

Ethnomedicinal Study of Plants in Begumgonj, Noakhali, Bangladesh

Akter Kazi-Marjahan

Gyeongsang National University

Noor Hasan Sajib

Ministry of Environment

Dong-Min Kang

Gyeongsang National University

Mi-Jeong Ahn (✉ amj5812@gnu.ac.kr)

Gyeongsang National University <https://orcid.org/0000-0002-1201-0746>

Sheik Bokhtear Uddin

University of Chittagong

Research

Keywords: Begumganj upazila, Ethnobotany, Ethnomedicinal knowledge, Medicinal plants

Posted Date: May 7th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-490592/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

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 ethnobotanical 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 Lakshmpur 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 play 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 (F_{IC})

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

$$F_{IC} = (N_{ur} - N_t) / (N_{ur} - 1)$$

where N_{ur} 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]:

$$FL = (N_p / N) \times 100$$

where N_p 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 lacera*, *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*, *Streblus 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 F_{IC}

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, gonorrhoea 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

Acknowledgements

The authors are cordially grateful to the people of Begumganj upazila for sharing their traditional knowledge and also thank to the department of botany, University of Chittagong (CU) for providing the necessary facilities. The authors acknowledge to professor Dr. M. K. Pasha for helping exact identification of the plants.

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.

Funding

No funding.

Availability of data and materials

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

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that no conflict of interest exist.

Author details

¹Department of Botany, University of Chittagong, Bangladesh. ²College of Pharmacy and Research Institute of Pharmaceutical Sciences, Gyeongsang National University, Republic of Korea. ³Department of Environment, Chattogram District Office, Bangladesh

References

1. Asongwe C. Traditional medicine, disease control and human welfare in colonial southern Cameroons. *Saudi J Humanities Soc Sci.* 2021;6:26–36.
2. Jamila M, Rahman AHMM. Ethnobotanical study of traditional medicinal plants used by the Santal Tribal practitioners at the village Jamtala of Chapai Nawabganj district, Bangladesh. *JPRB.* 2016;3:142–56.
3. Pasha MK, Uddin SB. *Dictionary of Plant Names of Bangladesh (Vascular Plants)*. Chittagong: Janokallyan Prokashoni; 2013.
4. Faruque O, Uddin SB. Ethnodiversity of medicinal plants used by Tripura community of Hazarikhil in Chittagong district of Bangladesh. *J Taxon Biodiv Res.* 2011;26:27–32.
5. Sajib NH, Uddin SB. Medico–Botanical studies of Sandwip island in Chittagong, Bangladesh. *Bangladesh J Plant Taxon.* 2013;20:39–49.
6. Kadir MF, Sayeed MSB, Mia MM. Ethnopharmacological survey of medicinal plants used by traditional healers in Bangladesh for gastrointestinal disorders. *J Ethnopharmacol.* 2013;147:148–56.
7. Uddin SB, Sajib NH, Islam MM. Investigation of ethnomedicinal plants of Subarnachar in Noakhali, Bangladesh. *Chittagong Univ J Biol Sci.* 2011;6:77–86.
8. Faruque O, Uddin SB, Barlow JW, Hu S, Dong S, Cai Q, Li X, Hu X. Quantitative ethnobotany of medicinal plants used by indigenous communities in the Bandarban district of Bangladesh. *Front Pharmacol.* 2018;9:40.
9. Haque MA, Bari L, Hassan MM, Sultana SA. A survey on medicinal plants used by the folk medicinal practitioners in Tangail Sadar Upazilla, Tangail, Bangladesh. *J Environ Sci Natural Resources.* 2014;7:35–9.
10. Khatun MR, Rahman AHMM. Ethnomedicinal uses of plants by Santal tribal at Nawabganj Upazila of Dinajpur district, Bangladesh. *Bangladesh J Plant Taxon.* 2019;26:117–26.
11. Mohiuddin M, Alam MK, Basak SR, Hossain MK. Ethno–medico botanical study among the four indigenous communities of Bandarban, Bangladesh. *Bangladesh J Plant Taxon.* 2012;19:45–53.
12. Roy S, Uddin MZ, Hassan MA, Rahman MM. Medico–botanical report on the Chakma community of Bangladesh. *Bangladesh J Plant Taxon.* 2008;15:67–72.
13. Uddin MZ, Hassan MA, Rahman M, Arefin K. Ethno–medico–botanical study in Lawachara National park, Bangladesh. *Bangladesh J Bot.* 2012;41:97–104.
14. Yusuf M, Wahab MA, Chowdhury JU. Ethno-medico-botanical knowledge from Kauhkali proper and Betbungia of Rangamati district. *Bangladesh J Plant Taxon.* 2006;13:55–61.
15. Banglapedia. National Encyclopedia of Bangladesh online. 2014. <http://en.banglapedia.org/index.php?title=File:BegumganjUpazila.jpg>.
16. Bhuiyan SM. Begumganj Upazila. In: Islam S, Jamal AA. *Banglapedia. National Encyclopedia of Bangladesh*. Dhaka: Asiatic Society of Bangladesh; 2012.
17. Alcorn JB. Development policy, forest, and peasant farms: reflections on Huastec-managed forests' contributions to commercial production and resource conservation. *Econ Bot.* 1984;38:389–406.
18. Alexiades MN. Protocol for Conducting Ethnobotanical Research in the Tropics. In: Alexiades MN, Sheldon JW. *Selected Guidelines for Ethnobotanical Research: A Field Manual*. New York: The New York Botanical Garden; 1996. pp. 5–15.
19. Alexiades MN. Collecting Ethnobotanical Data. An Introduction to Basic Concepts and Techniques. In: Alexiades MN, Sheldon JW. *Selected Guideline for Ethnobotanical Research: A field Manual*. New York: The New York Botanical Garden; 1996. pp. 53–94.
20. Given DR, Harris W. *Techniques and Methods of Ethnobotany: As an Aid to the Study, Evaluation, Conservation and Sustainable Use of Biodiversity*. London: Commonwealth Secretariat; 1994.

