OPEM
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Oriental Pharmacy and Experimental Medicine 2008 **8(3)**, 316-321
DOI 10.3742/OPEM.2008.8.3.316

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Short Communication

Screening of some Bangladeshi medicinal plants for *in vitro* antibacterial activity

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Received for publication September 28, 2006; accepted April 08, 2008

SUMMARY

A total of 33 extracts representing 26 plant species belonging to 24 families were collected from different regions of Bangladesh, and screened for their *in vitro* antibacterial activity against several pathogenic Gram-positive and Gram-negative bacterial strains using the conventional disc diffusion method. The most potent activity was exhibited by the extracts of *Aegiceras corniculatum*, *Alocasia fornicata, Ceriops decandra, Cuscuta reflexa, Lasia spinosa, Lantana camara, Pandanus foetidus* and *Xylocarpus granatum.* The extracts of *Abtilon indicum, Derris trifoliata, Dendrophthoe falcat, Ruellia tuberosa* and *X. moluccensis* did not show any antibacterial properties at test concentrations.

Key words: Antibacterial activity; Medicinal plants; Disc diffusion method; Bangladesh

INTRODUCTION

Natural products have long been utilized as an indispensable source for the discovery and development of new drugs. One of the major sources of these natural products is medicinal plants that have been used traditionally in many countries to combat various diseases, including infections. The healthcare systems in many developing countries like Bangladesh still rely significantly on the uses of medicinal plants. Bangladesh is one of the South Asian countries that have a rich and prestigious heritage of medicinal plants' uses to treat various diseases. As a consequence, medicinal plants have traditionally occupied an important status in the socio-cultural, spiritual and medicinal arena of rural and tribal lives on Bangladesh. A conservative estimate would include at least 500 species of medicinal plants that have been used in Bangladeshi traditional medicines (Ghani, 1998). A survey conducted in 1990 in different villages in Bangladesh revealed that on average of 14% of people suffering from illnesses approach qualified allopathic doctors, 29% contact unqualified village doctors, 10% contact mullahs,

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29% contact traditional phytotherapists ('kabiraj') and 19% contact homeopaths. The survey indicated an extensive use of medicinal plants, most of which are prescribed in crude form (Ahmed, 2000). Hundreds of indigenous medicinal plants are used in different Ayurvedic and Unani commercial preparations without proper standardizations, quality control, evaluation and determination of the chemical components, or pharmacological and toxicological studies of the active components. To promote the proper use of herbal medicine and to determine their potential as a source for new drugs, it is essential to assess medicinal plants, having folkloric reputation, for their medicinal properties.

In recent years, infections have increased to a great extent and antibiotics resistance has become an ever-increasing therapeutic problem. Plants produce various secondary metabolites as a mechanism for their defence against bacterial and fungal infections. Thus, it can be assumed that some of these plant-derived compounds could equally be useful against pathogenic bacteria causing infections in humans, and also could offer newer types of antimicrobial agents with possibly novel mechanisms of actions (Mothana and Lindequist, 2005). As a part of our on-going pharmacological studies on selected Bangladeshi medicinal plants (Shilpi *et al.*, 2004, 2005, 2006), we now report for the first time the antibacterial activity of some Bangladeshi medicinal plants, selected on the basis of traditional medicinal uses and information collated from native people.

MATERIALS AND METHODS

Plant materials and extraction

The plants were collected from different localities of the southern region of the district of Khulna, Bangladesh, during August-November, 2003 and identified by the experts of Bangladesh National Herbarium, Dhaka, Bangladesh and Forestry and Wood Technology Discipline, Life Science School, Khulna University and the voucher specimen were deposited at the herbarium of Pharmacy Discipline, Khulna University. Air-dried and powdered plant materials were macerated with 80% EtOH at room temperature. The extracts were filtered and air-dried to give the crude dried extracts (Table 1).

Antibacterial activity: Disc diffusion assay

Conventional disc diffusion method (Bauer *et al.*, 1966; Cruickshank, 1968) has been employed to assess the antibacterial potential of the extracts. Sterile 6.0 mm diameter blank discs (BBL, Cocksville, USA) were impregnated with test substances at a dose of 500 μg/disc. These discs, along with standard disks (30 μg/disc) (Kanamycin, Oxoid Ltd., UK) and control disks were placed on Petri dishes containing a suitable agar medium seeded with the test organisms using sterile transfer loop and kept at 4 °C to facilitate maximum diffusion. The plates were kept in an incubator (37 °C) to allow the growth of the bacteria. The antibacterial activities of the test agents were determined by measuring the diameter of the zone of inhibition in terms of millimetre. Antimicrobial activity was tested against *Escherichia coli, Vibrio cholerae, Salmonella typhi, Shigella dysenteriae, S. boydii, S. flexneri, S. sonnei, Enterobacter aerogenes, Staphylococcus aureus, S. epidermis, S. pyogenes* and *Pseudomonas aeruginosa.*

