INTRODUCTION

The use of wild plants is an essential part by the tribe. They are used to meet varied necessities of strong traditional and cultural systems and preparation, which has established and accumulated over generations. The scientific study of substances used by different ethnic or cultural groups therapeutically, especially folk medications, is called ethnopharmacology [1]. Every ethnic community has its own system of traditional medicine, and they utilize natural resource around their habitats for various medicinal purposes [2]. Bangladesh is an unindustrialized country with little cities. The minority of the residents survive in villages. A considerable segment of the population has income beneath the poverty line of US $1 per day; subsequently, an enormous segment of the population suffers from starvation [3] and do not use modern health-care services because of insufficient transportation, lack of allopathic doctors and nonexistence of hospitals or clinics, nonaffordability to buy modern medications, and age-old dependency on folk medicinal practitioners, who are locally known as Kavirajes. The Kavirajes depend largely on medicinal plants for the healing of various illnesses [4].

A large section of the rural populations living far away from the urban area still relies on traditional herbal medicine for their primary healthcare needs because medicinal plants are easily available and cost effective [2].

Over the past two decades, several medicinal and ethnobotanical studies in Bangladesh have been carried out. Some workers have documented the indigenous ethnopharmacology in different parts of Bangladesh [5], but documentation of such study in our research area, Kalaroa Upazila, Satkhira District, Khulna Division, and Bangladesh was not done before; therefore, it is necessary to conserve the ethnomedical knowledge of Satkhira district. A widespread sort of wild plant species is used by the native residents in Kalaroa including many wild green vegetable leaves, roots, and fruits as food.
The objective of this study was to conduct a randomized survey among the traditional medicinal practitioners, Kavirajes to find out the medicinal plants of Kalaroa. We have observed considerable variation in the use of medicinal plants by individual Kavirajes. This is the first attempt to elucidate the ethnomedicinal uses of plants in Kalaroa Thana (police station).

Consequently, this study was designed with the aim to document the reliable information on indigenous ethnomedical knowledge of traditional healers and to provide baseline information for further chemical and pharmacological investigation for the advancement and improvement in animal drugs system.

MATERIALS AND METHODS

Study Area

The study was conducted in the villages of Kalaroa is an Upazila (subdistrict) of Satkhira District in the Division of Khulna, Bangladesh. Kalaroa Upazila area 232.64 km², located in between 22°48’ and 22°57’ north latitudes and in among 88°54’ and 89°09’ east longitudes. It is surrounded by Sharsha, Jhikargacha, and Manirampur upazilas on the north, Satkhira sadar and Talal upazilas on the south; Keshabpur, Manirampur, Talal upazilas, and the Kopothakho river on the east; West Bengal state of India on the west [6].

The average level of arsenic in shallow tube-well water is 137 µg. Sanitation 25.97% (rural 51.43% and urban 61.70%) of dwelling households of the upazila use sanitary latrines and 39.06% (rural 41.23% and urban 21.99%) of dwelling households use nonsanitary latrines; 34.97% of households do not have latrine facilities. The health center’s Upazila health complex 1, the family planning center 12, clinic 1, private clinics/facilities 27, and community clinics 21. Natural disasters are also a common problem in this area [7,8].

The rural population of the village was found to visit Kavirajes for the treatment of both common ailments as well as complicated ailments, which are difficult to treat with modern medicines [Figure 1].

Ethnomedicinal Data Collection

To document the utilization of medicinal plants, a survey was carried out in Narayanpur and Bamonkholi Village of Kalaroa Upazila of Satkhira district of Bangladesh from November 01, 2015, to December 31, 2015.

Before the household survey, casual field visits were arranged with 48 people including local old persons, religious leaders, and other key informants to review and document the availability of medicinal plants in the locality. Meetings were held in the interviewee’s home using the native language (Bengali).

After the interviews, the survey was conducted among 30 households, consisting of 155 people altogether, to get the information about the local use of various plants. Those houses were selected where at least two people take treatments from herbal practitioners.

They were asked about the local name of the plant, which parts they used, where they collected it from, how they prepared it, which diseases they used it, and in which form they take the medication from. Collected information provided by the local informants were cross-checked by three local herbal practitioners locally referred to as Kaviraj namely Md. Mizan Moral, Md. Omar Sardar, Md. Golampor who have sound knowledge on medicinal plants and are highly rated in the society. The survey objectives were explained to informants to get information about traditional medicinal plants. Interviews were conducted based on a semi-structured questionnaire form with answers. For this survey, following information was gathered from them: (a) the local name, (b) plants part’s used, (c) the method of preparation, (d) medicinal uses, (e) mode of application, and (f) dose and dosage forms.

