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Medicinal Plants Used by Folk and Tribal Medicinal Practitioners of Bangladesh for Treatment of Gonorrhoea

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ABSTRACT

Gonorrhoea is a sexually transmitted disease and is prevalent in practically every country of the world, including Bangladesh. Although ciprofloxacin is one of the recommended drugs of choice for the treatment of gonorrhoea, *in vitro* resistance to this drug has been reported from many parts of the world. This is also applicable to Bangladesh, where strains have been found of the gonorrhoea causing microorganism, *Neisseria gonorrhoea*, which has developed resistance to a number of antibiotics. As such, development of new antibiotics is essential. The plant kingdom can be a valuable source for such new drugs. Various forms of traditional medicinal practices exist in Bangladesh of which folk medicine is the most common. Folk medicinal practitioners, otherwise known as Kavirajes, rely essentially on medicinal plants for treatment of various ailments. Gonorrhoea is one such ailment, which is widely treated by the Kavirajes. The objective of this study was to document the medicinal plants used by the Kavirajes for treatment of gonorrhoea. Additionally, tribal medicinal practitioners from various tribes of Bangladesh were also interviewed to document any medicinal plants that they use for treatment of this disease. A survey of both Kavirajes and tribal medicinal practitioners revealed that a total of 96 plants distributed in to 54 families were used for treatment of gonorrhoea. The Fabaceae family contributed the largest number of plants with ten plants used from this family. The Euphorbiaceae family contributed six plants followed by the Lamiaceae and the Malvaceae family with five and four plants, respectively. The Amaranthaceae, Combretaceae, Liliaceae, Menispermaceae, Moraceae, and the Solanaceae family contributed three plants each. Anti-gonorrhoeal activities have been reported for a number of plants in the scientific literature for the medicinal plants used in Bangladesh for treatment of gonorrhoea. Taken together, the plants merit further studies for discovery of new drugs, which can be used to combat various existing antibiotic-resistant strains of *Neisseria gonorrhoeae*.

Key words: Medicinal plants, folk medicine, gonorrhoea, Bangladesh.

Introduction

Gonorrhoea is caused by the microorganism, *Neisseria gonorrhoeae*, and is one of the most common sexually transmitted infections in developing countries. Symptoms of this disease in men include burning or pain during urination, increased urinary frequency, discharges from the penis, red or swollen opening of the urethra, and tender or swollen testicles. In women, the symptoms include burning and pain while urinating, vaginal discharge, increased urination, severe pain in lower abdomen, and fever. The disease is also prevalent in Bangladesh, particularly among the sex workers and their clients. Recent years have witnessed the emergence of various strains of the gonorrhoea-causing microorganism, which are resistant to the conventional antibiotics used for treatment of this disease.

A study of commercial sex workers in the capital city of Dhaka, Bangladesh revealed that 17.5% of gonorrhoea cases were resistant to tetracycline and 11.7% were resistant to ciprofloxacin (Bhuiyan *et al.*, 1999). In 1997, it has been reported that 9% of gonorrhoeal isolates were resistant to ciprofloxacin, while in 1998 and 1999 the figures were 41 and 49%, respectively, thus demonstrating a dramatic increase in ciprofloxacin-resistant gonorrhoeal strains (Rahman *et al.*, 2002). A survey among females of high risk behavior in Dhaka showed that 54.54% of the isolated gonorrhoeal strains were resistant to penicillin, ampicillin, and cephalixin (Jahan *et al.*, 1999). A very recent study has found that while in 1997, 9% of the strains isolated from gonorrhoeal cases were resistant to ciprofloxacin, in 2006 the number has increased to 87% (Ahmed *et al.*, 2010). The same

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study also found that multidrug-resistant strains of gonorrhea-causing microorganism emerged in 1997, and in 2006, 44% of the isolates were found to have become multi-drug resistant.