RESULTS

The antibacterial activity of a number of selected Bangladeshi medicinal plants against several pathogenic Gram-positive and Gram-negative bacteria has been assessed using the conventional disc diffusion method. A total of 33 extracts representing 26 plant species belonging to 24 families were subjected to this screening. Table 1 shows the botanical names, families, plant part used, voucher specimens and traditional uses of these Bangladeshi plants. The results of antibacterial activity of the investigated extracts are shown in Table 2. The ethanolic extracts of *A. corniculatum, A.*

Table 1. List of plants screened for antibacterial activity

Plant	Family	Part used	Extract yield in %	Voucher details[a]	Traditional uses[b]
Aegiceras corniculatum	Myrsinaceae	B	6.36	KUP001	Asthma, diabetes, rheumatism, fish poison
Anthocephalus chinensis	Rubiaceae	B L	8.0 10.90	DACB-30321	Fever, chest congestion, tonic
Abtilon indicum	Malvaceae	L	2.26	DACB-30544	Anthelmintic, fever, piles, diuretic
Alocasia indica	Araceae	R	1.0	KUP002	Rheumatism, cough, leprosy
Alocasia fornicata	Araceae	R	2.56	DACB-30548	Pain, diarrhoea, fever
Amorphophallus campanulatus	Araceae	R	5.13	KUP003	Asthma, pain, bronchitis, diarrhoea
Ceriops decandra	Rhizophoraceae	B L P	27.36 6.66 24.0	DACB-30322	Pain, haemorrhages
Commelina benghalensis	Commelinaceae	L	5.0	KUP004	Leprosy, swellings, gonorrhea, cold.
Crataeva nurvala	Capparidaceae	L	3.04	KUP005	Rheumatic fever, urinary infections, anthelmintic, disease of tuberculous glands
Cyperus rotundus	Cyperaceae	R	9.02	KUP006	Pain, fever, diarrhoea, dysentery
Diospyros peregrina	Ebenaceae	L	3.23	DACB-30323	Bactericide, diarrhoea, fever, malaria
Desmodium gangeticum	Leguminoceae	L	2.12	KUP007	Bronchitis, asthma, cough, dysentery
Derris trifoliata	Fabaceae	L	2.50	KUP008	Spasmodic, fish poison, insecticide, counter irritant
Dendrophthoe falcata	Loranthaceae	L	5.50	DACB-31155	Spermatorrhoea
Ficus hispida	Moraceae	B L F	6.66 5.33 4.16	DACB-30551	Dysentery, jaundice
Fleurya interrupta	Urticaceae	L	2.43	DACB-30542	Stimulant, used in dermatitis, root extract is diuretic
Heritiera fomes	Sterculiaceae	B L	23.33 20.0	DACB-30324	Unknown
Lasia spinosa	Araceae	R	1.0	KUP009	Piles, rheumatism, affection of throat, pain
Lantana camara	Verbenaceae	L	2.66	DACB-30543	Antiseptic, tetanus, rheumatism, malaria
Pandanus foetidus	Pandanaceae	L	4.54	DACB-30,212	Leprosy, small pox, syphilis, scabies
Polyalthia suberosa	Annonaceae	L	2.03	KUP010	Rheumatism, dysentery, various skin infection
Ruellia tuberosa	Acanthaceae	L	1.56	DACB-30545	Febrifuge, sudorific
Sonneratia apetala	Lythraceae	B L	2.0 1.25	DACB-30549	Hepatitis
Solanam sisymbrifolium	Solanaceae	L	6.0	KUP011	Pain, inflamation
Xylocarpus granatum	Meliaceae	B	20.8	DACB-12789	Diarrhoea,Dysentery, febrifuge,astringent
Xylocarpus moluccensis	Meliaceae	L	9.5	DACB-30320	Diarrhoea, cholera, fever, astringent

[a]Voucher specimens have been deposited in Pharmacy Discipline, Khulna University. [b]The information about traditional uses has been taken from published literature (Yousuf *et al.,* 1994; Ghani, 1998; Kirtikar and Basu, 1999; ARCBC database, 2004), and from consultation with native people. B: bark; L: leaves; R: rhizome; P: pneumatophore.

