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

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ABSTRACT

Gonorrhea 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 gonorrhea, *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 gonorrhea causing microorganism, *Neisseria gonorrhea*, 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. Gonorrhea 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 gonorrhea. 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 gonorrhea. 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-gonorrheal activities have been reported for a number of plants in the scientific literature for the medicinal plants used in Bangladesh for treatment of gonorrhea. 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, gonorrhea, Bangladesh

Introduction

Gonorrhea 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 gonorrhea-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

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gonorrhea 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 gonorrheal 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 gonorrheal strains (Rahman *et al*., 2002). A survey among females of high risk behavior in Dhaka showed that 54.54% of the isolated gonorrheal strains were resistant to penicilliun, ampicillin, and cephalexin (Jahan *et al*., 1999). A very recent study has found that while in 1997, 9% of the strains isolated from gonorrheal cases were resistant to ciprofloxacin, in 2006 the number has increased to 87% (Ahmed *et al*., 2010). The same 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 gonorrheal 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
Justicia adhatoda L.	Acanthaceae	Bashok
Ruellia tuberosa L.	Acanthaceae	Chot poti
Polianthes tuberosa L.	Agavaceae	Rojonigondha
Aloe vera (L.) Burm.f.	Aloaceae	Ghrito kumari
Achyranthes aspera L.	Amaranthaceae	Apang
Alternanthera sessilis (L.) DC	Amaranthaceae	Shanti shak
Amaranthus spinosus L.	Amaranthaceae	Kanta khudurey
Celosia cristata L.	Amaranthaceae	Morogh phool
Curculigo orchioides Gaertn.	Amaryllidaceae	Talmul
Uvaria hamiltonii Hook.f. & Thom.	Annonaceae	Lotkon
Foeniculum vulgare Mill.	Apiaceae	Mouri
Plumeria acutifolia Poir.	Apocynaceae	Kath gulap
Pistia stratiotes L.	Araceae	Topa pana
Stereospermum suaveolens DC.	Bignoniaceae	Parul
Bombax ceiba L.	Bombacaceae	Shimul
Bixa orellana L.	Bixaceae	Jafran
Ananas comosus (L.) Merr.	Bromeliaceae	Anarosh
Crataeva religiosa G. Forst.	Capparaceae	Dathon (Garo tribe)
Cecropia peltata L.	Ceropiaceae	Jongli udal
Calophyllum inophyllum L.	Clusiaceae	Kathali chapa
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Combretaceae	Arjun
Terminalia belerica (Gaertn.) Roxb.	Combretaceae	Bohera
Terminalia chebula Retz.	Combretaceae	Horitoki
Ipomoea aquatica Forssk.	Convolvulaceae	Kolmi shak
Costus speciosus (J. König.) Sm.	Costaceae	Keu danga
Kalanchoe pinnata (Lam.) Pers.	Crassulaceae	Pathorkuchi
Benincasa hispida (Thunb.) Cogn.	Cucurbitaceae	Chal kumra
Coccinia grandis (L.) J. Voigt	Cucurbitaceae	Telakucha
Dipterocarpus turbinatus Gaertn.f. D. Laevis	Dipterocarpaceae	Gorjon
Acalypha hispida Burm.f.	Euphorbiaceae	Aam-nanga
Euphorbia hirta L.	Euphorbiaceae	Godhani
Jatropha curcas L.	Euphorbiaceae	Jamal gota
Phyllanthus emblica L.	Euphorbiaceae	Amloki
Phyllanthus niruri L.	Euphorbiaceae	Bhui amla
Sonneratia apetala Buch.-Ham.	Euphorbiaceae	Keowra
Abrus precatorius L.	Fabaceae	Laal koonch
Acacia farnesiana L.	Fabaceae	Babla
Arachis hypogaea L.	Fabaceae	Cheena badam
Caesalpinia bonduc (L.) Roxb.	Fabaceae	Nata
Cassia alata L.	Fabaceae	Dard mordon
Cassia sophera L.	Fabaceae	Thonthoni
Dalbergia sissoo Roxb. ex DC.	Fabaceae	Shishu
Lablab purpureus (L.) Sweet	Fabaceae	Shimbi (Santal tribe)
Tephrosia purpurea (L.) Pers.	Fabaceae	Bon niil
Uraria picta (Jacq.) DC.	Fabaceae	Rahu chondal
Swertia chirata (Roxb. ex Fleming) H. Karst.	Gentianaceae	Chirota
Clerodendrum viscosum Vent.	Lamiaceae	Bhati
Gmelina arborea Roxb.	Lamiaceae	Gamari
Hyptis suaveolens (L.) Poit.	Lamiaceae	Tokma (Garo tribe)
Ocimum basilicum L.	Lamiaceae	Babui tulshi
Ocimum gratissimum L.	Lamiaceae	Ram tulshi
Cinnamomum tamala (Buch.-Ham.) Nees & Eberm.	Lauraceae	Tejpata

