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Research Article

EVALUATION OF ANTIMICROBIAL ACTIVITIES OF SOME BANGLADESHI MEDICINAL PLANTS

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ABSTRACT

The crude methanol extracts of aerial parts of *Abrus precatorius* L., leaf *of Magnolia pterocarpa* Roxb., *Dracaena spicata* Roxb. and *Ravenala madagascariensis* Sonn. as well as their hexane, carbon tetrachloride, chloroform and aqueous soluble partitionates were subjected to screenings for disc diffusion assay. Among the test samples of *A. precatorius*, the highest zone of inhibition (15.0mm) was exhibited by the carbon tetrachloride soluble fraction against *Pseudomonas aeruginosa*. The *M. pterocarpa* extractives exhibited significant zone of inhibition ranging from 7.0 to 23.0mm against the test organisms. The highest zone of inhibition (23.0mm) was demonstrated by the carbon tetrachloride soluble fraction against *Pseudomonas aeruginosa*. This fraction also exhibited 20.0mm zone of inhibition against the gram positive bacteria *Staphylococcus aureus* and gram negative bacteria *Vibrio parahemolyticus.* Among the test samples of *D. spicata*, the highest (18.0mm) zone of inhibition was demonstrated by the aqueous soluble fraction against *Pseudomonas aeruginosa.* The test samples of *R. madagascariensis* exhibited weak antimicrobial activity with zone of inhibition ranging from 2.0 to 9.0mm.

Keywords: *Abrus precatorius* L. *Magnolia pterocarpa* Roxb. *Dracaena spicata* Roxb. *Ravenala madagascariensis* Sonn. Disc diffusion method. Zone of inhibition. Ciprofloxacin

INTRODUCTION

According to the World Health Organization (WHO), 80% of the world's populations rely on traditional medicines [1]. The practice of herbal medicine is common in rural areas where western medicines are too expensive or not available [1] . Humans have frequently used plants to treat common infectious diseases and some of these traditional medicines are still part of the habitual treatment of various maladies. It has been reported that 115 articles were published on the antimicrobial activity of medicinal plants in Pub med during the period between 1966-1994, but in the following decade, between 1995 and 2004, 307 were published [2]. The demand for more and more drugs from plant sources is continuously increasing. It is therefore essential for systematic evaluation of plants used in traditional medicine for various ailments. Hence, there is need to screen medicinal plants for promising biological activity [3]. Drugs derived from unmodified natural products or drugs semi-synthetically obtained from natural sources corresponded to 78% of the new drugs approved by the FDA between 1983 and 1994 [4].

Abrus precatorius L. (Synonyms: *Abrus abrus*, *Glycine abrus*; Bengali name: Kunch, Ratii) commonly known as crab's eye, john crow bead, precatory bean and jumbie bean, is a slender, perennial climber of Fabaceae family. The plant is native to India and other tropical and subtropical areas of the world. A tea is made from the leaves and used to treat fevers, cough and cold. Seeds are poisonous and therefore are used after mitigation. The plant is also used in Ayurveda [5]. An ethanolic extract of seeds was found to have antioxidant, anti-inflammatory and analgesic potentials in rodents [6]. *A. precatorius* seed extract also caused reversible alterations in the estrous cycle pattern and completely blocked ovulation in Sprague-Dawley rats [7]. A methanolic extract of the plant produced dose-dependent bronchodilator activity in a guinea pig model [8].

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Magnolia pterocarpa Roxb. (Synonyms: *Lirianthe grandiflora, Liriodendron grandiflorum* Roxb., *L. indicum* Spreng.) locally known as dulichapa, is a flowering medium to large tree of Magnoliaceae family. The plant is native to 3600 feet altitude forests of India, Burma and Pakistan. The bark contains sesamin, eudesmin, fargesin, imperatorin, dimethyl teraphthalate and β-sitosterol. Powdered bark is used for fever and cough (Indian medicinal plants).

Dracaena spicata Roxb. (Synonyms: *D. wallichii* Kunth., *Draco spicata* Roxb. Kuntze.; Bengali name: ognikundo), commonly known as dragon tree, is a tree of Asparagaceae family. The plant is distributed in Assam, Bangladesh, Andaman Islands and Myanmar. The leaf extract is used by the chakma communities in the treatment of measles [9]. Leaf juice is used to cure long term fever, coughs and mucus in nose by traditional healers of the Marma tribe of Naikhongchhari, Bandarban District [10].