Among street-based female sex workers in Dhaka, 35.5% were reportedly positive for gonorrhea (Rahman *et al.*, 2000). Another study observed that 37.8% of the gonococcal isolates recovered from female sex workers in Dhaka were resistant to ciprofloxacin (Rahman *et al.*, 2001). The prevalence of gonorrhea has been reported to be 0.5% among married women in Dhaka (Bogaerts *et al.*, 2001). Among Bangladeshi women living adjacent to a truck stand, the prevalence of gonorrhea was found to be 5.4% (Gibney *et al.*, 2001). In slum communities of Dhaka, prevalence rate of gonorrhea has been reported to be 1.7% (Sabin *et al.*, 2003). Among hotel-based sex workers, 35.8% has been found to be positive for gonorrhea (Nessa *et al.*, 2004). Among truck stand workers in Dhaka, prevalence of gonorrhea has been reported to be 7.7% among men and 8.3% among women (Alam *et al.*, 2007). Prevalence of gonorrhea was reported at 23.3% in street-based female sex workers in Rajshahi city, Bangladesh (Mondal *et al.*, 2008). A pilot study conducted in Jessore town of Bangladesh demonstrated that clients of brothel-based female sex workers had a 4.5% prevalence rate for gonorrhea (Huq *et al.*, 2010). Cumulatively speaking, the available studies strongly suggest that gonorrhea is on the increase in Bangladesh and is spreading from the capital city Dhaka to other towns and rural areas of the country. What is also a worrying aspect is that not only gonorrhoeal cases are on the rise, but also the causative organism has developed resistance to a number of antibiotics, which has been traditionally used by allopathic doctors for treatment of this disease.

Quite obviously, the emerging pattern of drug-resistant strains of gonorrhea demand immediate discovery of new drugs to combat this disease. Plant kingdom can form a useful source for such drugs. Bangladesh has a number of traditional medicinal systems, among which the folk medicinal practitioners, otherwise known as Kavirajes, are regarded as the forming the first-tier of primary health-care providers, particularly to the rural population. Kavirajes rely on medicinal plants for treatment and are known to have treated this disease for centuries. As such, they have a first-hand cumulative knowledge on treatment of gonorrhea with a variety of medicinal plant species. We had been conducting ethnomedicinal surveys among the Kavirajes of the mainstream population as well as tribal medicinal practitioners of Bangladesh for the last few years (Nawaz *et al.*, 2009; Rahmatullah *et al.*, 2009a-c; Hasan *et al.*, 2010; Hossan *et al.*, 2010; Mollik *et al.*, 2010a,b; Rahmatullah *et al.*, 2010a-g; Jahan *et al.*, 2011). The objective of the present study was to compile information from our various published and yet to be published surveys on medicinal plants used by Kavirajes and tribal medicinal practitioners for treatment of gonorrhea.

Materials and Methods

The survey was conducted among Kavirajes of various regions of Bangladesh. Altogether, 48 out of the 64 districts of Bangladesh were involved in the survey areas. However, instead of a comprehensive survey of the Kavirajes of the whole district, which would have been too broad and time-consuming, Kavirajes were selected from randomly selected villages of any particular district and interviewed. Besides such Kavirajes, surveys were also conducted among the Garo and Santal tribal practitioners of randomly selected communities of such tribes.

Informed consent was obtained from each Kaviraj prior to the survey. Briefly, the Kavirajes were informed as to the nature of our visit, and consent obtained that any divulged information may be disseminated by us both nationally and internationally. Kavirajes were specifically asked whether they treat gonorrhea and can recognize it as a disease. Since gonorrhea has been reported in this part of the world for centuries, the Kavirajes have treated this disease over generations and had no problem in distinguishing this disease from other diseases. It is to be noted that the practice of Kaviraj is usually run within the family and accumulated knowledge is transferred from generation to generation. Actual interviews were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin (1995) and Maundu (1995). In this method, the Kavirajes took the interviewers on guided field-walks through areas from where they collected their medicinal plants, showed the plants to the interviewers, and described their uses. Plant specimens were collected from the spot and identified at the Bangladesh National Herbarium at Dhaka or by Mr. Manjur-Ul-Kadir Mia, ex-Curator and Principal Scientific Officer of the Bangladesh National Herbarium. Interviews were conducted in Bengali with the Kavirajes, who along with the interviewers spoke the same language. With the Garo and the Santal tribal practitioners, interviews were conducted with the help of an interpreter, the interpreter usually forming the Headman of the tribe, and who spoke both Bengali as well as the tribal language.

Results and Discussion

A total of 96 plants distributed in to 54 families were found in the present survey to be used by Kavirajes of the mainstream Bengali-speaking population as well as tribal medicinal practitioners for treatment of gonorrhea. The results are shown in Table 1. The Fabaceae family contributed 10 plants followed by the Euphorbiaceae family with 6 plants. Five plant species belonged to the Lamiaceae family, and 4 plant species to the Malvaceae

family. The Amaranthaceae, Combretaceae, Liliaceae, Menispermaceae, Moraceae, and Solanaceae families contributed 3 plants each.

Table 1: List of medicinal plants used in folk and tribal medicines of Bangladesh for treatment of gonorrhea.