Table 2. Results of the antibacterial assay of the investigated plants in disc diffusion assay

Plants	Part used	Zones of inhibition in mm											
		Sa	*Se*	*Sp*	*Sd*	*Sb*	*Sf*	*Ss*	*St*	*Ec*	*Vc*	*Ea*	*Pa*
Aegiceras corniculatum	B	-	18	14	-	-	-	20	14	13	12	14	-
Anthocephalus chinensis	B	-	15	8	-	-	-	-	-	8	-	-	9
	L	-	10	8	-	-	-	-	-	--	-	-	8
Abtilon indicum	L	-	-	-	-	-	-	-	-	-	-	-	-
Alocasia indica	R	10	-	10	12	-	-	-	10	-	-	-	-
Alocasia fornicata	R	12	-	15	12	-	-	-	10	11	16	10	10
Amorphophallus campanulatus	R	8	-	-	10	-	-	-	8	7	10	8	-
Ceriops decandra	B	10	-	12	10	-	-	-	12	12	18	16	12
	L	12	-	15	10	-	-	-	-	12	-	-	-
	P	18	-	16	12	-	-	-	-	12	20	-	-
Commelina benghalensis	L	10	-	12	10	-	-	-	10	-	-	-	-
Crataeva nurvala	L	-	-	-	-	-	10	-	12	-	10	-	12
Cyperus rotundus	R	-	-	-	-	16	-	-	-	-	18	-	-
Diospyros peregrina	L	8	-	-	9	-	-	-	-	7	-	-	8
Desmodium gangeticum	L	-	-	8	12	9	-	-	-	8	-	-	-
Derris trifoliata	L	-	-	-	-	-	-	-	-	-	-	-	-
Dendrophthoe falcata	L	-	-	-	-	-	-	-	-	-	-	-	-
Ficus hispida	B	10	-	-	9	-	-	-	10	-	8	-	-
	L	-	-	-	-	-	-	-	-	-	-	-	-
	F	-	-	-	-	8	8	-	-	--	8	-	-
Fleurya interrupta	L	10	-	-	10	-	-	-	10	-	-	-	-
Heritiera fomes	B	-	10	11	-	-	-	-	-	10	-	8	15
	L	-	10	-	-	-	-	-	-	-	-	-	8
Lasia spinosa	R	18	15	16	12	-	-	-	-	17	16	18	18
Lantana camara	L	10	13	11	15	12	12	13	10	10	-	12	15
Pandanus foetidus	L	16	-	12	10	-	-	12	10	16	11	16	18
Polyalthia suberosa	L	-	-	17	-	-	-	-	-	-	19	-	18
Ruellia tuberosa	L	-	-	-	-	-	-	-	-	-	-	-	-
Sonneratia apetala	B	18	14	16	-	-	-	-	-	-	-	-	-
	L	-	20	-	-	-	-	-	-	-	-	-	-
Solanam sisymbrifolium	L	-	-	-	-	-	-	-	-	-	-	-	-
Xylocarpus granatum	B	19	18	16	-	20	-	-	18	20	-	-	-
Xylocarpus moluccensis	L	-	-	-	-	-	-	-	-	-	-	-	-
Kanamycin (30 μg/disc)		27	28	25	29	27	25	30	28	30	29	30	27

-: No activity at test concentration.
Sa: *Staphylococcus aureus*; *Se*: *Staphylococcus epidermis*; *Sp*: *Staphylococcus pyogenes*; *Sd*: *Shigella dysenteriae*; *Sb*: *Shigella boydii*; *Sf*: *Shigella flexneri*; *Ss*: *Shigella sonnei*; *St*: *Salmonella typhi*; *Ec*: *Escherichia coli*; *Vc*: *Vibrio cholera*; *Ea*: *Enterobacter aerogenes*; *Pa*: *Pseudomonas aeruginosa*

fornicata, C. decandra, L. spinosa, L. camara, P. foetidus, and *X. granatum* showed the most potent activity against both Gram-positive and Gram-negative bacteria. The extracts *A. Chinensis, A. indica, A. campanulatus, C. benghalensis, C. nurvala, C. rotundus, D. peregrina, D. gangeticum, F. hispida, F. interrupta, H. fomes, P. suberosa, S. apetala,* displayed moderate levels of activity whereas the extracts of *A. indicum,*

D. trifoliata, D. falcata S. sisymbrifolium and *X. moluccensis* did not show any antibacterial activity at test concentration.

Traditionally, the plant species selected for the present study, have long been used in Bangladesh to treat various diseases including bacterial and fungal infections. The results from this current study revealed, at least to some extent, the scientific basis of the traditional usage of the plants against infections. Most of these extracts exhibited activity against both of Gram-positive and Gram-negative bacteria. Considerable variations in the antibacterial profiles of the extracts of different parts of the same plant were observed, which indicated the variations in the chemical compositions of these extracts. For example, the extracts of the bark, leaves and pneumatophores of *Ceripos decandra* were active against *Staphylococcus aureus*, *Staphylococcus pyogenes*, *Shigella dysenteriae* and *E. coli*, but the extract of the bark showed broader spectrum of activities and was also active against *Salmonella typhi, Vibrio cholera, Enterobacter aerogenes* and *Pseudomonas aeruginosa* (Table 2). The most notable activity with inhibition zones of more than 12 mm was displayed by the ethanolic extracts of *A. corniculatum, A. fornicata, C. decandra, L. spinosa, L. camara, P. foetidus,* and *X. granatum*. Among these, *L. camara* showed the most potent inhibitory activity against both Gram-positive and Gram-negative bacteria (Table 2).