Ravenala madagascariensis Sonn. (Synonyms: - *Heliconia ravenala* Willemet., *Urania madagascariensis* Sonn. Raeusch.; Bengali name: Panthapadak) commonly known as Traveller's Tree or Traveller's Palm, is a species from Madagascar. It is not a true palm but a member of the bird of paradise family, Strelitziaceae. It is endemic to secondary forests in Madagascar. The leaves have been reported to have anti-diabetic activity in alloxan induced diabetic rats [11].

As part of our ongoing investigations on medicinal plants of Bangladesh [12-17], the crude methanol extracts of aerial parts of *A. precatorius,* leaf *of M. pterocarpa*, *D. spicata* and *R. madagascariensis* growing in Bangladesh, as well as their organic and aqueous soluble fractions were studied for antimicrobial activity for the first time and we, here in, report the results of our preliminary investigations.

MATERIALS AND METHODS

Collection of plant materials and extraction: The aerial parts of *A. precatorius,* leaf *of M. pterocarpa*, *D. spicata* and *R. madagascariensis* were collected in March 2012 from Dhaka. Voucher specimens DUSH-10775, DUSH-10774 and DUSH-10777 for the collection of the plant parts of *A. precatorius, M. pterocarpa* and *D. spicata* have been deposited in Salar Khan Herbarium, Department of Botany, University of Dhaka, respectively. In Bangladesh National Herbarium, voucher specimen DACB 38302 has been deposited for the collection of leaf of *R. madagascariensis.* The experiments were conducted in Phytochemical Research Laboratory, State University of Bangladesh in 2012.

The collected plant materials were cleaned, sun dried and pulverized. The powdered materials (500g each) of the collected plants were separately soaked in 2.0 liters of methanol at room temperature for 7 days. The extracts were then filtered through fresh cotton bed and finally with Whatman filter paper number 1 and concentrated with a rotary evaporator at reduced temperature and pressure. An aliquot (5g) of each of the concentrated methanol extract was fractionated by the modified Kupchan partition protocol [18] and the resultant partitionates were evaporated to dryness with rotary evaporator to yield hexane (HXSF), carbon tetrachloride (CTCSF), chloroform (CSF) and aqueous (AQSF) soluble materials (Table I). The residues were then stored in a refrigerator until further use.

Antimicrobial screening: Antimicrobial activity of the extractives was determined against gram positive and gram negative bacteria and fungi by the disc diffusion method [19]. Measured amount of the test samples were dissolved in definite volume of solvent (chloroform or methanol) and applied to sterile discs and carefully dried to evaporate the residual solvent. In this investigation, ciprofloxacin (30μg/disc) disc was used as the reference.

Statistical analysis: For all bioassays, three replicates of each sample were used for statistical analysis and the values are reported as mean ± SD.

RESULTS AND DISCUSSION

The crude methanol extracts of aerial parts of *A. precatorius,* leaf of *M. pterocarpa*, *D. spicata* and *R. madagascariensis* as well as their hexane, carbon tetrachloride, chloroform and aqueous soluble partitionates were subjected to screenings for antimicrobial potential by disc diffusion method and the results of the antimicrobial screening are presented in Table II, III and IV.

The test samples of *A. precatorius* exhibited zone of inhibition ranging from 7.0 to 15.0mm against the test organisms. The highest 15.0mm zone of inhibition was exhibited against *Pseudomonas aeruginosa* by the carbon tetrachloride soluble fraction. This fraction also showed 14.0mm zone of inhibition against *Sacharomyces cerevacae*.

Among the test samples of *M. pterocarpa*, the carbon tetrachloride soluble fraction exhibited 20.0mm zone of inhibition against gram positive bacteria *Staphylococcus aureus*. The *M. pterocarpa*

extractives exhibited zone of inhibition ranging from 7.0 to 23.0mm against gram negative bacteria. The carbon tetrachloride soluble fraction revealed 23.0mm against *Pseudomonas aeruginosa*. The crude methanol extract showed 21.0mm zone of inhibition against the same gram negative strain.