Botanical name	Family	Local name
<i>Justicia adhatoda</i> L.	Acanthaceae	Bashok
<i>Ruellia tuberosa</i> L.	Acanthaceae	Chot poti
<i>Polianthes tuberosa</i> L.	Agavaceae	Rojonigondha
<i>Aloe vera</i> (L.) Burm.f.	Aloaceae	Ghrito kumari
<i>Achyranthes aspera</i> L.	Amaranthaceae	Apang
<i>Alternanthera sessilis</i> (L.) DC	Amaranthaceae	Shanti shak
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Kanta khudurey
<i>Celosia cristata</i> L.	Amaranthaceae	Morogh phool
<i>Curculigo orchoides</i> Gaertn.	Amoryllidaceae	Talmul
<i>Uvaria hamiltonii</i> Hook.f. and Thom.	Annonaceae	Lotkon
<i>Foeniculum vulgare</i> Mill.	Apiaceae	Mouri
<i>Plumeria acutifolia</i> Poir.	Apocynaceae	Kath gulap
<i>Pistia stratiotes</i> L.	Araceae	Topa pana
<i>Stereospermum suaveolens</i> DC.	Bignoniaceae	Parul
<i>Bombax ceiba</i> L.	Bombacaceae	Shimul
<i>Bixa orellana</i> L.	Bixaceae	Jafran
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Anarosh
<i>Crataeva religiosa</i> G. Forst.	Capparaceae	Dathon (Garo tribe)
<i>Cecropia peltata</i> L.	Ceropiaceae	Jongli udal
<i>Calophyllum inophyllum</i> L.	Clusiaceae	Kathali chapa
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight and Arn.	Combretaceae	Arjun
<i>Terminalia belerica</i> (Gaertn.) Roxb.	Combretaceae	Bohera
<i>Terminalia chebula</i> Retz.	Combretaceae	Horitoki
<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Kolmi shak
<i>Costus speciosus</i> (J. König.) Sm.	Costaceae	Keu danga
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Pathorkuchi
<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Chal kumra
<i>Coccinia grandis</i> (L.) J. Voigt	Cucurbitaceae	Telakucha
<i>Dipterocarpus turbinatus</i> Gaertn.f. D. Laevis	Dipterocarpaceae	Gorjon
<i>Acalypha hispida</i> Burm.f.	Euphorbiaceae	Aam-nanga
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Godhani
<i>Jatropha curcas</i> L.	Euphorbiaceae	Jamal gota
<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amloki
<i>Phyllanthus niruri</i> L.	Euphorbiaceae	Bhui amla
<i>Sonneratia apetala</i> Buch.-Ham.	Euphorbiaceae	Keowra
<i>Abrus precatorius</i> L.	Fabaceae	Laal koonch
<i>Acacia farnesiana</i> L.	Fabaceae	Babla
<i>Arachis hypogaea</i> L.	Fabaceae	Cheena badam
<i>Caesalpinia bonduc</i> (L.) Roxb.	Fabaceae	Nata
<i>Cassia alata</i> L.	Fabaceae	Dard mordon
<i>Cassia sophora</i> L.	Fabaceae	Thonthoni
<i>Dalbergia sissoo</i> Roxb. ex DC.	Fabaceae	Shishu
<i>Lablab purpureus</i> (L.) Sweet	Fabaceae	Shimbi (Santal tribe)
<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	Bon niil
<i>Uraria picta</i> (Jacq.) DC.	Fabaceae	Rahu chondal
<i>Swertia chirata</i> (Roxb. ex Fleming) H. Karst.	Gentianaceae	Chirota
<i>Clerodendrum viscosum</i> Vent.	Lamiaceae	Bhati
<i>Gmelina arborea</i> Roxb.	Lamiaceae	Gamari
<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Tokma (Garo tribe)
<i>Ocimum basilicum</i> L.	Lamiaceae	Babui tulshi
<i>Ocimum gratissimum</i> L.	Lamiaceae	Ram tulshi
<i>Cinnamomum tamala</i> (Buch.-Ham.) Nees and Eberm.	Lauraceae	Tejpata
<i>Litsea chinensis</i> Lam.	Lauraceae	Khara zura
<i>Asparagus acerosa</i> Sond.	Liliaceae	Shotomuli (Garo tribe)
<i>Asparagus racemosus</i> Willd.	Liliaceae	Shotomuli
<i>Gloriosa superba</i> L.	Liliaceae	Ulot chondal
<i>Lawsonia inermis</i> L.	Lythraceae	Mehedi
<i>Michelia champaca</i> L.	Magnoliaceae	Shorno chapa
<i>Abelmoschus moschatus</i> Medik.	Malvaceae	Lota kosturi
<i>Hibiscus esculentus</i> (L.) Moench	Malvaceae	Dherosh
<i>Hibiscus rosa sinensis</i> L.	Malvaceae	Joba
<i>Sida cordifolia</i> L.	Malvaceae	Brela
<i>Cocculus hirsutus</i> L. Diels	Menispermaceae	Sundal shona
<i>Stephania japonica</i> (Thunb.) Miers	Menispermaceae	Aknodi
<i>Tinospora cordifolia</i> (Willd.) Hook.f. and Thoms.	Menispermaceae	Guloncho
<i>Ficus benghalensis</i> L.	Moraceae	Bot gach