21. Ahmed ZU, Begum ZNT, Hassan MA, Khondker MM, Kabir SMH, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU. Encyclopedia of Flora and Fauna of Bangladesh, Angiosperms: Dicotyledons. Dhaka: Asiatic Society of Bangladesh; 2008. Vol. 6–10.
22. Ghani A. Medicinal plants of Bangladesh: Chemical constituents and uses. Dhaka: Asiatic Press; 1998.
23. Rashid ME, Rahman MA. Updated nomenclature and taxonomic status of the plants of Bangladesh included in Hook. f., The Flora of British India: Vol. I. Bangladesh J Plant Taxon. 2011;18:177–97.
24. Rashid ME, Rahman MA. Updated nomenclature and taxonomic status of the plants of Bangladesh included in Hook. f., The Flora of British India: Vol.II. Bangladesh J Plant Taxon. 2012;19:173–90.
25. Siddiqui KU, Islam MA, Ahmed ZU, Begum ZNT, Hassan MA, Khondker M, Rahman MM, Kabir SMH, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU. Encyclopedia of Flora and Fauna of Bangladesh, Vol. 11. Angiosperms: Monocotyledons (Agavaceae–Najadaceae). Dhaka: Asiatic Society of Bangladesh; 2007.
26. Yusuf M, Begum J, Hoque MN, Chowdhury JU. Medicinal Plants of Bangladesh. Chittagong: Bangladesh Council of Scientific and Industrial Research; 2009.
27. Bhat P, Hedge GR, Hedge G, Mulgund GS. Ethnomedicinal plants to cure skin diseases—an account of the traditional knowledge in the coastal parts of central Ghats, Karnataka, India. J Ethnopharmacol. 2013;151:493–502.
28. Singh AG, Kumar A, Tewari DD. An ethnobotanical survey of medicinal plants used in terai forest of western Nepal. J Ethnobiol Ethnomed. 2012;8:19.
29. Abebe D, Ayehu A. Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. Addis Ababa: Berhanena Selam Printing Press; 1993.
30. Uddin SB. Medicinal Plants Database of Bangladesh. 2010. <https://mpbd.cu.ac.bd/>.
31. Malla B, Chhetri RB. Indigenous knowledge on medicinal non–Timber forest products (NTFP) in Parbat district of Nepal. Indo Glob J Pharm. 2012;2:213–25.
32. Bhargava C, Thakur M, Yadav SK. Effect of *Bombax ceiba* L. on spermatogenesis, sexual behaviour and erectile function in male rats. Andrologia. 2012;44:474–8.
33. Meenakshi SC, Basavaraj SB, Ramesh LL. Review on ethnobotany phytoconstituents and phytopharmacology of *Bombax ceiba* Linn. Int J Pharm Biol Sci. 2019;9:1061–6.
34. Ahmed F, Urooj A. Glucose-lowering, Hepatoprotective and hypolipidemic activities of stem bark of *Ficus racemosa* in streptozotocin–induced diabetic rats. J Young Pharm. 2009;1:160–4.
35. Amin MM, Bhakta S, Das SK. Anti-diabetic potential of *Ficus racemosa*: current state and prospect especially in the developing countries. J Biosci Agric Res. 2015;5:65–72.
36. Attanayake AP, Jayatilaka KAPW, Mudduwa LKB. Anti-diabetic potential of ivy gourd (*Coccinia grandis*, family: Cucurbitaceae) grown in Sri Lanka: A review. J Pharmacogn Phytochem. 2016;5:286–9.
37. Ravi K, Sekar DS, Subramanian S. Hypoglycemic activity of inorganic constituents in *Eugenia jambolana* seed on streptozotocin–induced diabetes in rats. Biol Trace Elem Res. 2004;99:145–55.
38. Ravi K, Sivagnanam K, Subramanian S. Anti-diabetic activity of *Eugenia jambolana* seed kernels on streptozotocin–induced diabetic rats. J Med Food. 2004;7:187–91.
39. Sharma SB, Nasir A, Prabhu KM, Murthy PS, Dev G. Hypoglycaemic and hypolipidemic effect of ethanolic extract of seeds of *Eugenia jambolana* in alloxan–induced diabetic rabbits. J Ethnopharmacol. 2003;85:201–6.
40. Friedman J, Yaniv Z, Dafni A, Palewitch D. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. J Ethnopharmacol. 1986;16:275–87.
41. Wang YH, Wang C. Common Research Methods of Ethnobotany. Hangzhou: Zhejiang Education Publishing House; 2017.
42. Ugulu I. Fidelity level and knowledge of medicinal plants used to make therapeutic Turkish baths. J Altern Complement Med. 2010;16:13–22.