All plant specimen was collected from local forest, follow land, roadside. Plant specimens as pointed out by the Kavirajes were collected and dried.

After completion of survey dried plants was brought to excurator and Principal Scientific Officer of the Bangladesh National Herbarium at Dhaka for complete identification and also, got the information of the scientific names, family names, habit, habitat, nature, relative abundance, and preservation of the species. The voucher specimens of the plants were deposited in Bangladesh National Herbarium, Dhaka (DACB).

Data Analysis

All the species were listed by their scientific name, family, local name, the general name, plants parts used, mode of preparation, habit, habitat, nature, the general name, and solvent used. Statistical analysis of obtained data was performed using Excel software.

RESULTS

In this study, a total of 29 plants distributed into 21 families were observed to be used by the 3 Kavirajes for treatment of various ailments such as cough, pain, cholera, dysentery, fever, flux, erectile dysfunction, leukorrhoea, skin disease, ophthalmia, opacity of cornea, pox, tuberculosis, hypertension, inflammation, diabetes, dysmenorrhoea, paralysis, gonorrhoea, ulcer, and asthma. The Malvaceae family contributed the highest number of plants with four plants, followed by the Amaranthaceae three plants and the Leguminosae and Euphorbiaceae family with two plants, respectively. Other important families included the Bromeliaceae, Arecaceae, Cucurbitaceae, Papaveraceae, Aristolochiaceae, Papaveraceae, Poaceae, Oxalidaceae, Meliaceae, Arecaceae, Menispermaceae, Asteraceae, Areceae, Plantaginaceae, and Verbenaceae. Some of the plants used by traditional medicinal practitioners are shown in Figure 2. The results are summarized in Table 1.
DISCUSSION

It was observed that whole plants, as well as, plant parts such as leaves, stems, roots, bark, fruit, flowers, seeds, and wood were used in their treatment of various ailments. Leaves were the major plant parts used solely or mixed with other parts forming 33% of total users. This was followed by roots (22%), whole plants (12%), stems and bark, fruit and seeds and flowers (10%), and the lowest parts used were pods, rhizomes, and sap (2%) [Figure 3]. Mode of applications was either oral or topical depending on the ailment. In most cases, obtained juice from macerated plant part was administered.

Our survey identified around 42 different individual sicknesses which were claimed to be cured by plants mentioned by the Kavirajes. Maximum numbers of plants (7 plants) were used to treat skin diseases, namely, Aristolochia indica, Argemone mexicana, Euphorbia hirta, Achyranthes aspera, Acalypha indica, Eupatorium odoratum, and Clerodendrum viscosum. Four plants, namely, Abroma augusta, A. aspera, C. viscosum, and Sida cordifolia, were used to treat erectile dysfunction. Cough, diabetes, diarrhea, dysentery, and ulcer were other important diseases which were also treated by five plants each. Asthma, diuretic, and leukorrhea were treated by three plants each. Hypertension was treated by Sida rhombifolia and Scoparia dulcis plant [Table 2].

According to the Health Bulletin 2016, top diseases were fever, asthma, hypotension, and hypertension, diarrhea and gastroenteritis of presumed infectious origin, peptic ulcer, heart failure, secondary hypertension, etc. Hence, from the above data, diseases such as diarrhea, fevers, hypertension, and ulcers are treated by herbal practitioners [Table 2] [8].

Some plants were used to treat multiple diseases, while others were used as a remedy for a single disease. For instance, juice from the leaves of Centella asiatica was used to treat cholera,
Table 1: List of plants along with their local uses and other relevant information described by the Kavirajes

| Scientific name                       | Local name       | Family        | Habit      | Habitat                                                                 | Nature          | Used plant part | Local use                                      | Preparation       | Mode of application |
|---------------------------------------|------------------|---------------|------------|----------------------------------------------------------------------|-----------------|-----------------|------------------------------------------------|-------------------|--------------------|
| Justicia gendarussa Burm.f.            | Kalkasindhi      | Acanthaceae   | Shrub      | Light, medium and heavy soils                                         | Cultivated      | Leaf, bark      | The leaf of this plant is used for treating pain and sprained leg It is also used to treat cough, cold, throat infections and asthma | Juice, Oral       |                    |
| Justicia adhatoda L.                   | Bakasha, Vasok   | Acanthaceae   | Shrub      | Low moisture areas and dry soils                                      | Cultivated wild | Leaf | The leaf extract is used for treating cough The leaf juice is also used to treat dyspepsia | Extract, Oral     |                    |
| Aerva lanata (L.) Juss.                | Daiye khaiye     | Amaranthaceae | Herb       | Wild                                                                  | Wild, cultivated | Leaf, root, flower | A combination of root and red sugar is useful for treating leukorrhea It is also used as antidiarrheal medicine The root is used in a snake-bite treatment In my study area, it is effective for treating erectile dysfunction It is also used in paralysis The root is used in skin disease Juice of the leaves is used in dysentery Dysentery, pain and inflammatory, root with betel vine is used in the treatment of infertility of women | Soup, Oral        |                    |
| Achyranthes aspera L.                  | Chirchira         | Amaranthaceae | Herb       | All parts                                                             |                 |                 | Juice of leaves is used in dysentery, indigestion Anti-inflammatory and analgesic | Powders, Decoction, Oral        |                    |
| Cyathula prostrata (L.) Blume          | Bou-thukuni       | Amaranthaceae | Herb       | Wild                                                                  | Whole plant     |                 | Sap of the plant, central tender part, fruit, gum | Juice, Oral       |                    |
| Centella asiatica (L.) Urb.            | Thankuni          | Apiaceae      | Shrub      | Cultivated wild                                                        |                 |                 | The leaf juice is used for treating cholera, dysentery, and asthma The leaf is also used in diabetes, indigestion | Juice, Oral       |                    |
| Rhaphidophora pertusa (Roxb.) Schott   | Katakacu          | Araceae       | Climber    | Wild                                                                  |                 | Leaf            | It is used in a cough, fever, and gonorrhoea Root is used in a toothache and in nervous debility Gum is useful in diarrhoea | Juice, Oral       |                    |
| Phoenix sylvestris (L.) Roxb.          | Khejura           | Arecaceae     | Tree       | Wild                                                                  | Wild, cultivated | Sap of the plant, central tender part, fruit, gum | It is used in skin disease | Juice, Oral       |                    |
| Aristolochia indica L.                 | Isharmul          | Aristolochiaceae | Climber    | Wild                                                                  |                 | Rhizome, leaf, root | A combination of root and chilli is used as antivenom medicine The juice of leaves is used in vomiting | Decoction, Oral   |                    |

(Contd...)
Table 1: (Continued)

| Scientific name                      | Local name | Family          | Habit    | Habitat                  | Nature | Used plant part | Local use                  | Preparation | Mode of application |
|--------------------------------------|------------|-----------------|----------|--------------------------|--------|-----------------|----------------------------|-------------|---------------------|
| Chromolaena odorata (L.) King         | Germany    | Asteraceae      | Shrub, herb | Bush land, forest margins, roadsides, disturbed sites, waste areas, neglected pastures, crops and plantations | Wild    | Leaf            | Combination of leaf extract and salt is used as antiulcerant medicine It is used in cold, fever, and useful in skin disease | Extract     | Topical oral        |
| Diplazium sylvaticum (Bory) Sw.      | Kaldhera   | Athyriaceae     | Herb     | Evergreen forests, along stream banks | Wild    | Root            | Antidiarrheal, severe pain, pox | Decomposition, juice | Oral, topical        |
| Ananas sativus Schult. and Schult.f. | Anaros     | Bromeliaceae    | Herb     | Light, permeable soils | Cultivated | Root, fruit, leaf | Combination of leaf and honey is used for treating cough Juice of the ripe fruit is diuretic The unripe fruit is abortifacient, digestive, good for influenza The combination of root and mustard oil is used for treating dysentery Leaf extract is a good laxative It is also used in diabetes | Juice, unripe fruit | Oral topical        |
| Coccinia grandis (L.) Voigt          | Telakucha  | Cucurbitaceae   | Herb     | Dry deciduous forests and wastelands | Wild, cultivated | Root, fruit, and leaf | | | Oral topical |
| Euphorbia hirta L.                   | Sada dudhagach | Euphorbiaceae  | Herb     | Grasslands, roadsides, and pathways | Cultivated | All parts | | | Oral, topical |
| Acalypha indica L.                   | Mukta jhuri | Euphorbiaceae   | Herb     | Wastelands, in moist and shaded places, riverbanks. Plains from the coast | Wild, cultivated | Whole plant | | | Vegetables, infusion, powder, paste |
| Acacia nilotica (L.) Delile          | Baabalaa   | Leguminosae     | Shrub or a small to medium tree | Dry environments and can also endure floods | Wild, cultivated | Root, stem, bark, leaf, gum, seed, pod | The leaf juice is used as antiulcer medicine It is also used in skin disease The plant is used in severe cough associated with bleeding The bark is used in colds and pneumonia The bark is also used in dysentery and diarrhea Dysmenorrhea, epilepsy | Juice, infusion | Oral |
| Sesbania cannabina (Retz.) Poir.     | Lal chainche | Leguminosae     | Herb shrub | Heavy soils on watercourses and low-lying areas | Wild, cultivated | Root, bark, leaf | | | Pills Oral |
| Abroma augusta (L.) L.f.             | Ulat Kambal | Malvaceae       | Shrub or small tree | The well-drained soil mix | Wild, cultivated | Leaf, root | The combination of root and honey shows its effectiveness against erectile dysfunction It is also used for treating leukorrhea It is used in amenorrhea and dysmenorrhea | Decoction, paste, decoction | Oral, topical |

