Ethnomedicinal Study of Plants in Begumgonj, Noakhali, Bangladesh

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Research

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Abstract

**Background:** The aim of this study was to document and preserve the ethnomedicinal knowledge used by traditional healers of Begumganj upazila, Bangladesh, to treat human diseases and evaluate the relative efficacy of the medicinal plants.

**Methods:** The uses of medicinal plants were documented as an ethnomedicinal data sheet using direct observation, field interview, plant interview and group interview techniques from December 2012 to January 2014 in the study area. Data were collected from 98 traditional healers through a questionnaire survey and analyzed through informant consensus factor and fidelity level.

**Results:** Overall, 75 plant species under 71 genera of 47 families were documented, which are used to treat 41 diseases. Data analysis revealed that 41.33%, 14.67%, 36% and 8% of the medicinal plant species were herbs, shrubs, trees, and climbers, respectively. Leaves were the most used parts, followed by stem, root, fruit, bark, latex and rhizome. The most frequently treated diseases were dysentery, rheumatism and skin diseases.

**Conclusions:** This is the first ethnobotanical survey, which recorded the importance of medicinal plants in Begumganj upazila, Bangladesh. This study can contribute to preserving the indigenous knowledge on the traditional use of medicinal plants in this region and attract future generations towards traditional healing practice.

Background

Medicinal plants continue to be important therapeutics for alleviating human diseases. The ancient civilizations in India, China, Greece, Arab countries and other countries in the world developed their independent systems of medicine, all being predominantly plant-based. It is estimated that 80% of people worldwide rely primarily on traditional, largely herbal, medicine to meet their primary health care needs [1, 2]. Approximately, 5,000 angiosperm plant species have been recorded in Bangladesh [3]. Among them, 250 plants are documented as medicinal plants [4], but their phytochemical or pharmacological properties are not extensively studied. Currently, ethnomedicine, as traditional medicine, is practiced by not only various ethnic groups, but also indigenous people worldwide.

Bangladesh is a country in Southeast Asia with diverse herbal remedies being used traditionally [5]. Among different communities of Bangladesh, indigenous knowledge of traditional medicine exists to cure several diseases. Most of the rural population of Bangladesh depends on traditional remedies for ailments such as cough, cold, fever, headache, and dysentery. The local community of Begumganj upazila has gathered knowledge about the use of plants treating diseases through observations, intuition, and experimentation. They enriched the knowledge through selection and rejection and transferred it from generation to generation through various channels such as talks, documents and teaching. Due to mass deforestation, lack of interest of the younger generation in traditional treatment methods and tendency of traditional medicinal healers to change their professions, the existing pattern of indigenous health care system may gradually change in rural areas of the country [6, 7]. Nevertheless, ethnomedicinal studies have been conducted to preserve the traditional knowledge and to identify the scientific value in various areas in Bangladesh [2, 4, 8–14].

The present study was aimed at investigating the traditional use of plants in Begumganj in Noakhali district, Bangladesh. The study area is part of the country’s source of ethnomedicinal knowledge. However, no specific work studied the use of ethnomedicinal plants by the people of Begumganj. This study was undertaken (1) to identify and explore plant species that are used locally for treating various ailments, (2) to document traditional recipes of medicine preparation from medicinal plants, including methods of preparation and mode of administration and (3) to select candidate medicinal plant species of high priority for phytochemical and pharmacological analyses.

Materials And Methods

**Study area**

The study was conducted in an area in Begumganj upazila, Bangladesh (Fig. 1) [15], between 22°52’ N and 23°06’ N, and between 90°59’ E and 91°13’ E. The area was of 255.95 km², bounded by Sonaimuri and Chatkhil upazilas on the north, Noakhali Sadar, Kabirhat and Senbagh upazilas on the south, Senbagh upazila on the east, and Lakshmipur Sadar and Chatkhil upazilas on the west [16].

**Field survey and ethnobotanical data collection**

The uses of medicinal plants were documented as an ethnomedicinal data sheet using direct observation, field interview, plant interview and group interview techniques [17–19] from December 2012 to January 2014 in the study area. Overall, 11 field trips were conducted in various flowering seasons and 75 interviews from 98 local informants were recorded. Audio recordings were saved using a digital voice recorder. Additionally, ethnomedicinal information was obtained through informal interviews using semi-structured and structured techniques. Local persons of various age groups, mostly between 25 and 84 years, were interviewed, including herbal practitioners (termed as Kabiraj). The interview was based on health problems, their diagnosis, treatment methods, local name of the medicinal plant used, the source of collection (wild or cultivated), plant parts used, and methods of preparation and application. Depending on the response, more specific questions concerning the types of uses were gradually formulated. To ensure that the information was as unbiased as possible, it was tried to avoid the presence of other people during the interviews. Participant observation such as age and education level was accomplished to increase reliability in our experimental data when the information from the local practitioners was collected. All information regarding plant species, local names, family, habit and treatment mode was documented. Informant’s data on their background and the medicinal plants used in Begumganj were schematically recorded in a Microsoft Excel spreadsheet.