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 (47)	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
Caesalpinaceae	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
<i>Acampe praemorsa</i> (Roxb.) Blatt. & McCann KMA-161	Amrashi	Orchidaceae	Herb	Wild	Leaves	Tablet prepared from crushed leaves of <i>Acampe praemorsa</i> , fruits of <i>Phyllanthus emblica</i> , stem of <i>Amaranthus spinosus</i> (without spine) and <i>Curcuma longa</i> (young) mixture is taken to treat hot flash, heart disease and rheumatism.
<i>Aegle marmelos</i> (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.
<i>Aerides odorata</i> L. KMA-162	Rasna	Orchidaceae	Herb	Wild	Leaves	Juice prepared from the crushed leaves is taken to treat rheumatism.
<i>Aerva sanguinolenta</i> (L.) Blume KMA-164	Bishali korola pata	Amaranthaceae	Herb	Wild	Leaves	Juice prepared from crushed leaves is taken to treat blood dysentery.
<i>Allium cepa</i> L. KMA-200	Piaj	Liliaceae	Herb	Cultivated	Rhizome	Juice prepared from crushed rhizomes mixed with water is taken to treat ascariasis.
<i>Allium sativum</i> L. KMA-199	Roshun	Liliaceae	Herb	Cultivated	Rhizome	Juice prepared from crushed rhizomes is taken to treat rheumatism.
<i>Amaranthus spinosus</i> 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.
<i>Ananus comosus</i> (L.) Merr. KMA-197	Anaros	Bromeliaceae	Herb	Cultivated	Leaves	Juice prepared from crushed young leaves is taken to treat ascariasis.
<i>Aphanamixis polystachya</i> (Wall.) R.Parker KMA-196	Rona	Meliaceae	Tree	Wild	Fruit	Juice prepared from crushed fruits is taken to treat constipation and as laxative.
<i>Artocarpus heterophyllus</i> 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
<i>Artocarpus lacucha</i> Buch.-Ham. KMA-194	Dheua	Moraceae	Tree	Cultivated	Latex	Latex of stem is taken to treat acidity.
<i>Azadirachta indica</i> 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 <i>Curcuma longa</i> is applied to infected areas for treating skin diseases.
<i>Bambusa balacooa</i> Roxb. KMA-192	Boro bash	Poaceae	Tree	Cultivated	Root	Juice prepared from crushed roots is taken to treat fever.
<i>Blumea lacera</i> (Burm.f.) DC. KMA-191	Kormuta	Asteraceae	Herb	Wild	Leaves	Juice prepared from the crushed leaves is taken to treat dysentery and diarrhea.
<i>Bombax ceiba</i> L. KMA-190	Shimul	Bombacaceae	Tree	Cultivated	Root	Juice prepared from crushed roots is taken to treat sexual diseases.
<i>Calophyllum inophyllum</i> L. KMA-189	Dughagach	Clusiaceae	Tree	Cultivated	Leaves	Juice prepared from crushed leaves is taken to treat lactation.
<i>Calotropis gigantea</i> (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.
<i>Carica papaya</i> L. KMA-187	Cokia	Caricaceae	Shrub	Cultivated	Fruit	Fruit taken as digestive.
<i>Cassia fistula</i> L. KMA-186	Honalu	Caesalpiniaceae	Tree	Cultivated	Leaves	Paste prepared from crushed leaves is applied in affected area to treat fracture.
<i>Centella asiatica</i> (L.) Urban KMA-185	Aduni	Apiaceae	Herb	Wild	Whole plant	Paste prepared from whole plant is taken to relieve from kidney stone.
<i>Chromolaena odorata</i> (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
<i>Citrus aurantiifolia</i> (Christm.) Swingle KMA-183	Lebu	Rutaceae	Tree	Cultivated	Seed	Juice prepared from crushed seeds is taken to relieve from vomiting.
<i>Coccinia grandis</i> (L.) Voigt KMA-182	Kolakochu	Cucurbitaceae	Climber	Wild	Leaves	Paste prepared from crushed leaves is taken to treat to diabetes and cancer.
<i>Colocasia esculenta</i> (L.) Schott KMA-181	Tankachu	Araceae	Herb	Wild	Root	Cooked roots are taken to treat low back pain.
<i>Commelina benghalensis</i> L. KMA-180	Kanaier shag	Commelinaceae	Herb	Wild	Whole plant	Paste prepared from whole plant is taken to treat acidity.
