Antimicrobial Activity of Some Indigenous Plants of Bangladesh

Mohammad S. Rahman[1], Mohammed Z. Rahman[2], Md. Abdul Wahab[3], Rasheduzzaman Chowdhury[1] and Mohammad A. Rashid[1,4]

[1]Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Dhaka, Dhaka-1000, Bangladesh
[2]Department of Pharmacy, The University of Asia Pacific, Dhaka-1209, Bangladesh
[3]Department of Skin & Veneral Diseases, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka-1000, Bangladesh
[4]Centre for Biomedical Research, University of Dhaka, Dhaka-1000, Bangladesh

ABSTRACT: The antimicrobial activity of methanol extracts of 17 plant species of Bangladesh was evaluated by the agar disc diffusion method. Among those, eight plant extracts exhibited potent antimicrobial activity against a wide variety of Gram positive and Gram negative bacteria and fungi at a concentration of 400 µg /disc.

Key words: Antimicrobial activity, Disc diffusion method.

INTRODUCTION

The plant kingdom comprises many species of plants containing substances of medicinal value, which are yet to be explored. A large number of plants are constantly being screened for their possible medicinal value.[1] The use of plant extracts in traditional medicine has been going on from ancient time.[2] Herbalism and folk medicine, both ancient and modern, have been the source of much useful therapy.[3-5] In the recent years, the development of resistance of pathogens against antibiotics has become a difficult issue caused by the indiscriminate use of modern antibiotics.[6-12] Therefore, the demand for new and effective antimicrobial agents with broadspectrum activities from natural sources are increasing day by day. In order to identify plant species having potential antimicrobial principles, the methanol extracts of 17 plants of Bangladesh were screened by disc diffusion method.[13] Here we report the result of our preliminary antimicrobial screening.

Correspondence to: Mohammad A. Rashid
Tel.: 880-2-8612069, 9661900-73,
Extn.- 4363, 8137; Fax: 880-2-8612069
E-mail: rashidma@aitlbd.net

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MATERIALS AND METHODS

Plant materials. The plants *Solanum ferox, Petunia meleagris, Petunia phoenica, Petunia punctata, Petunia violaceae, Brunfelsia americana, Brunfelsia latifolia, Combretum glandifolium, Citrus hystrix, Poivera coccinea, Buchanania lanzen, Lannea coromendelica, Swintonia floribunda, Semecarpus anacardium, Amoora chittagonga, Chukrasia tabularis, Feronia elephantum* and *Proteum serratum* were collected from the National Botanical Garden, Dhaka, Bangladesh in August 2004 and were identified at the Bangladesh National Herbarium. The plant materials were oven-dried at 40ºC and then ground into coarse powder.

Extraction of the plant materials. The coarse powder of the *S. ferox* (18.0 g), *P. meleagris* (8.5 g),

P. phoenica (17.0 g), *P. punctata* (31.0 g), *P. violaceae* (13.5 g), *B. americana* (43.0 g), *B. latifolia* (100.0 g), *C. glandifolium* (17.0 g), *C. hystrix* (18.0 g), *P. coccinea* (10.0 g), *B. lanzen* (44.0 g), *L. coromendelica* (78.1 g), *S. floribunda* (7.06 g), *S. anacardium* (67.6 g), *A. chittagonga* (17.0 g), *C. tabularis* (128.0 g), *F. elephantum* (78.0 g) and *P. serratum* (28.0 g) were extracted with methanol for a week at room temperature. The extracts were then filtered off through Whatman filter paper number-1 and the solvent was removed under vacuum at 30°C until dry mass were obtained by Buchi rotavapor.

Microorganisms. Ten bacteria (4 Gram positive, 6 Gram negative) and three fungi, collected from the stock cultures of the Institute of Nutrition and Food Science (INFS), University of Dhaka, Bangladesh, were used for the antimicrobial assays.

Antimicrobia assay. Disc diffusion method[13] was used to test the antimicrobal activity of the extractives against ten bacteria and three fungi (Table-1). Dried and sterilized filter paper discs (6 mm diameter) were then impregnated with known amount of the test substances dissolved in methanol (40 µg/ml) using micropipette and the residual solvents were completely evaporated. Discs containing the test material (400 µg/disc) were placed on nutrient agar medium uniformly seeded with the test microorganisms. Standard disc of kanamycin (30 µg/disc) and blank discs (impregnated with solvents followed by evaporation) were used as positive and negative control, respectively. These plates were then kept at low temperature (4°C) for 24 hours to allow maximum diffusion of test samples. The plates were then incubated at 37°C for 24 hours to allow maximum growth of the organisms. The test materials having antimicrobial activity inhibited the growth of the microorganisms and a clear, distinct zone of inhibition was visualized surrounding the disc. The antimicrobial activity of the test agents was determined by measuring the diameter of zone of inhibition in millimeter. The experiment was carried out in triplicate and the average zone of inhibition was calculated.