**Plant collection, identification, and preservation**
All plant specimens were collected in both flowering and fruiting conditions. In case of no flowering and fruiting, plant twigs with few leaves were collected for proper identification with the help of local practitioners of ayurvedic medicine (called vaidyas) and knowledgeable persons to ascertain the correct identification of plants and to obtain information on their habit. Knowledgeable informants plays a significant role in ethnobotany [20]. Samples of medicinal plants were collected through repeated field trips during documentation. Voucher specimens were prepared and deposited in the taxonomic laboratory of the Chittagong University Herbarium (CTGUH). The scientific identification was done by Professor Dr. Shaikh Bokhtear Uddin, Department of Botany, University of Chittagong, Bangladesh. In some cases, standard literature [21–26] was referred for the identification of species. Identified plant species were cross-checked with the ‘Dictionary of Plant Names of Bangladesh (vascular plants)’ [3], and on websites of The Plant List (TPL) and International Plant Name Index (IPNI) for recent nomenclature of all specimens and author citations.

Informants consensus factor ($\text{F}_{\text{IC}}$)

Informant's consensus factor was calculated to determine the homogeneity in the information given by the informants. The $\text{F}_{\text{IC}}$ is calculated using the following formula [27, 28]:

$$\text{F}_{\text{IC}} = \frac{(N_u - N_t)}{(N_u - 1)}$$

where $N_u$ is the number of use report in a particular disease category by informants, and $N_t$ is the number of taxa or species used to treat the particular disease category by the informants.

Fidelity level (FL) value

The FL, the percentage of informants claiming the use of certain plants for the same major purpose was calculated according to the following formula [18, 19]:

$$\text{FL} = \frac{N_i}{N} \times 100$$

where $N_i$ is the number of informants who independently suggested the use of a plant species for a particular disease, and $N$ is the total number of informants who mentioned the same plant for any disease.

Results And Discussion

Demographic feature

A total of 98 informants (54 males and 44 females) aged between 25 and 84 years were interviewed, in which 55.10% were males and 44.90% were females. The most number of informants was in the age group 45–64 years (Fig. 2). The illiteracy rate was 38.8%. Among the literate people, 29.6%, 19.4%, 10.2% and 2.0% had completed education up to primary, middle, secondary and university level, respectively (Table 1).

Phytodiversity, utilisation and its application

In the present ethnomedicinal survey, 75 species under 71 genera of 47 families were documented (Table 2), which are used for treating 41 types of disease. The most frequently used families as per the number of species are Asteraceae, Moraceae, Araceae, Euphorbiaceae, and Rutaceae. Analysis of the data based on habits showed that among the highly used plants, 41% were herbs, and 14.67%, 36% and 8% were shrubs, trees, and climbers, respectively (Fig. 3). Among the ethnomedicinal plants, 57.33% of the species were naturally growing, whereas 42.67% species were cultivated or planted. For each species, botanical name, local name (Bangla name), family, biological forms and treatment mode are presented in Table 3.

Plant parts

Among the recorded species, analysis of parts used revealed that leaves were the most used plant parts (50%), followed by stem (8.75%), root (7.5%), fruit (6.25%), bark (6.25%), latex (5%), rhizome (5%), whole plant (5%), seed (3.75%) and flower (2.5%) (Fig. 4). Herbal preparations can be made from roots, rhizomes, barks, stems or whole plant, which affect mother plants when they are collected [29]. However, in the present study area, this threat was minimal because leaves were the most frequently used plant parts for medicinal purposes. It was observed that the collection of bark and whole plant as the medicinal part from the wild were not sustainable. According to local people, this type of activity is conducted by the collectors related to illegal trade of medicinal plants. *Oroxylum indicum*, *Ricinus communis*, *Centella asiatica*, *Commelina benghalensis*, *Eclipta prostrata*, and *Scoparia dulcis* are vulnerable to such activity in the study area.

Forms of medication

The most frequently used form of medication was juice (50.65%), followed by paste (20.78%), raw form (10.38%), infusion (3.90%), powder (3.90%), cooked form (3.90%), tablet (2.60%), ointment (2.60%), and syrup (1.30%) (Fig. 5). A plant preparation was turned into a herbal medicine in the form of juice, paste, tablet or ointment by mixing it in various food items, spices, or oil. Both external and internal modes of application of herbal medicine have been prescribed. Consequently, oral administration was predominant. Mostly, local herbalists prescribed fresh plant material as a source of herbal medicine. Usually, they do not store the herbal preparation.