<i>Curcuma longa</i> L. KMA-179	Halud	Zingiberaceae	Herb	Cultivated	Rhizome	Paste prepared from the crushed rhizome is applied to treat skin diseases.
<i>Cynodon dactylon</i> (L.) Pers. KMA-178	Dupa	Poaceae	Herb	Wild	Leaves	Juice prepared from crushed whole plant is taken to treat ulcer of uterus and piles. It also used in hemorrhage.
<i>Datura metel</i> L. KMA-177	Datura	Solanaceae	Herb	Cultivated	Leaves	Juice prepared from the crushed leaves is mixed with mustard oil and warmed and used to rub for treating rheumatism.
<i>Dillenia indica</i> L. KMA-176	Chaelta	Dilleniaceae	Tree	Wild	Leaves	Juice prepared from crushed leaves is taken to treat dysentery.
<i>Eclipta prostrata</i> (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 leuchorrhoea and rheumatism.
<i>Enhydra fluctuans</i> 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
<i>Ficus racemosa</i> L. KMA-235	Jogga dumur	Moraceae	Tree	Wild	Fruit	Powder prepared from crushed fruits is taken to treat diabetes.
<i>Glycosmis pentaphylla</i> (Retz.) A.DC. KMA-243	Hotikhira	Rutaceae	Tree	Wild	Root	Tablet prepared from crushed roots, <i>Piper betle</i> and <i>Areca catechu</i> is taken 3 times per day to treat asthma/shortness of breathing.
<i>Grangea maderaspatana</i> (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.
<i>Hibiscus rosa-sinensis</i> L. KMA-241	Joba	Malvaceae	Shrub	Cultivated	Flower	Juice prepared from crushed flower is applied to treat scaling of palm.
<i>Hibiscus schizopetalus</i> (Mast.) Hook.f. KMA-240	Lanthan joba	Malvaceae	Shrub	Cultivated	Leaves	Juice prepared from crushed leaves is taken to treat dysentery of children.
<i>Homalomena aromatica</i> (Spreng.) Schott KMA-239	Tan kochu	Araceae	Herb	Wild	Stem and root	Cooked stem and root is taken to treat rheumatism.
<i>Hygrophila auriculata</i> (Schumach.) Heine KMA-238	Kulekhara	Acanthaceae	Herb	Wild	Seed	Infusion of seed is taken to treat hot flash.
<i>Ipomoea maxima</i> (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.
<i>Justicia adhatoda</i> L. KMA-236	Bashok	Acanthaceae	Shrub	Wild	Leaves	Juice prepared from crushed leaves is taken to treat asthma, polydypsia and vomiting.
<i>Kalanchoe pinnata</i> (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
<i>Lablab purpureus</i> (L.) Sweet KMA-202	Shim	Fabaceae	Herb	Cultivated	Leaves	Ointment prepared from crushed leaves mixed with juice of rhizome of <i>Curcuma longa</i> and mustard oil is applied on affected area to treat skin disease.
<i>Lasia spinosa</i> (L.) Thwaites KMA-203	Bonadia	Araceae	Herb	Wild	Stem	Fibreless stem are cut into piece and cooked is taken to treat jaundice.
<i>Lawsonia inermis</i> L. KMA-204	Mendi	Lythraceae	Tree	Cultivated	Leaves	Paste of leaves is applied to treat skin diseases and alopecia.
<i>Leea indica</i> Merr. KMA-205	Shagoler bodi	Leeaceae	Shrub	Wild	Leaves	Paste prepared from crushed young leaves is applied to treat skin diseases.
<i>Litsea monopetala</i> (Roxb.) Pers. KMA-206	Meda pata	Lauraceae	Tree	Wild	Leaves	Juice prepared from crushed leaves and mixed with salt is taken to treat dysentery.
<i>Lygodium japonicum</i> (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.
<i>Mangifera indica</i> 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.
<i>Mikania micrantha</i> Kunth KMA-209	Ribuji pata	Asteraceae	Climber	Wild	Leaves	Juice prepared from crushed leaves is applied to stop haemorrhages.
<i>Moringa oleifera</i> Lam. KMA-210	Sojina	Moringaceae	Tree	Cultivated	Leaves	Paste prepared from crushed leaves is taken to treat cough.
<i>Nyctanthes arbor- tristis</i> L. KMA-211	Shefali	Verbenaceae	Tree	Cultivated	Leaves	Juice prepared from crushed leaves is taken to relieve from fever, anorexia and as anthelmintic.