Statistical analysis. For each of the extracts, three samples were prepared for the bioassay. The zones of inhibition were calculated as mean ± SD (n=3).

RESULTS AND DISCUSSION

The result of the antimicrobial screening has been represented in Table 1. This investigation demonstrated promising broad-spectrum antimicrobial activity of the methanol extracts of *P. violaceae, P. meleagris, P. punctata, P. phoenica, A. chittagonga, S. floribunda, L. coromendelica* and *P. serratum*. The four species of the genus *Petunia* belonging to solanaceae family showed moderate to strong antimicrobial activity. The growth of *B. megaterium* (22.5 mm), *V. parahemolyticus* (18.36 mm) and *B. subtilis* (15.33) was strongly inhibited by the *P. punctata* extractive. On the other hand, *P. meleagris* also revealed potent inhibitory activity against microbial growth with average zone of inhibition 10.31-21.27 mm. The growth of *B. megaterium* (20.33 mm) and *V. parahemolyticus* (18.37 mm) were strongly inhibited by *P. phoenica* and it also showed strong antifungal action against *A. niger* (15.25 mm) and *S. cerevaceae* (14.39 mm). Again, *P. violaceae* displayed potential antibacterial activity against *V. mimicus* (19.34 mm), *V. parahemolyticus* (17.37 mm), *B. megaterium* (15.36 mm) and *B. subtilis* (14.14 mm). At the same time, it showed mild antifungal action (9.24-13.29 mm) against the test fungi. Again, *L. coromendelica* (Fam. Anacardiaceae) also showed inhibition of growth of *S. paratyphi* with the average zone of inhibition 14.36 mm. *S. floribunda* (Fam. Anacardiaceae) exhibited mild to moderate antimicrobial activity against most of the tested microorganisms, whereas, *A. chittagonga* (Fam. Meliaceae) strongly inhibited the growth of *V. parahemolyticus* (16.06 mm) and moderately inhibited the growth of *P. aeruginosa* (12.33 mm) and *E. coli* (12.33 mm). At the same time, *P. serratum* revealed the average zone of inhibition 9.32-15.33 mm and with strong inhibition of growth of *P. aeruginosa* (15.33 mm). The results obtained in this preliminary screenings showed that a

Table 1. Antimicrobial activity of 17 medicinal plants of Bangladesh

Family	Plant (400 µg / disc)	Zones of inhibition (mm)						
		B.c.	*B.m.*	*B.s.*	*S.a.*	*E.c.*	*P.a.*	*S.p.*
Anacardiaceae	*Buchanania lanzen*	-	-	-	10.3 ± 1.12	-	-	-
	Lannea coromendelica	11.12 ± 2.10	10.06 ± 1.11	11.25 ± 1.36	10.2 ± 1.10	-	10.27 ± 1.19	14.36 ± 1.33
	Swintonia floribunda	11.23 ± 1.69	10.03 ± 1.14	11.11 ± 2.22	-	09.33 ± 1.37	12.36 ± 0.89	-
	Semecarpus anacardium	-	-	-	10.04 ± 1.94	-	--	-
Burseraceae	*Proteum serratum*	-	11.38 ± 0.57	09.32 ± 1.58	09.59 ± 1.52	11.36 ± 1.47	15.33 ± 1.18	10.08 ± 1.97
Combretaceae	*Combretum glandifolium*	-	-	-	-	10.37 ± 1.85	09.57 ± 1.31	-
	Poivera coccinea	-	-	-	-	14.26 ± 1.64	11.27 ± 1.34	-
Meliaceae	*Amoora chittagonga*	10.11 ± 0.64	-	09.44 ± 0.64	12.33 ± 1.25	12.33 ± 1.94	12.33 ± 1.25	-
	Chukrasia tabularis	-	-	-	-	10	-	-
Rutaceae	*Feronia elephantum*	11.33 ± 0.39	-	-	-	-	-	-
Solanaceae	*Solanum ferox*	-	-	-	-	-	-	-
	Brunfelsia Americana	-	-	-	-	-	-	-
	B. lotifolia	-	-	-	-	-	08.35 ± 1.10	-
	Petunia violaceae	-	15.36 ± 0.68	14.14 ± 0.39	-	11.25 ± 0.33	12.39 ± 1.18	12.47 ± 0.39
	P. phoenica	-	20.33 ± 1.33	-	-	10.28 ± 1.69	12.22 ± 0.68	11.37 ± 0.94
	P. meleagris	13.37 ± 1.14	11.28 ± 0.37	18.45 ± 0.91	-	11.27 ± 0.37	13.37 ± 0.94	11.54 ± 0.31
	P. punctata	10.07 ± 0.74	22.25 ± 0.61	15.33 ± 0.13	11.24 ± 0.33	10.11 ± 0.94	11.25 ± 0.64	--
Kanamycin (30 µg / disc)		25.25 ± 1.14	23.36 ± 0.94	24.24 ± 0.58	26.26 ± 0.54	24.94 ± 0.15	23.98 ± 1.25	24.94 ± 0.37