Plant species used against diseases
Plants species are mostly used for treating dysentery (10 cases), rheumatism (10), skin disease (7), fever (5), hot flash (4), acidity (3), various types of pain (3), cough (3), diabetes (3), diarrhoea (3), heart disease (3), ascariasis (2), digestive (2), asthma (2), hair tonic (2), burn wound (2), constipation (2), excessive fat (2), faint disease (2), jaundice (2), haemorrhages (2), ulcer (2), ring worm (2), toothache (2), vomiting (2) and other diseases (16) (Table 3).

The most commonly used plant species in the study area were Aphanamixis polystachya, Azadirachta indica, Blumea lacerca, Calotropis gigantea, Centella asiatica, Coccinia grandis, Eclipta prostrata, Kalanchoe pinnata, Lawsonia inermis, Litsea monopetala, Mikania micrantha, Ocimum basilicum, Oroxylum indicum, Scoparia dulcis, Psidium guajava, Stephania japonica, Stereobas asper, Terminalia arjuna, Vitex negundo and Zingiber officinale. The recorded species in this study were previously recorded from various areas of Bangladesh as ethnomedicinal species [22, 26, 30]. However, the present study recorded seven new ethnomedicinal observations in Bangladesh. They are Pithecellobium dulce to treat dysentery, Stephania japonica to treat heart disease, Smilax ovalifolia to treat vertigo, leaves of Nymphoides indica and latex of Phoenix sylvestris to treat burns, leaves of Leea indica to treat skin diseases and Lasia spinosa to treat jaundice. Establishment of modern healthcare centres is in progress in many rural areas; this may gradually change the existing pattern of indigenous knowledge systems of healthcare [5]. Field observations and discussion with local people demonstrated that the diversity of ethnomedicinal plant species and traditional knowledge of the area is at great risk because of threats including habitat destruction; exotic monoculture plantations; agricultural development; degradation of village groves and construction of buildings for housing, commercial farms and industry.

The ethnomedicinal plants of the study area exhibited diverse habitats, such as homestead area, cultivated land, scrub jungles, fallow lands, and wetland. The present generation is losing interest to continue their parental profession because it does not provide them proper financial support for their livelihood [5, 7]. Hence, the documentation of these traditional uses of plant species as herbal medicine is essential before they disappear permanently.

**Use reports and FIC**

In the ethnomedicinal studies, informant’s consensus analysis provides a measure of consistency for the given claim of evidence [31]. The studied upazila had a significant variety of plants with traditional uses against diseases. A total of 41 diseases were grouped into 13 therapeutic categories based on the information gathered from the interviews (Table 4).

The $F_{IC}$ was calculated for each ailment category, and the range was from 0.71 to 0.91. Given results of the $F_{IC}$ showed that the category of hormonal disorder had the highest value with 0.91%, wherein the root of Bombax ceiba and whole plant of Eclipta prostrata were reported by the informants to be used for treating sexual diseases and leucorrhoea, respectively. The root of Bombax ceiba is used for treating impotency, gonorhoea and improving the functionality of the sexual organ [32, 33]. The second highest $F_{IC}$ value (0.87%) was calculated for endocrine disorder category, which included the reported use of Coccinia grandis, Ficus racemosa, and Syzygium cumini. These three plant species have anti-diabetic property [34–39]. The similar $F_{IC}$ value (0.85%) was exhibited by cardiovascular and respiratory system disorders. Gastrointestinal disorders, dental care and liver or hepatobiliary disorders exhibited the value as 0.83%. The category of external injury or bleeding and burn wound exhibited the lowest $F_{IC}$ value. This study implied that the medicinal plants for treating several ailments is still in practice by different indigenous people and it can attract future generations towards traditional healing practice.

**FL value**

For each of the 14 most commonly used plant species as ranked by the informants, the FL (Table 5) was calculated to quantify their importance in treating a major ailment [40, 41]. The remedies for frequently reported ailments have the highest FL values, and those with a low number of reports have the lowest FL values [42]. This study showed a high FL of >60% for 9 plant species, which highlighted the importance of these species in the treatment of the frequently mentioned diseases in the study area. The highest FL value (93.3%) was exhibited by Cynodon dactylon, followed by Aegle marmelos (88.9%), and Paederia foetida (81.8%), (Table 5). The high FL levels for these species indicated their outstanding preference for treating most of the gastrointestinal disorders and haemorrhages. Additionally, Nyctanthes arbor-tristis (77.8%), Coccinia grandis (75.0%), and Lawsonia inermis (75.0%) had high FL values (Table 5).

**Conclusion**

The present findings are most likely the first record of ethnomedicinal knowledge in Begumganj using standard research methods, focussing on medicinal plants and their local uses for primary health care. This ethnomedicinal information can contribute to preserving the indigenous knowledge on the use of medicinal plants and attracting future generations towards traditional healing practice.

**Declarations**

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**Author's contributions**

KMA and NHS designed the research and conducted the field surveys. KMA, NHS and DMK analyzed data and prepared a manuscript. SBU and MJA guided the work and reviewed the manuscript. The authors read and approved the final manuscript.