<i>Nymphoides indica</i> (L.) Kuntze KMA-212	Topdubi pata	Menyanthaceae	Herb	Wild	Leaves	Leaves can be applied in affected area immediately after burning.
<i>Ocimum basilicum</i> 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
<i>Oroxylum indicum</i> (L.) Kurz KMA-215	Thona	Bignoniaceae	Tree	Wild	Bark	Powder prepared from the crushed barks is taken in the morning to treat
<i>Paederia foetida</i> L. KMA-213	Gondho vaduli	Rubiaceae	Climber	Wild	Leaves	Juice prepared from crushed leaves is taken to relieve from acidity. It a
<i>Phoenix sylvestris</i> (L.) Roxb. KMA-216	Khejur	Arecaceae	Tree	Cultivated	Latex	Syrup prepared from boiled two years old latex mixed with compact su to treat obesity. Latex of this plant can be applied on the burn wound in
<i>Phrynium imbricatum</i> Roxb. KMA-217	Pituli pata	Marantaceae	Herb	Wild	Leaves	Paste prepared from crushed leaves is taken to treat rheumatism.
<i>Phyllanthus emblica</i> L. KMA-218	Amloki	Euphorbiaceae	Tree	Cultivated	Fruit	Juice of fruits taken as refrigerant and tonic.
<i>Phyllanthus reticulatus</i> Poir. KMA-219	Chitthi Pata	Euphorbiaceae	Shrub	Wild	Stem	Juice prepared from the crushed branch of stem is taken with honey in
<i>Pithecellobium dulce</i> (Roxb.) Benth KMA-220	Nodaiel	Mimosaceae	Tree	Cultivated	Latex	Latex of stem is taken to treat dysentery.
<i>Polyalthia longifolia</i> (Sonn.) Thwaites KMA-221	Debdaru	Annonaceae	Tree	Cultivated	Bark	Powder prepared from crushed barks is taken to treat fever.
<i>Psidium guajava</i> L. KMA-222	Gobia, Heyara	Myrtaceae	Tree	Cultivated	Young leaves	Hot infusion of young leaves is taken to relief toothache.
<i>Ricinus communis</i> L. KMA-223	Verenda	Euphorbiaceae	Shrub	Wild	Bark	Added honey with juice prepared from the crushed bark and tuber of Z
<i>Scoparia dulcis</i> L. KMA-224	Meshri pata	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 /voucher specimen number	Local name	Family	Habit	Status	Parts used	Ethnomedicinal uses
<i>Senna alata</i> (L.) Roxb. KMA-225	Dadmardon	Caesalpiniaceae	Shrub	Cultivated	Leaves	Paste prepared from the crushed leaves is applied to treat skin diseases.
<i>Smilax ovalifolia</i> Roxb. ex D.Don KMA-226	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.
<i>Solanum indicum</i> L. KMA-227	Putki begun	Solanaceae	Shrub	Wild	Stem	Juice prepared from stem is taken to treat skin disease.
<i>Spilanthes acmella</i> (L.) L. KMA-228	Gha gach	Asteraceae	Herb	Wild	Flower	Flowers are chewed in mouth and then thrown out to treat oral ulcer.
<i>Stephania japonica</i> (Thunb.) Miers KMA-229	Mucchanir pata	Menispermaceae	Climber	Wild	Leaves	Paste prepared from crushed leaves is applied on head to treat faint unconscious and taken to treat heart disease.
<i>Streblus asper</i> Lour. KMA-230	Horba	Moraceae	Tree	Wild	Leaves	Juice prepared from crushed leaves is taken to treat dysentery.
<i>Syzygium cumini</i> (L.) Skeels KMA-231	Jam	Myrtaceae	Tree	Cultivated	Seed	Crushed seeds are taken to treat diabetes.
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. KMA-232	Arjun	Combretaceae	Tree	Cultivated	Bark	Juice prepared from the crushed bark is taken with sugar and cow milk to treat heart disease.
<i>Trichosanthes dioica</i> Roxb. KMA-233	Potol	Cucurbitaceae	Herb	Cultivated	Leaves	Juice prepared from crushed leaves is taken to treat fever.
<i>Vitex negundo</i> L. KMA-234	Nishinda	Verbenaceae	Shrub	Wild	Leaves	Paste of leaf is applied in affected areas to treat boils. Juice prepared from the crushed leaves is applied for alopecia .
<i>Zingiber officinale</i> Roscoe KMA-244	Ada	Zingiberaceae	Herb	Cultivated	Rhizome	Juice prepared from rhizome is taken to treat rheumatism and cough.