(Contd...)
Table 1: (Continued)

| Scientific name                  | Local name | Family      | Habit                        | Habitat                                      | Nature | Used plant part | Local use                                                                 | Preparation | Mode of application |
|----------------------------------|------------|-------------|------------------------------|----------------------------------------------|--------|-----------------|---------------------------------------------------------------------------|-------------|---------------------|
| *Sida rhombifolia* L.            | Sbetabarila | Malvaceae   | Shrub or woody herbaceous plant | Wastelands, wastelands, fallow fields also in degraded forest areas | Wild   | Whole plant     | It is used as antihypertensive medicine It also used as analgesic medicine and contains diuretic action | Juice, pounded | Oral, topical        |
| *Hibiscus scandens* Roxb.        | Kaanphul   | Malvaceae   | Climber                      | Forests outskirts and village shruberie | Wild, cultivated | Root             | Leukorrhea                                                                | Juice | Oral                |
| *Sida cordifolia* L.             | Hagara     | Malvaceae   | Herb, undershrub             | Roadsides, sandy seacosts, and wastelands   | Wild   | Root, bark, leaf, flowers, seed | The combination of leaf extract and salt is used in erectile dysfunction It is also used in the treatment of piles It is used as antiulcer and antidiarrheal medicine Leaves are used to treat skin diseases like eczema Leaves are also used as anti diabetic medicine | Extract, paste | Oral, topical        |
| *Azadirachta indica* A. Juss.    | Neem       | Meliaceae   | Tree                         | Plains Forests                             | Cultivated | Leaf, seed, tree | Juice decoction paste                                                      |             | Oral, topical        |
| *Stephania japonica* (Thunb.) Miers | Nimako   | Menispermaceae | Climbing shrub             | Evergreen and moist deciduous forests      | Wild   | Whole plant     | Extract, juice                                                           |             | Oral                |
| *Oxalis articulata* Savigny      | Aamarul    | Oxalidaceae  | Herb                         | Well-drained soils                         | Wild   | Leaf            | The leaf juice is useful in dysentery The leaf juice is used to cure ophthalmia and opacity of the cornea Skin disease is treated by cooking the leaves of this plant Seeds are used for sedative action | Juice | Oral                |
| *Argemone mexicana* L.           | Siyal kata | Papaveraceae | Herb                         | Fallow lands                               | Wild   | Leaf, root, seed | Juice                                                                      |             | Oral                |
| *Piper peepuloides* Roxb.        | Pepula     | Piperaceae   | Herb or climbing shrubs      | Subtropical forests                        | Wild, cultivated | Leaf            | Juice decoction                                                          |             | Oral, topical        |
| *Scoparia dulcis* L.             | Gurapana   | Plantaginaceae | Herb/undershrub           | Waste places                               | Wild, cultivated | All parts       | Juice, extract, infusion                                                  |             | Oral                |