<i>Morus alba</i> L.	Moraceae	Tunth
<i>Streblus asper</i> Lour.	Moraceae	Deshi shaora
<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	Punornova
<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Shondha maloti
<i>Euryale ferox</i> Salisb.	Nymphaeaceae	Makhna
<i>Cymbidium aloifolium</i> (L.) Sw.	Orchidaceae	Rashna
<i>Pandanus odoratus</i> Ridl.	Pandanaceae	Shanlha
<i>Piper cubeba</i> L.f.	Piperaceae	Kabab chini
<i>Piper longum</i> L.	Piperaceae	Pipul
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Durba
<i>Drynaria quercifolia</i> (L.) J. Smith	Polypodiaceae	Jotamanosi
<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Boroi
<i>Ixora coccinea</i> L.	Rubiaceae	Rongon
<i>Nauclea latifolia</i> Sm.	Rubiaceae	Jongli gulap jaam
<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Bael
<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	Lebu
<i>Santalum album</i> L.	Santalaceae	Seth chondon
<i>Scoparia dulcis</i> L.	Scrophulariaceae	Chini gura
<i>Smilax china</i> L.	Smilacaceae	Kumar kata
<i>Smilax zeylanica</i> L.	Smilacaceae	Kumari lota
<i>Datura metel</i> L.	Solanaceae	Kalo dhutura
<i>Solanum melongena</i> L.	Solanaceae	Baegun
<i>Solanum surattense</i> Burm.f.	Solanaceae	Kontikari
<i>Abroma augusta</i> L.f.	Sterculiaceae	Ulot kombol
<i>Sterculia foetida</i> L.	Sterculiaceae	Pesta badam
<i>Grewia subinaequalis</i> DC.	Tiliaceae	Chondoni shaora
<i>Trema orientalis</i> (L.) Blume	Ulmaceae	Khoksa
<i>Centella asiatica</i> (L.) Urb.	Umbelliferae	Thankuni
<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	Khoi upra
<i>Curcuma longa</i> L.	Zingiberaceae	Holud

Unless specific tribes have been mentioned, the medicinal plants listed in Table 1 above were used by Kavirajes for treatment of gonorrhoea.

Some of the plants used by the Kavirajes have already been reported in the scientific literature as to contain anti-gonorrhoeal activity. For instance, the bark of *Bixa orellana* is used in Guatemalan traditional medicine for treatment of gonorrhoea, and this use has been scientifically validated (Cáceres *et al.*, 1995). Preliminary scientific studies have also indicated that extracts of *Ocimum sanctum* (synonym of *Ocimum gratissimum*) and *Drynaria quercifolia* caused inhibition of *Neisseria gonorrhoeae* clinical isolates and World Health Organization strains (Shokeen *et al.*, 2005). The anti-inflammatory compound, curcumin, isolated from *Curcuma longa* reportedly inhibited *Neisseria gonorrhoeae*-induced NF- κ B signaling, release of pro-inflammatory cytokines/chemokines and attenuated adhesion in late infection (Wessler *et al.*, 2005).

The number of plants used for treatment of gonorrhoea by the folk and tribal medicinal practitioners of Bangladesh indirectly indicated that gonorrhoea is fairly prevalent within the rural and tribal population. Recent reports strongly suggest that multi-drug resistant gonorrhoea is on the rise in Bangladesh, and such resistant strains are increasing at a fairly rapid rate. Studies need to be conducted directly as to the prevalence of this disease among the rural population, who form the substantial majority of the people of the country. At the same time, such studies need to be conducted among the various tribes of Bangladesh. The sheer number of plants used for treatment of gonorrhoea presents a hopeful picture in the sense that scientific evaluation of these plant species can lead to discovery of novel drugs with which multi-drug resistant gonorrhoeal strains can be combated. Notably use of four plants by the Kavirajes, namely *Bixa orellana*, *Ocimum gratissimum*, *Drynaria quercifolia*, and *Curcuma longa*, for treatment of gonorrhoea has been validated. The other plants also merit serious scientific studies as to their anti-gonorrhoeal effects.

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