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

Figures

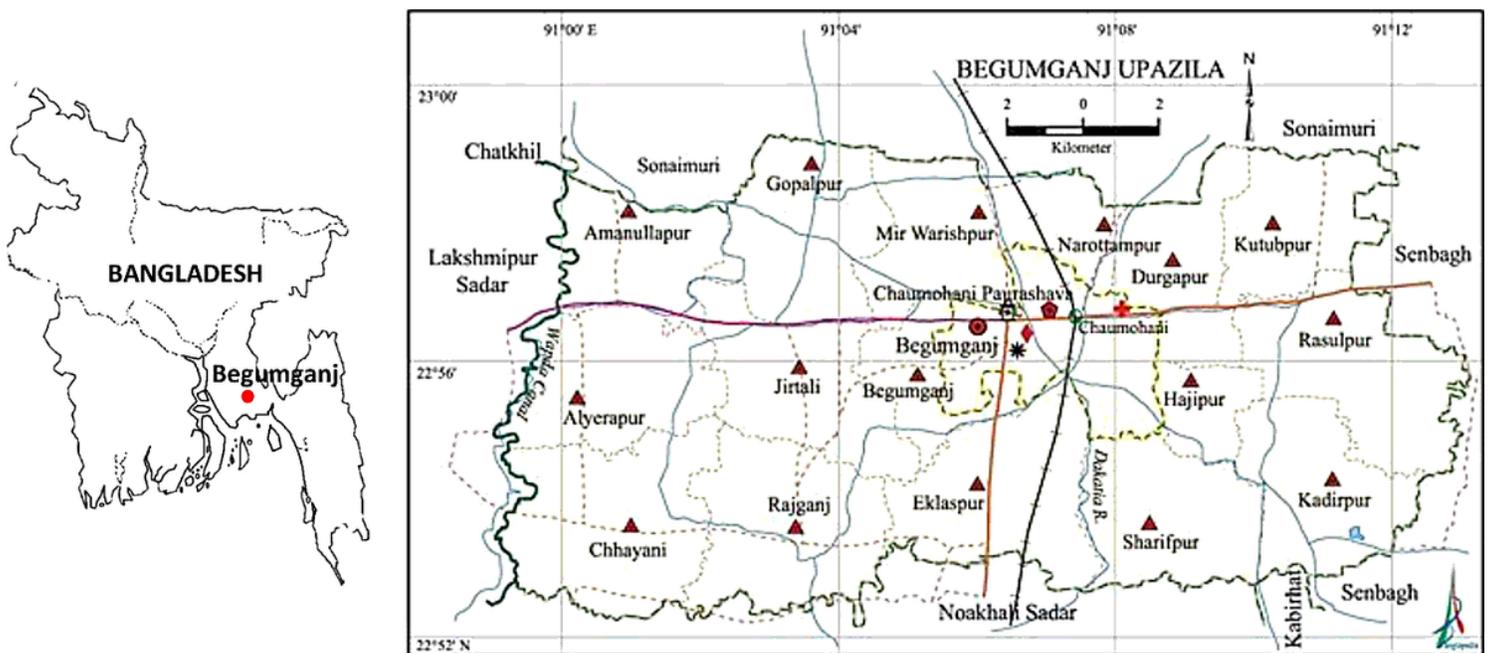


Figure 1

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.