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**Availability of data and materials**

All data analyzed in this study are included in this published article.

**Ethics approval and consent to participate**

Not applicable.

**Consent for publication**

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**Competing interests**

The authors declare that no conflict of interest exist.

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Tables

Table 1 Education level of interviewed ethnic informants

| Education level | No. of individuals | Percentage (%) |
|-----------------|--------------------|----------------|
| Illiterate      | 38                 | 38.8           |
| Primary         | 29                 | 29.6           |
| Middle          | 19                 | 19.4           |
| Secondary       | 10                 | 10.2           |
| University      | 2                  | 2.0            |

Table 2 Taxonomical diversity of plant species
| Family               | Number of genera | Percentage of genera | Number of species | Percentage of species |
|----------------------|------------------|----------------------|-------------------|-----------------------|
| Acanthaceae          | 2                | 2.82                 | 2                 | 2.67                  |
| Amaranthaceae        | 2                | 2.82                 | 2                 | 2.67                  |
| Araceae              | 3                | 4.22                 | 3                 | 4.00                  |
| Asteraceae           | 7                | 9.86                 | 7                 | 9.33                  |
| Caesalpiniaceae      | 2                | 2.82                 | 2                 | 2.67                  |
| Cucurbitaceae        | 2                | 2.82                 | 2                 | 2.67                  |
| Euphorbiaceae        | 2                | 2.82                 | 3                 | 4.00                  |
| Liliaceae            | 1                | 1.40                 | 2                 | 2.67                  |
| Malvaceae            | 1                | 1.40                 | 2                 | 2.67                  |
| Meliaceae            | 2                | 2.82                 | 2                 | 2.67                  |
| Moraceae             | 3                | 4.22                 | 4                 | 5.33                  |
| Myrtaceae            | 2                | 2.82                 | 2                 | 2.67                  |
| Orchidaceae          | 2                | 2.82                 | 2                 | 2.67                  |
| Poaceae              | 2                | 2.82                 | 2                 | 2.67                  |
| Rutaceae             | 3                | 4.22                 | 3                 | 4.00                  |
| Solanaceae           | 2                | 2.82                 | 2                 | 2.67                  |
| Verbenaceae          | 2                | 2.82                 | 2                 | 2.67                  |
| Zingiberaceae        | 2                | 2.82                 | 2                 | 2.67                  |
| Other 29 families    | 29               | 40.84                | 29                | 34.66                 |
| Total                | 71               | 100                  | 75                | 100                   |

*Table 3* Enumeration of ethnomedicinal plant species used by the people in Begumganj
| Scientific name /voucher specimen number | Local name | Family | Habit | Status | Parts used | Ethnomedicinal uses |
|------------------------------------------|------------|--------|-------|--------|------------|---------------------|
| Acampe praemorsa (Roxb.) Blatt. & McCann KMA-161 | Amrashi | Orchidaceae | Herb | Wild | Leaves | Tablet prepared from crushed leaves of *Acampe praemorsa*, fruits of *Phyllanthus emblica*, stem of *Amaranthus spinosus* (without spine) and *Curcuma longa* (young) mixture is taken to treat hot flash, heart disease and rheumatism. |
| Aegle marmelos (L.) Corr. Serr. KMA-163 | Bel | Rutaceae | Tree | Cultivated | Leaves, Bark and fruit | Juice prepared from crushed leaves and bark is taken to treat constipation and fever. Infusion of dried fruit is taken to treat dysentery. |
| Aerides odorata L. KMA-162 | Rasna | Orchidaceae | Herb | Wild | Leaves | Juice prepared from the crushed leaves is taken to treat rheumatism. |
| Aerva sanguinolenta (L.) Blume KMA-164 | Bishali korolapata | Amaranthaceae | Herb | Wild | Leaves | Juice prepared from crushed leaves is taken to treat blood dysentery. |
| Allium cepa L. KMA-200 | Piaj | Liliaceae | Herb | Cultivated | Rhizome | Juice prepared from crushed rhizomes mixed with water is taken to treat ascariasis. |
| Allium sativum L. KMA-199 | Roshun | Liliaceae | Herb | Cultivated | Rhizome | Juice prepared from crushed rhizomes is taken to treat rheumatism. |
| Amaranthus spinosus L. KMA-198 | Kanta maira | Amaranthaceae | Herb | Wild | Stem | Juice prepared from crushed stem mixed with water and salt is taken at 5 gm as dose to treat body pain. |
| Ananas comosus (L.) Merr. KMA-197 | Anaros | Bromeliaceae | Herb | Cultivated | Leaves | Juice prepared from crushed young leaves is taken to treat ascariasis. |
| Aphanamixis polystachya (Wall.) R.Parker KMA-196 | Rona | Meliaceae | Tree | Wild | Fruit | Juice prepared from crushed fruits is taken to treat constipation and as laxative. |
| Artocarpus heterophyllus Lam. KMA-195 | Kadol | Moraceae | Tree | Cultivated | Latex | Latex of petiole is applied in affected area to treat ring worm. |