The test samples of *D. spicata* exhibited zone of inhibition ranging from 7.0 to 18.0mm against the test organisms. The highest (18.0mm) zone of inhibition was demonstrated by the aqueous soluble fraction against *Pseudomonas aeruginosa*. Against gram positive bacteria *Staphylococcus aureus*, the carbon tetrachloride and aqueous soluble extractives revealed 15.0mm zone of inhibition.

The test samples of *R. madagascariensis* exhibited weak antimicrobial activity with zone of inhibition ranging from 2.0 to 9.0mm against the test organisms. The crude methanol extract showed 9.0mm zone of inhibition against *Escherichia coli*.

CONCLUSION

The objective of the study was to evaluate the antimicrobial potentials of crude methanol extracts of aerial parts of *A. precatorius*, leaf *of M. pterocarpa*, *D. spicata* and *R. madagascariensis* as well as their hexane, carbon tetrachloride, chloroform and aqueous soluble partitionates. It is clearly evident from the above findings that the extractives of *M. pterocarpa* demonstrated very significant antimicrobial activity. On the other hand, *A. precatorius* and *D. spicata* extractives exhibited mild to moderate antimicrobial activity but the *R. madagascariensis* extractives demonstrated very weak activity against the microbial strains. Therefore, further work especially bioassay-guided fractionation is warranted in order to isolate and characterize the active constituents responsible for the antimicrobial property.

TABLE I - Kupchan partitioning of *A. precatorius, M. pterocarpa, D. Spicata* and *R. madagascariensis*

Crude extract/ Fractions	***A. precatorius* (g)**	***M. pterocarpa* (g)**	***D. spicata* (g)**	***R. madagascariensis* (g)**
ME	5.0	5.0	5.0	5.0
HXSF	1.0	1.3	1.0	1.5
CTCSF	1.5	0.8	1.0	1.2
CSF	1.0	0.5	0.5	0.5
AQSF	0.5	1.5	1.5	1.0

ME= Methanolic crude extract; HXSF= Hexane soluble fraction; CTCSF= Carbon tetrachloride soluble fraction; CSF= Chloroform soluble fraction; AQSF= Aqueous soluble fraction

TABLE II - Antimicrobial activity of *A. precatorius, M. pterocarpa, D. spicata* and *R. madagascariensis* extractives against gram positive bacteria

Diameter of zone of inhibition (mm)					
Test Samples	***Bacillus cereus***	***B. megaterium***	***B. subtilis***	***Staphylococcus aureus***	***Sarcina lutea***
A. precatorius					
ME	-	-	-	-	-
HXSF	-	-	-	-	7.0±0.95
CTCSF	-	-	9.0±0.72	12.0±0.32	10.0±0.76
CSF	-	-	-	-	-
AQSF	-	8.0±0.58	-	-	-
M. pterocarpa					
ME	10.0±0.82	-	12.0±0.57	7.0±1.03	13.0±0.30
HXSF	-	-	7.0±0.42	-	-
CTCSF	18.0±0.82	11.0±0.55	13.0±0.67	20.0±1.02	18.0±0.25
CSF	-	-	-	-	-
AQSF	-	-	-	-	-
D. spicata					
ME	-	8.0±0.12	-	-	-
HXSF	-	-	-	-	-
CTCSF	-	-	8.0±0.65	15.0±0.22	8.0±1.12

CSF	-	-	-	-	-
AQSF	8.0±1.4	8.0±0.92	-	15.0±0.39	12.0±0.86
R. madagascariensis					
ME	2.0±0.41	-	3.0±0.80	-	2.0±0.08
HXSF	2.0±0.30	-	-	3.0±0.14	-
CTCSF	-	2.0±0.86	-	-	3.0±0.78
CSF	-	7.0±0.71	7.0±0.40	-	-
AQSF	-	-	-	-	-
CF (30 µg / disc)	45.0±2.01	42.0±1.17	42.0±0.73	42.0±0.56	42.0±0.13

ME= Methanolic crude extract; HXSF= Hexane soluble fraction; CTCSF= Carbon tetrachloride soluble fraction; CSF= Chloroform soluble fraction; AQSF= Aqueous soluble fraction; CF= Ciprofloxacin