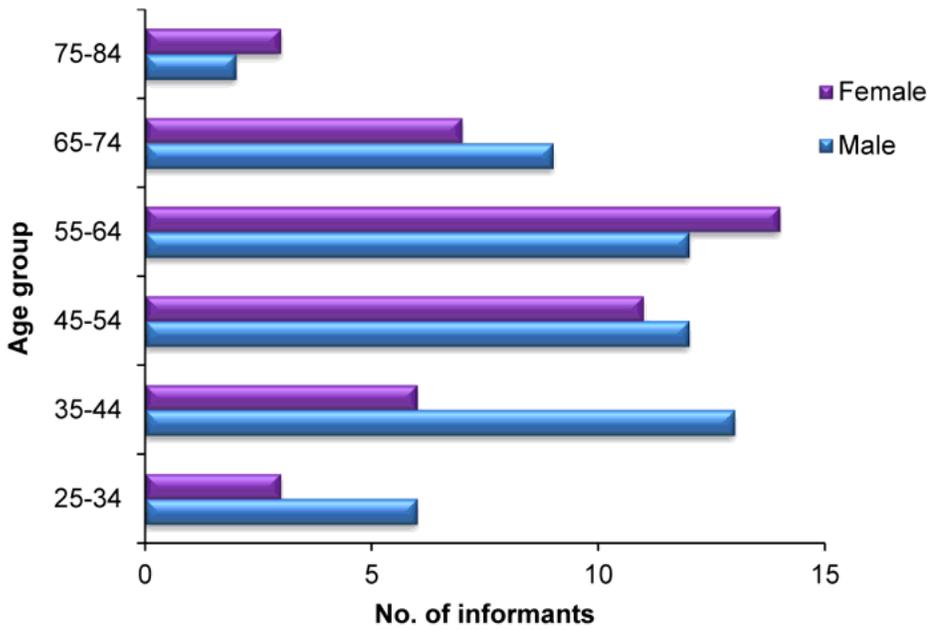


Figure 2

Number of informants by age category and gender in Begumganj upazila

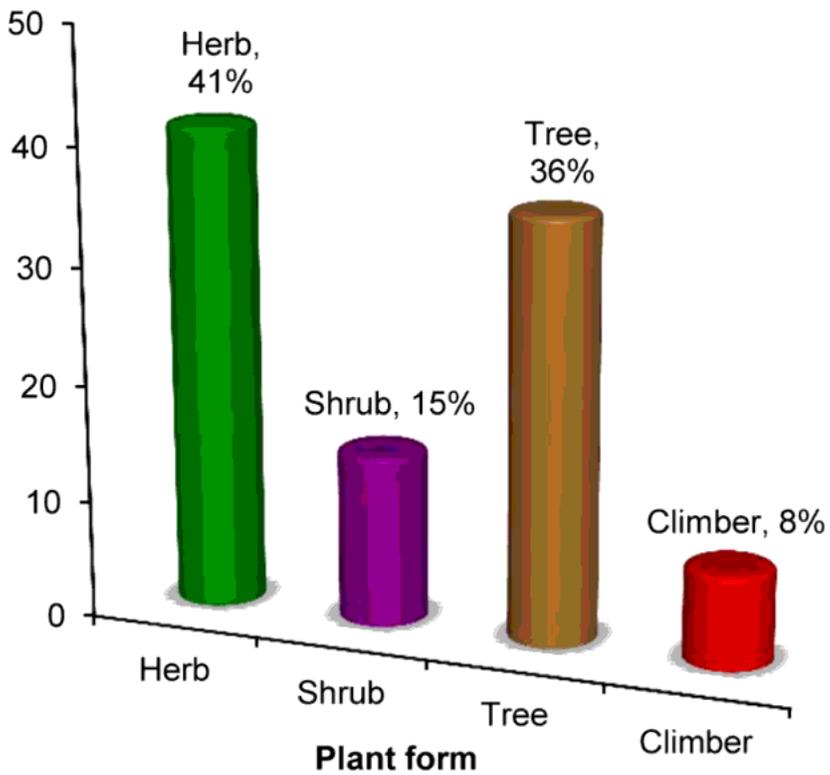


Figure 3

Habits of documented medicinal plant species

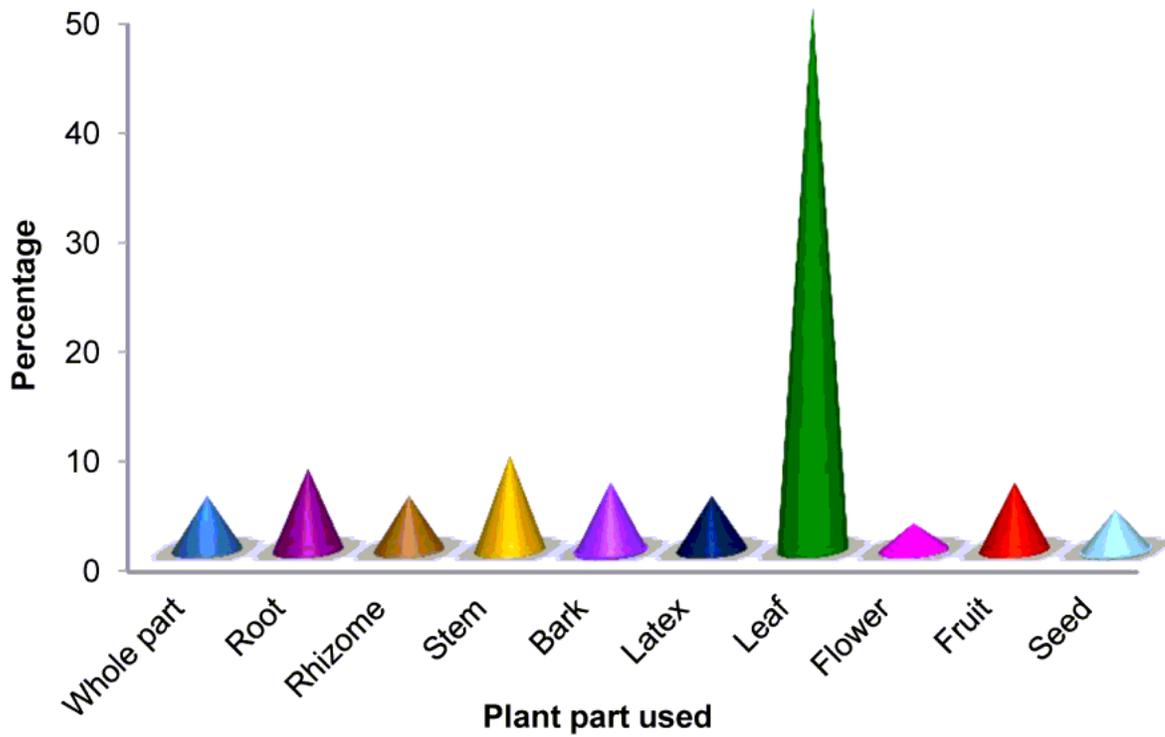


Figure 4

Different parts of plants used by local people in Begumganj

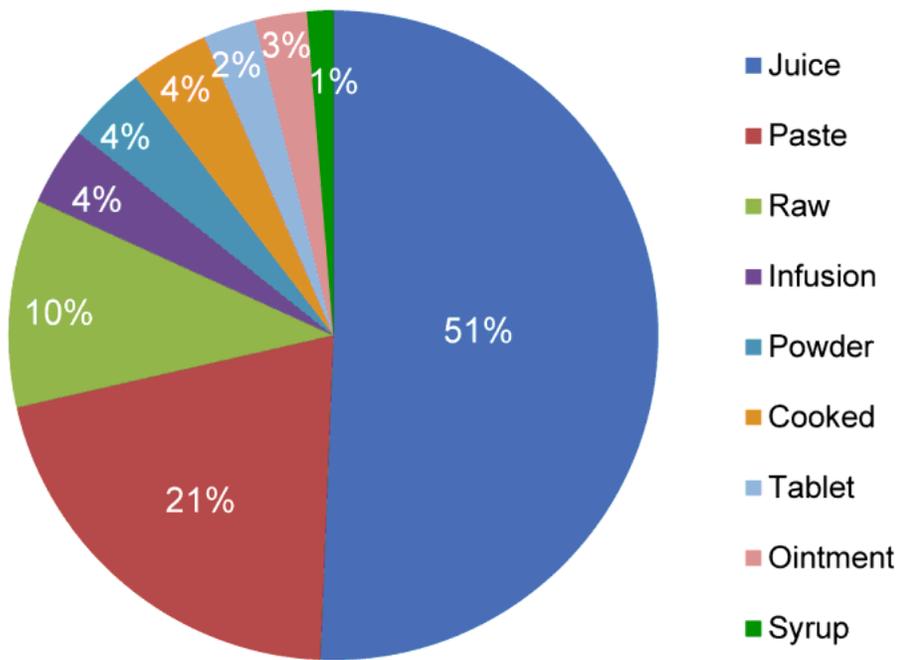


Figure 5

Forms of medication