Table 3 Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name / voucher specimen number | Local name | Family | Habit | Status | Parts used | Ethnomedicinal uses |
|------------------------------------------|------------|--------|-------|--------|------------|---------------------|
| *Artocarpus lacucha* Buch.-Ham. KMA-194 | Dheua      | Moraceae | Tree  | Cultivated | Latex      | Latex of stem is taken to treat acidity. |
| *Azadirachta indica* A. Juss. KMA-193 | Nim        | Meliaceae | Tree  | Cultivated | Stem and leaves | Branches of stem are used as tooth brush for treating toothache. Paste prepared from the crushed leaves of the plant and young rhizome of *Curcuma longa* is applied to infected areas for treating skin diseases. |
| *Bambusa balacooa* Roxb. KMA-192 | Boro bash | Poaceae | Tree  | Cultivated | Root       | Juice prepared from crushed roots is taken to treat fever. |
| *Blumea lacera* (Burm.f.) DC. KMA-191 | Kornuta    | Asteraceae | Herb  | Wild     | Leaves     | Juice prepared from the crushed leaves is taken to treat dysentery and diarrhea. |
| *Bombax ceiba* L. KMA-190 | Shimul     | Bombacaceae | Tree  | Cultivated | Root       | Juice prepared from crushed roots is taken to treat sexual diseases. |
| *Calophyllum inophyllum* L. KMA-189 | Dugha gach | Clusiaceae | Tree  | Cultivated | Leaves     | Juice prepared from crushed leaves is taken to treat lactation. |
| *Calotropis gigantea* (L.) Ait.f. KMA-188 | Aapon pata | Asclepiadaceae | Shrub | Wild     | Leaves     | Paste prepared from crushed leaves is applied in ring worm and warm leaf is applied to affected area for treating rheumatism. |
| *Carica papaya* L. KMA-187 | Cokia      | Caricaceae | Shrub | Cultivated | Fruit      | Fruit taken as digestive. |
| *Cassia fistula* L. KMA-186 | Honalu     | Caesalpinaceae | Tree  | Cultivated | Leaves     | Paste prepared from crushed leaves is applied in affected area to treat fracture. |
| *Centella asiatica* (L.) Urban KMA-185 | Aduni      | Apiaceae | Herb  | Wild     | Whole plant | Paste prepared from whole plant is taken to relieve from kidney stone. |
| *Chromolaena odorata* (L.) R.M.King & H.Rob. KMA-184 | Asam lata | Asteraceae | Herb  | Wild     | Leaves     | Juice prepared from the crushed leaves is applied in hemorrhages. |

Table 3 Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name /voucher specimen number | Local name | Family | Habit  | Status | Parts used | Ethnomedicinal uses                                                                 |
|----------------------------------------|------------|--------|--------|--------|------------|-------------------------------------------------------------------------------------|
| Citrus aurantiifolia (Christm.) Swingle KMA-183 | Lebu       | Rutaceae | Tree   | Cultivated | Seed       | Juice prepared from crushed seeds is taken to relieve from vomiting.               |
| Coccinia grandis (L.) Voigt KMA-182     | Kolakchu   | Cucurbitaceae | Climber | Wild       | Leaves     | Paste prepared from crushed leaves is taken to treat to diabetes and cancer.     |
| Colocasia esculenta (L.) Schott KMA-181 | Tankachu   | Araceae | Herb   | Wild       | Root       | Cooked roots are taken to treat low back pain.                                    |
| Commelina benghalensis L. KMA-180       | Kanaier shag Commelinae | Herb | Wild       | Whole plant | Paste prepared from whole plant is taken to treat acidity. | Paste prepared from the crushed rhizome is applied to treat skin diseases. |
| Curcuma longa L. KMA-179                | Halud      | Zingiberaceae | Herb    | Cultivated | Rhizome    | Juice prepared from crushed whole plant is taken to treat ulcer of uterus and piles. It also used in hemorrhage. |
| Cynodon dactylon (L.) Pers. KMA-178     | Dupa       | Poaceae | Herb   | Wild       | Leaves     | Juice prepared from the crushed leaves is mixed with mustard oil and warmed and used to rub for treating rheumatism. |
| Datura metel L. KMA-177                 | Datura     | Solanaceae | Herb    | Cultivated | Leaves     | Juice prepared from the crushed leaves is taken to treat dysentery.               |
| Dillenia indica L. KMA-176              | Chaelta    | Dilleniaceae | Tree    | Wild       | Leaves     | Juice prepared from crushed leaves is taken to treat diseases of gallbladder.     |
| Eclipta prostrata (L.) L. KMA-175       | Kalakessa  | Asteraceae | Herb    | Wild       | Whole plant | Juice prepared from whole plant body is taken as 5 gm once in a day after breakfast for 4 days to treat leucorrhoea and rheumatism. |
| Enhydra fluctuans Lour. KMA-174         | Tita molicha | Asteraceae | Herb    | Wild       | Leaves     | Juice prepared from crushed young leaves is taken to treat diseases of gallbladder. |