Shigella dysenteriae is one of the major causes of diarrhoea and dysentery in Bangladesh. Among the test extracts, at least 14 extracts showed antibacterial activity against *Shigella dysenteriae* (Table 2). It is interesting to note that the extracts of *Alocasia indica, Amorphophallus campanulatus, Diospyros peregrina, Desmodium gangeticum* and Ficus hispida, which have traditionally been used to treat diarrhoea and dysentery, were among those 14 active extracts. This finding certainly substantiated the use of these plants against diarrhoea and dysentery (Table 1) On the other hand, *Cyperus rotundus, Polyalthia suberosa, Xylocarpus granatum, and Xylocarpus molucensis*, which have been known to possess antidiarrhoeal and antidysentery properties, did not show any activity against *Shigella dysenteriae.* While the claimed antidiarrhoeal and antidysentery properties of *Xylocarpus granatum* could be supported by its prominent activity against *Shigella boydii*, such traditional medicinal uses of *Cyperus rotundus* and *Polyalthia suberosa* could also be substantiated from their activities against *S. boydii* and/or *Vibrio cholera* (Table 2). Although *Alocasia fornicata, Ceriops decandra, Commelina benghalensis, Fleurya interrupta, Lasia spinosa, Lana camara* and *Pandanus foetidus* have never been used in the traditional medicine to treat diarrhoea and dysentery, these extracts were active against *Shigella dysenteriae.*

DISCUSSION

The present findings support, at least to some extent, the traditional uses of these plants for the treatment of bacterial and fungal infections. As diarrhoea is one of the major causes of mortality and morbidity in Bangladeshi population, especially children, these present findings could be useful to develop newer and low-cost remedies to treat diarrhoea caused by bacterial infections.

REFERENCES

ARCBC database. (2004) ASEAN Regional Centre for Biodiversity Conservation. The Philippines available on-line at: http://www.arcbc.org/ arcbcweb/medicinal_ plants /default.htm.

Ahmed M. (2000) Present status of traditional medicine in Bangladesh. Dhaka.

Bauer AW, Kirby WMM, Sherris JC, Truck M. (1966) Antimicrobial susceptibility testing by a standardized single disk method. *Am. J. Clin. Pathol.* **45**, 493-496.

Cruickshank R. (1968) Medical microbiology: A guide to diagnosis and control of infection. E. and S. Livingstone Ltd., Edinburgh and London, p. 888.

Ghani A. (1998) Medicinal Plants of Bangladesh. Asiatic Society of Bangladesh, Dhaka.

Kiritikar KR, Basu BD. (1999) Indian Medicinal Plants, 2nd edition, Allahabad, India.

Mothana AAR, Lindequist UJ. (2005) Antimicrobial activity of some medicinal plants of the island of Soquotra. *J. Ethnopharmacol.* **96**, 177-181.

Shilpi JA, Uddin SJ, Hossain M, Sarder MM. (2005) Antibacterial and antinociceptive activity study of methanol extract of *Mimosa pudica*. *Khulna University Studies* **6**, 35-37.

Shilpi SJ, Uddin SJ, Rouf R, Billah MM. (2004) Central nervous system depressant activity of *Diospyros peregrina* bark. *Orient. Pharm. Exp. Med.* **4**, 249-252.

Shilpi JA, Ray PK, Uddin SJ. (2005) Analgesic activity of *Amorphophallus campanulatus* tuber. *Fitoterapia* **76**, 367-369.

Uddin SJ, Shilpi JA, Alam SMS, Alamgir M, Rahman MT, Sarker SD. (2005) Antidiarrhoeal activity of the methanol extract of the barks of *Xylocarpus moluccensis* in castor oil and magnesium sulphate-induced diarrhoea models in mice. *J. Ethnopharmacol.* **101**, 139-143.

Uddin SJ, Shilpi JA, Barua J, Rouf R. (2005) Antinociceptive activity of *Ceriops decandra* leaf and pneumatophore. *Fitoterapia* **76**, 261-263.

Uddin SJ, Shilpi JA, Delazar A, Nahar L, Sarker SD. (2004) Free radical scavenging activity of some Bangladeshi plant extracts. *Orient. Pharm. Exp. Med.* **4**, 185-193.

Yusuf M, Chowdhury JU, Wahab MA, Begum J. (1994) Medicinal Plants of Bangladesh, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh.