *A. heterophyllus*, *A. catechu*, *H. suaveolens* Poit., and *O. sanctum* play a significant role in household's cash income generation as well

TABLE 4: Status of medicinal plants species from biodiversity conservation point of view.

Species category	Individual species	Percentage
Indigenous	32	71.11
Exotics	13	28.89
Plants produce edible fruits/seeds	22	48.89
Plants parts used as spices/vegetables	13	28.89
Plants parts suitable for animals and birds	26	57.78
Natural regeneration present	29	64.44
Natural regeneration absent	16	35.56

as meet the body requirement of vitamins. Such economic contribution of these species also has a significant role in species conservation and poverty reduction in the study area. Several studies [40, 45–48] found that medicinal plants play a key role in sustaining the rural livelihood and contributing to poverty reduction.

3.6. Traditional Management System. In terms of the level of management in cultural practices, traditional production system of home gardens in Bangladesh is very poor. Owners mainly depend on naturally growing trees on the home gardens. However, both men and women play a significant role in decision making in case of choice of species, nursery raising, plantation, silvicultural practices, and management activities of medicinal plants. Mostly women encouraged both their neighbors and family to conserve home gardens by planting diverse plant species especially medicinal plants and by taking proper care of the gardens. It was found that labor-intensive activities like digging holes (78%), pruning (63%), planting species (66%), and fencing (59%) were done by men, while seed selection (74%), watering (79%), fertilizing (52%), and weeding (51%), utilization patterns of medicinal plants (60%), and storage and pest control techniques (67%) were mainly done by women.

Families exchange seeds of medicinal plants among themselves, usually at the time of fruit selection. Cattle browsing, pest and disease attack, low productivity, and poor fertility of seeds with sometimes-human disturbance are common problems expressed by the owner. Women also have a responsibility for pest control and use a simple indigenous technique to pest control in their garden which is the application of ashes to plants infected by pests. For excessive pest and disease attacks, they used pesticide but at a low rate that could not affect human and animals. Recently, majority of the households were interested to know about species suitability, appropriate mixture, and information related to high yielding and more pest-disease resistance varieties. Cultivation of medicinal plants species is an important strategy for conservation and sustainable maintenance of home gardens. However, the home gardens present an outstanding example of all acceptance multipurpose land-use system and biodiversity conservation point of view.

4. Conclusion

This study revealed that there are medicinal plants species that make a significant contribution to the healing of diseases of rural community. Due to the increased dependence on herbal treatment and overexploitation of plants, not only by the *Kabiraj*, but also by most of the local people, anthropogenic pressures on medicinal plants are more increased. From the conservation point of view, the plants diversity is critically depleted due to habitat destruction. Therefore, there is an urgent need for conservation of the genetic diversity of the species with special emphasis on anthropogenic populations. Further work should focus on the thorough phytochemical investigation such as alkaloid extraction and isolation along with few clinical trials. This could help in creating mass awareness regarding the need for conservation of such plants and in promoting ethno-medico-botany knowledge within the region. Besides, the young generation should be motivated to acquire this traditional medicinal knowledge. Both government agencies and nongovernmental organizations have roles to play in this regard. This also contributes to the preservation and enrichment of the gene bank of such economically important species before they are lost forever. While there is an issue on the conservation of biological diversity all over the world, local people are using plants for their health care in a sustainable manner, and this may be the key factor in the conservation of plant diversity. It can be concluded from the study that people inherit a rich traditional knowledge and documentation of this knowledge has provided novel information from the area.

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