**Table 3** Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name / voucher specimen number | Local name | Family | Habit | Status | Parts used | Ethnomedicinal uses |
|------------------------------------------|------------|--------|-------|--------|------------|-------------------|
| Ficus racemosa L. KMA-235 | Jogga dumur | Moraceae | Tree | Wild | Fruit | Powder prepared from crushed fruits is taken to treat diabetes. |
| Glycosmis pentaphylla (Retz.) A.DC. KMA-243 | Hotikhira | Rutaceae | Tree | Wild | Root | Tablet prepared from crushed roots, Piper betle and Areca catechu is taken 3 times per day to treat asthma/shortness of breathing. |
| Grangea maderaspatana (L.) Poir. KMA-242 | Thundi, Teria | Asteraceae | Herb | Wild | Leaves and stem | Ointment prepared from Leaves and stem, mixed with salt and kerosene oil is applied to treat body pain. |
| Hibiscus rosa-sinensis L. KMA-241 | Joba | Malvaceae | Shrub | Cultivated | Flower | Juice prepared from crushed flower is applied to treat scaling of palm. |
| Hibiscus schizopetalus (Mast.) Hook.f. KMA-240 | Lanthan joba | Malvaceae | Shrub | Cultivated | Leaves | Juice prepared from crushed leaves is taken to treat dysentery of children. |
| Homalomena aromatica (Spreng.) Schott KMA-239 | Tan kochu | Araceae | Herb | Wild | Stem and root | Cooked stem and root is taken to treat rheumatism. |
| Hygrophila auriculata (Schumach.) Heine KMA-238 | Kulekharda | Acanthaceae | Herb | Wild | Seed | Infusion of seed is taken to treat hot flash. |
| Ipomoea maxima (L.f.) D.Don ex Sweet KMA-237 | Bish kolmi | Convolvulaceae | Herb | Wild | Leaves | Juice prepared from crushed leaves is taken to treat faint disease of ducks. |
| Justicia adhatoda L. KMA-236 | Bashok | Acanthaceae | Shrub | Wild | Leaves | Juice prepared from crushed leaves is taken to treat asthma, polydypsia and vomiting. |
| Kalanchoe pinnata (Lam.) Pers. KMA-201 | Pathorkuchi | Crassulaceae | Herb | Wild | Leaves | Juice prepared from the crushed leaves is taken to treat hot flash. |

Table 3 Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name /voucher specimen number | Local name | Family      | Habit | Status | Parts used | Ethnomedicinal uses |
|-----------------------------------------|------------|-------------|-------|--------|------------|---------------------|
| *Lablab purpureus* (L.) Sweet KMA-202   | Shim       | Fabaceae    | Herb  | Cultivated | Leaves | Ointment prepared from crushed leaves mixed with juice of *Curcuma longa* and mustard oil is applied on affected area to treat skin disease. |
| *Lasia spinosa* (L.) Thwaites KMA-203   | Bonadia    | Araceae     | Herb  | Wild    | Stem      | Fibreless stem are cut into piece and cooked is taken to treat jaundice. |
| *Lawsonia inermis* L. KMA-204           | Mendi      | Lythraceae  | Tree  | Cultivated | Leaves | Paste of leaves is applied to treat skin diseases and alopecia. |
| *Leea indica* Merr. KMA-205              | Shagoler bodi | Leeaceae   | Shrub | Wild    | Leaves | Paste prepared from crushed young leaves is applied to treat skin diseases. |
| *Litsea monopetala* (Roxb.) Pers. KMA-206 | Meda pata | Lauraceae  | Tree  | Wild    | Leaves | Juice prepared from crushed leaves and mixed with salt is taken to treat dysentery. |
| *Lygodium japonicum* (Thunb.) Sw. KMA-207 | Lohachura | Schizaeaceae | Climber | Wild | Leaves | Paste prepared from crushed leaves is put on head and patient has to stand under straw-roof with root of the plant tied at neck to treat diarrhea. |
| *Mangifera indica* L. KMA-208           | Aam        | Anacardiaceae | Tree | Cultivated | Leaves | Paste prepared from leaves crushed with 100 gm boiled rice is taken at 125gm as dose for 4 days to treat dysentery and hot flash. |
| *Mikania micrantha* Kunth KMA-209       | Ribuji pata | Asteraceae  | Climber | Wild | Leaves | Juice prepared from crushed leaves is applied to stop haemorrhages. |
| *Moringa oleifera* Lam. KMA-210         | Sojina     | Moringaceae | Tree  | Cultivated | Leaves | Paste prepared from crushed leaves is taken to treat cough. |
| *Nyctanthes arbor-tristis* L. KMA-211   | Shefali    | Verbenaceae | Tree  | Cultivated | Leaves | Juice prepared from crushed leaves is taken to relieve from fever, anorexia and as anthelmintic. |
| *Nymphoides indica* (L.) Kuntze KMA-212 | Topdubi pata | Menyanthaceae | Herb | Wild | Leaves | Leaves can be applied in affected area immediately after burning. |
| *Ocimum basilicum* L. KMA-214           | Tulshi     | Lamiaceae  | Herb  | Wild    | Leaves | Juice prepared from crushed leaves is taken to relieve from cough. |