Table 1: Continue

Litsea chinensis Lam.	Lauraceae	Khara zura
Asparagus acerosa Sond.	Liliaceae	Shotomuli (Garo tribe)
Asparagus racemosus Willd.	Liliaceae	Shotomuli
Gloriosa superba L.	Liliaceae	Ulot chondal
Lawsonia inermis L.	Lythraceae	Mehedi
Michelia champaca L.	Magnoliaceae	Shorno chapa
Abelmoschus moschatus Medik.	Malvaceae	Lota kosturi
Hibiscus esculentus (L.) Moench	Malvaceae	Dherosh
Hibiscus rosa sinensis L.	Malvaceae	Joba
Sida cordifolia L.	Malvaceae	Brela
Cocculus hirsutus L. Diels	Menispermaceae	Sundal shona
Stephania japonica (Thunb.) Miers	Menispermaceae	Aknodi
Tinospora cordifolia (Willd.) Hook.f. & Thoms.	Menispermaceae	Guloncho
Ficus benghalensis L.	Moraceae	Bot gach
Morus alba L.	Moraceae	Tunth
Streblus asper Lour.	Moraceae	Deshi shaora
Boerhaavia diffusa L.	Nyctaginaceae	Punornova
Mirabilis jalapa L.	Nyctaginaceae	Shondha maloti
Euryale ferox Salisb.	Nymphaeaceae	Makhna
Cymbidium aloifolium (L.) Sw.	Orchidaceae	Rashna
Pandanus odorus Ridl.	Pandanaceae	Shanlha
Piper cubeba L.f.	Piperaceae	Kabab chini
Piper longum L.	Piperaceae	Pipul
Cynodon dactylon (L.) Pers.	Poaceae	Durba
Drynaria quercifolia (L.) J. Smith	Polypodiaceae	Jotamanosi
Zizyphus mauritiana Lam.	Rhamnaceae	Boroi
Ixora coccinea L.	Rubiaceae	Rongon
Nauclea latifolia Sm.	Rubiaceae	Jongli gulap jaam
Aegle marmelos (L.) Corr.	Rutaceae	Bael
Citrus aurantiifolia (Christm.) Swingle	Rutaceae	Lebu
Santalum album L.	Santalaceae	Seth chondon
Scoparia dulcis L.	Scrophulariaceae	Chini gura
Smilax china L.	Smilacaceae	Kumar kata
Smilax zeylanica L.	Smilacaceae	Kumari lota
Datura metel L.	Solanaceae	Kalo dhutura
Solanum melongena L.	Solanaceae	Baegun
Solanum surattense Burm.f.	Solanaceae	Kontikari
Abroma augusta L.f.	Sterculiaceae	Ulot kombol
Sterculia foetida L.	Sterculiaceae	Pesta badam
Grewia subinaequalis DC.	Tiliaceae	Chondoni shaora
Trema orientalis (L.) Blume	Ulmaceae	Khoksa
Centella asiatica (L.) Urb.	Umbelliferae	Thankuni
Phyla nodiflora (L.) Greene	Verbenaceae	Khoi upra
Curcuma longa L.	Zingiberaceae	Holud

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

Some of the plants used by the Kavirajes have already been reported in the scientific literature as to contain anti-gonorrheal activity. For instance, the bark of *Bixa orellana* is used in Guatemalan traditional medicine for treatment of gonorrhea, 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-kB 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 gonorrhea by the folk and tribal medicinal practitioners of Bangladesh indirectly indicated that gonorrhea is fairly prevalent within the rural and tribal population. Recent reports strongly suggest that multi-drug resistant gonorrhea 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 gonorrhea 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 gonorrheal 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 gonorrhea has been validated. The other plants also merit serious scientific studies as to their anti-gonorrheal effects.

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