(Contd...)
Table 1: (Continued)

| Scientific name | Local name | Family | Habit | Habitat | Nature | Used plant part | Local use | Preparation | Mode of application |
|-----------------|------------|--------|-------|---------|--------|-----------------|-----------|-------------|---------------------|
| Cynodon dactylon (L.) Pers. | Durbaghass | Poaceae | Herb | Gardens, landscapes, turf areas, orchards, roadsides, vineyards, and industrial areas | Wild, cultivated | Root, stem, leaf | A combination of plant leaf and bay leaf is used for treating pox | Extract | Oral, topical |
| Clerodendrum viscosum Vent. | Bunobhati | Verbenaceae | Shrub or undershrub, small tree | Moist evergreen forests, river banks, degraded forest areas and also in the plains. | Ornamental, wild | Leaf, root | Leaves and roots are used in asthma and skin diseases | Juice, decoction | Oral |

For treating some diseases, plant parts are used in combination with other plants or substances. For example, the combination of root of A. augusta and honey shows effectiveness against erectile dysfunction; combination of root of Aerva lanata and red sugar is useful for treating leukorrhea; combination of leaf extract of E. odoratum and salt is used as antiulcer medicine; combination of plant leaf and bay leaf is used for treating pox.

Many scientific studies confirm the use of medicinal plants by the Kavirajes. Other plants used by the Kavirajes have not been studied at all or relevant pharmacological studies are yet to be conducted. The literature review of plants is summarized in Table 3.

Local uses of different medicinal plants were evaluated according to the scientific literature study. C. asiatica locally used for the treatment of diabetes. From the literature, we noticed the similar type of medicinal use of this plant. The plant has been shown that chloroform fraction of ethanol extract contains terpenoids, coumarins, and saponins which shown antihypertglycemic activity [16]. C. asiatica extract and its active compound rutin may also provide a safe, natural, and cost-effective treatment for hyperlipidemia and hyperglycemia [47].

Local use of Adhatoda vasica was cough, dyspepsia. From literature, we found that a pectic arabinogalactan isolated from A. vasica by aqueous extraction and precipitation with ethanol inhibited the number of coughs induced by citric acid in guinea pigs and slightly decreased the values of specific airway resistance by peroral administration of this arabinogalactan (50 mg kg\(^{-1}\) body weight) [48].

Azadirachta indica (neem) locally use to treat skin diseases, acne, and fever. Neem is a common medicinal plant in Bangladesh. From the literature, we found that A. indica was used to determine the minimum inhibitory concentration (MIC) and
minimum fungicidal concentration, where extracts of the leaves and seeds were used in contradiction of various dermatophytes. Clinical isolates of dermatophytes were cured with extracts of leaves and seeds of the plant A. indica (neem) for antifungal activity by in vitro tube dilution technique. The achieved outcome was the MIC of neem seed extracts was 31 µg/mL for all the dermatophytes tested.

The neem seed extract at 15 µg/mL concentration (below MIC) was observed to be sufficient for distorting the growth pattern of the organisms tested. The variations in growing curve of the treated dermatophytes were found to be statistically significant with reference to the untreated fungi [49].

Locally, Acacia nilotica is used for the treatment of dysentery, diarrhea, liver disorders, inflammation, colds, and pneumonia. From the literature, we found that in mice, methanolic extract of A. nilotica (bark) showed significant actions against castor oil, magnesium sulfate induced diarrhea, and enteropooling activity due to castor oil treatment as well as on normal as well as barium chloride induced peristalsis of small intestine. It also showed antimicrobial activity against common pathogens responsible for diarrhea in vitro. The above studies support the ethnomedicinal use of A. nilotica bark for the treatment of diarrhea [27].

CONCLUSION

The recent increase in the manufacturing of herbal drugs has created a large demand for medicinal plants. Hence, it plays an important role in the establishment of pharmaceutical industries and identifying new and alternative drug in a more rational and scientific manner. The Kavirajes of Bangladesh merit further consideration for detailed scientific studies as to their uses of various medicinal plants for treatment of diverse ailments.

Diseases such as hypertension or diabetes are on the rise in modern society because of a change in lifestyle and an increase in stress. The medicinal plants used by the Kavirajes in the study to alleviate diabetes or hypertension can prove useful in the discovery of novel drugs to treat such diseases. A further study can be done to identify valuable phytochemicals present in the plant and their disease-curing abilities. The plants that
are mentioned by the Kavirajes in the present survey can be a potential source for the discovery of lead compounds and novel therapeutics.

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