Table 3 Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name /voucher specimen number | Local name | Family     | Habit | Status | Parts used | Ethnomedicinal uses                                                                 |
|-----------------------------------------|------------|------------|-------|--------|------------|-------------------------------------------------------------------------------------|
| Oroxylum indicum (L.) Kurz KMA-215      | Thona      | Bignoniaceae | Tree  | Wild   | Bark       | Powder prepared from the crushed barks is taken in the morning to treat fever.       |
| Paederia foetida L. KMA-213             | Gondho vaduli | Rubiaceae  | Climber | Wild   | Leaves     | Juice prepared from crushed leaves is taken to relieve from acidity. It a            |
| Phoenix sylvestris (L.) Roxb. KMA-216   | Khejur     | Arecaceae  | Tree  | Cultivated | Latex   | Syrup prepared from boiled two years old latex mixed with compact sugar to treat obesity. Latex of this plant can be applied on the burn wound in                         |
| Phrynium imbricatum Roxb. KMA-217       | Pituelpata | Marantaceae | Herb  | Wild   | Leaves     | Paste prepared from crushed leaves is taken to treat rheumatism.                     |
| Phyllanthus emblica L. KMA-218          | Amloki     | Euphorbiaceae | Tree  | Cultivated | Fruit   | Juice of fruits taken as refrigerant and tonic.                                     |
| Phyllanthus reticulatus Poir. KMA-219   | Chitthi Pata | Euphorbiaceae | Shrub | Wild   | Stem       | Juice prepared from the crushed branch of stem is taken with honey in               |
| Pithecellobium dulce (Roxb.) Benth KMA-220 | Nodaiel | Mimosaceae  | Tree  | Cultivated | Latex   | Latex of stem is taken to treat dysentery.                                          |
| Polyalthia longifolia (Sonn.) Thwaites KMA-221 | Debadaru | Annonaceae  | Tree  | Cultivated | Bark   | Powder prepared from crushed barks is taken to treat fever.                        |
| Psidium guajava L. KMA-222              | Gobia, Heyara | Myrtaceae  | Tree  | Cultivated | Young leaves | Hot infusion of young leaves is taken to relief toothache.                          |
| Ricinus communis L. KMA-223             | Verenda    | Euphorbiaceae | Shrub | Wild   | Bark       | Added honey with juice prepared from the crushed bark and tuber of Zi                |
| Scoparia dulcis L. KMA-224              | Meshripata | Scrophulariaceae | Herb  | Wild   | Whole plant | Juice prepared from crushed whole plant is taken to treat dysentery.               |