TABLE III - Antimicrobial activity of *A. precatorius, M. pterocarpa, D. spicata* and *R. madagascariensis* extractives against gram negative bacteria

Diameter of zone of inhibition (mm)								
Test Samples	***Escherichia Coli***	***Pseudomonas aeruginosa***	***Salmonella typhi***	***S. paratyphi***	***Shigella boydii***	***S. dysenteriae***	***Vibrio mimicus***	***V. parahemolyticus***
A. precatorius								
ME	-	8.0±0.24	-	-	-	-	-	-
HXSF	-	-	-	-	-	-	-	-
CTCSF	12.0±0.17	15.0±0.43	-	-	-	9.0±0.14	8.0±0.19	-
CSF	-	7.0±0.32	-	-	-	-	-	-
AQSF	-	7.0±0.74	-	-	-	-	-	-
M. pterocarpa								
ME	10.0±0.32	21.0±0.79	12.0±0.32	11.0±0.32	-	12.0±0.36	-	18.0±0.51
HXSF	-	18.0±0.32	8.0±0.19	7.0±0.47	-	-	-	8.0±0.34
CTCSF	16.0±0.53	23.0±0.44	18.0±0.32	13.0±0.61	10.0±0.43	17.0±0.75	15.0±0.28	20.0±0.63
CSF	-	-	7.0±0.32	-	-	-	-	-
AQSF	-	-	-	-	-	-	-	-
D. spicata								
ME	-	11.0±0.61	-	-	-	-	-	-
HXSF	-	-	-	-	-	-	-	-
CTCSF	-	14.0±0.84	8.0±0.95	12.0±1.15	-	7.0±0.36	7.0±0.54	-
CSF	12.0±0.95	9.0±0.55	8.0±0.95				-	-
AQSF	11.0±0.12	18.0±0.81	12.0±0.15	-	9.0±0.90	13.0±0.74	8.0±0.44	-
R. madagascariensis								
ME	2.0±0.51	-	-	3.0±0.57	3.0±0.36	4.0±0.31	-	-
HXSF	-	3.0±0.72	1.0±0.36	-	-	-	-	3.0±0.56
CTCSF	-	2.0±0.84	-	-	7.0±0.54	-	-	-
CSF	9.0±0.95	-	-	-	-	-	3.0±0.21	-
AQSF	-	-	-	-	-	-	-	-
CF (30 µg / disc)	42.0±0.43	42.0±1.11	45.0±0.73	47.0±2.33	34.0±0.58	42.0±0.22	35.0±0.44	40.0±0.53

ME = Methanol crude extract; HXSF = Hexane soluble fraction; CTCSF = Carbon tetrachloride soluble fraction; CSF = Chloroform soluble fraction; AQSF = Aqueous soluble fraction; CF= Ciprofloxacin

TABLE IV - Antimicrobial activity of *A. precatorius, M. pterocarpa, D. spicata* and *R. madagascariensis* extractives against fungi

Diameter of zone of inhibition (mm)			
Test Samples	***Candida albicans***	***Aspergillus niger***	***Sacharomyces cerevacae***
A. precatorius			
ME	-	-	10.0±0.22
HXSF	-	-	12.0±0.36
CTCSF	9.0±0.65	-	14.0±0.88
CSF	-	-	-
AQSF	-	-	-
M. pterocarpa			
ME	-	-	-
HXSF	-	-	8.0±0.36
CTCSF	-	10.0±0.15	12.0±0.18
CSF	-	-	-
AQSF	-	-	-
D. spicata			
ME	-	-	-
HXSF	-	-	-
CTCSF	8.0±0.65	-	-
CSF	-	-	-
AQSF	11.0±0.22	-	-
R. madagascariensis			
ME	-		-
HXSF	-	2.0±0.32	-
CTCSF	-	-	2.0±0.88
CSF	-	-	-
AQSF	-	-	-
CF (30 µg / disc)	38.0±0.49	37.0±0.64	38.0±0.30

ME= Methanolic crude extract; HXSF= Hexane soluble fraction; CTCSF= Carbon tetrachloride soluble fraction; CSF= Chloroform soluble fraction; AQSF= Aqueous soluble fraction; CF= Ciprofloxacin

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