Table contd.

Family	Plant (400 µg / disc)	Zones of inhibition (mm)					
		S.t.	*V.p.*	*V.m.*	*A.n.*	*C.a.*	*S.c.*
Anacardiaceae	*Buchanania lanzen*	-	-	12.4 ± 0.89	-	-	-
	Lannea coromendelica	10.34 ± 1.84	09.25 ± 1.37	10.41 ± 0.99	13.36 ± 2.65	12.23 ± 1.14	12.35 ± 1.15
	Swintonia floribunda	09.26 ± 1.69	-	09.45 ± 1.15	11.31 ± 1.44	-	-
	Semecarpus anacardium	-	-	10.33 ± 1.48	-	-	-
Burseraceae	*Proteum serratum*	11.34 ± 1.84	12.25 ± 1.94	10.33 ± 1.33	09.48 ± 1.37	12.24 ± 1.67	13.36 ± 2.01
Combretaceae	*Combretum glandifolium*	-	-	10.38 ± 1.37	-	-	-
	Poivera coccinea	-	-	12.06 ± 1.22	-	-	-
Meliaceae	*Amoora chittagonga*	-	16.06 ± 0.94	10.31 ± 0.98	-	09.34 ± 1.27	12.37 ± 1.64
	Chukrasia tabularis	-	-	-	-	-	-
Rutaceae	*Feronia elephantum*	-	-	-	-	-	10.37 ± 0.68
Solanaceae	*Solanum ferox*	-	-	-	08.31 ± 1.68	-	-
	Brunfelsia Americana	-	-	-	-	-	-
	B. lotifolia	-	-	-	-	-	-
	Petunia violaceae	11.28 ± 0.64	17.37 ± 1.28	19.34 ± 0.65	13.29 ± 0.29	09.24 ± 0.19	11.37 ± 0.98
	P. phoenica	-	18.37 ± 0.25	13.37 ± 1.28	15.25 ± 0.27	-	14.39 ± 0.27
	P. meleagris	10.47 ± 0.31	17.48 ± 0.31	15.24 ± 0.78	10.31 ± 0.94	11.11 ± 0.97	21.27 ± 0.31
	P. punctata	10.37 ± 0.22	18.36 ± 0.97	12.25 ± 0.54	11.33 ± 0.95	09.29 ± 0.94	11.46 ± 0.66
Kanamycin (30 µg / disc)		25.66 ± 0.54	24.94 ± 1.25	25.33 ± 0.33	22.33 ± 0.65	25.12 ± 0.64	25.64 ± 0.24

The diameters of zones of inhibition (mm) are expressed as mean ± SD (n=3); a diameter less than 7 mm was considered inactive; *B.c.:Bacillus cereus*; *B.m.:Bacillus megaterium; B.s.: Bacillus subtilis*; *S.a.: Staphylococcus aureus*; *E.c.:Escherichia coli*; *P.a.: Pseudomonas aeruginosa*; *S.p.:Salmonella paratyphi*; *S.t.:Salmonella typhi*; *V.p.: Vibrio parahemolyticus; V.m.:Vibrio mimicus*; *A.n.:Asperagillus niger; C.a.:Candida albicans; S.c.:Saccharomycse cerevaceae*

number of Bangladeshi plants to have promising antimicrobial activity. There is a chance to get better therapeutic agent against microbial diseases from some of the studied plants such as *P. violaceae, P. meleagris, P. punctata, P. phoenica, A. chittagonga, S. floribunda, L. coromendelica* and *P. serratum*. Further work especially bioassay-guided fractionation is warranted in order to isolate and characterize the antimicrobial active constituents responsible for the antimicrobial property.

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