Table 3 Enumeration of ethnomedicinal plant species used by the people in Begumganj (Continued)
| Scientific name          | Local name | Family       | Habit    | Status   | Parts used | Ethnomedicinal uses                                                                 |
|-------------------------|------------|--------------|----------|----------|------------|-------------------------------------------------------------------------------------|
| *Senna alata* (L.) Roxb. | Dadmardon  | Caesalpinia   | Shrub    | Cultivated | Leaves     | Paste prepared from the crushed leaves is applied to treat skin diseases.            |
| KMA-225                 |            | ceaeaeae      |          |          |            |                                                                                     |
| *Smilax ovalifolia* Roxb. ex D.Don | Koariar Lota | Smilacaceae  | Climber  | Wild     | Root       | Small pieces of roots are tied with patient's hair (Saturday or Tuesday) for 7 days to treat vertigo. |
| KMA-226                 |            |              |          |          |            |                                                                                     |
| *Solanum indicum* L.   | Putki begun| Solanaceae   | Shrub    | Wild     | Stem       | Juice prepared from stem is taken to treat skin disease.                            |
| KMA-227                 |            |              |          |          |            |                                                                                     |
| *Spilanthes acmella* (L.) L. | Gha gach  | Asteraceae   | Herb     | Wild     | Flower     | Flowers are chewed in mouth and then thrown out to treat oral ulcer.                |
| KMA-228                 |            |              |          |          |            |                                                                                     |
| *Stephania japonica* (Thunb.) Miers | Mucchanipata | Menispermae | Climber  | Wild     | Leaves     | Paste prepared from crushed leaves is applied on head to treat faint unconscious and taken to treat heart disease. |
| KMA-229                 |            |              |          |          |            |                                                                                     |
| *Streblus asper* Lour.  | Horba      | Moraceae     | Tree     | Wild     | Leaves     | Juice prepared from crushed leaves is taken to treat dysentery.                    |
| KMA-230                 |            |              |          |          |            |                                                                                     |
| *Syzygium cumini* (L.) Skeels | Jam       | Myrtaceae    | Tree     | Cultivated | Seed       | Crushed seeds are taken to treat diabetes.                                          |
| KMA-231                 |            |              |          |          |            |                                                                                     |
| *Terminalia arjuna* (Roxb. ex DC.) Wight & Am. | Arjun      | Combretaceae | Tree     | Cultivated | Bark       | Juice prepared from the crushed bark is taken with sugar and cow milk to treat heart disease. |
| KMA-232                 |            |              |          |          |            |                                                                                     |
| *Trichosanthes dioica* Roxb. | Potol     | Cucurbitaceae| Herb     | Cultivated | Leaves     | Juice prepared from crushed leaves is taken to treat fever.                        |
| KMA-233                 |            |              |          |          |            |                                                                                     |
| *Vitex negundo* L.      | Nishinda   | Verbenaceae  | Shrub    | Wild     | Leaves     | Paste of leave is applied in affected areas to treat boils. Juice prepared from the crushed leaves is applied for alopecia. |
| KMA-234                 |            |              |          |          |            |                                                                                     |
| *Zingiber officinale* Roscoe | Ada       | Zingiberaceae| Herb     | Cultivated | Rhizome    | Juice prepared from rhizome is taken to treat rheumatism and cough.                |
| KMA-244                 |            |              |          |          |            |                                                                                     |

**Table 4** Informant consensus factor (\(F_{IC}\)) of the Bangladeshi plant species for each therapeutic category

| Therapeutic category                  | \(N_t\) | \(N_{ur}\) | \(F_{IC}\) |
|---------------------------------------|---------|------------|-------------|
| Autoimmune disorder                   | 12      | 69         | 0.84        |
| Gastrointestinal disorders            | 23      | 132        | 0.83        |
| Cardiovascular disorders              | 3       | 14         | 0.85        |
| Dermatological/skin disorder          | 15      | 58         | 0.75        |
| Respiratory system disorders          | 5       | 27         | 0.85        |
| Liver disorder/hepatobiliary         | 3       | 13         | 0.83        |
| Endocrine disorder                    | 3       | 16         | 0.87        |
| Hormonal disorder                     | 2       | 12         | 0.91        |
| Dental care                           | 2       | 7          | 0.83        |
| External injury/bleeding, burn and wound | 5    | 15         | 0.71        |
| Neurocardiogenic syncope              | 2       | 5          | 0.75        |
| Nervous system disorder               | 4       | 19         | 0.83        |
| Others (cancer, kidney stone, fever and veterinary uses) | 8     | 30         | 0.76        |

**Table 5** Fidelity Levels (FL) of most frequently used plants by key informants
### Medicinal plant

| Medicinal plant                                      | Np | N  | FL Value (%) |
|------------------------------------------------------|----|----|--------------|
| Aegle marmelos (L.) Corr. Serr.                     | 16 | 18 | 88.9         |
| Azadirachta indica A. Juss                          | 4  | 7  | 57.1         |
| Blumea lacera (Burm.f.) DC.                         | 15 | 25 | 60.0         |
| Calotropis gigantea (L.) Alit.f.                    | 12 | 20 | 60.0         |
| Coccinia grandis (L.) Voigt                         | 6  | 8  | 75.0         |
| Cynodon dactylon (L.) Pers.                         | 14 | 15 | 93.3         |
| Eclipta prostrata (L.) L.                            | 17 | 28 | 60.7         |
| Justicia adhatoda L.                                | 6  | 11 | 54.5         |
| Lawsonia inermis L.                                 | 6  | 8  | 75.0         |
| Nyctanthes arbor-tristis L.                         | 7  | 9  | 77.8         |
| Paederia foetida L.                                 | 9  | 11 | 81.8         |
| Phoenix sylvestris (L.) Roxb.                       | 3  | 5  | 60.0         |
| Stephania japonica (Thunb.) Miers                    | 7  | 10 | 70.0         |
| Vitex negundo L.                                    | 4  | 6  | 66.7         |

### Figures

**Figure 1**

Map of the study area showing various unions and collecting sites. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 2
Number of informants by age category and gender in Begumganj upazila

Figure 3
Habits of documented medicinal plant species
Figure 4

Different parts of plants used by local people in Begumganj

Figure 5

Forms of medication