In Vitro Antimicrobial Screening of Four Reputed Bangladeshi Medicinal Plants

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ABSTRACT

The antimicrobial activity of extractives of different plants has been recognized for many years. In present study the crude methanolic extracts and their kupchan partitioning fractions of four medicinal plants of Bangladesh namely, *Sansevieria trifasciata* (Fam: Asparagaceae), *Justicia gendarussa* (Fam: Acanthaceae), *Hydnocarpus kurzii* (Fam: Achariaceae) and *Kigelia pinnata* (Fam: Bignoniaceae) were investigated for their *in vitro* antimicrobial properties. All fractions were tested against 11 different gram positive and gram negative bacteria by the disc diffusion technique for bacteria, where kanamycin (30 µg/disc) disk used as standard. Among the extractives, the methanol extract and their pet-ether, carbon tetrachloride and chloroform soluble kupchan fractions of leaf extract of *H. kurzii*, and the aerial part extract of *S. trifasciata* showed significant antibacterial activity, where as chloroform soluble extracts of leaves of *H. kurzii* revealed highest activity against *Vibrio mimicus* (15.00 mm) and the methnol extract of whole plant of *S. trifasciata* demonstrated highest activity against *V. mimicus* (14.67 mm). The chloroform soluble fractions of *J. gendarussa* also showed mild to moderate antimicrobial activity with zone of inhibition ranging from 8.33-13.00 mm, in which highest activity was seen against *Shigella boydii* (13.00 mm). All the extractives of *K. pinnata,* on the other hand, demonstrated mild antimicrobial activity, where highest zone of inhibition was displayed by the chloroform soluble extract against *S. boydii* (11.00 mm) and *Pseudomonas aeruginosa* (11.00 mm).

Key words: Antimicrobial activity, Disc diffusion, *Hydnocarpus kurzii, Justicia gendarussa, Kigelia pinnata* and *Sansevieria trifasciata*.

INTRODUCTION

The shade-loving, quick-growing, evergreen plant *Justicia gendarussa* (Burm F.) (Family: Acanthaceae), is mostly found in moist areas. It is believed to be native to China and is distributed widely across India, Sri Lanka, and Malaysia.[1] It is an erect, branched, smooth undershrub, 0.8-1.5 meters in height with long leaves (7 to 14 cm).[2] The plant is used in traditional medicinal practice for chronic rheumatism, inflammations, bronchitis, vaginal discharges, dyspepsia, eye diseases and fever. The plants of this genous are known to contain lignans, naturally occurring phenolic dimers and triterpenoids.[3] *Sansevieria trifasciata* (Prain) (Family: Ruscaceae), commonly known as snake plant or mother in-law's tongue is an evergreen herbaceous perennial plant which is found throughout Malaysia[4] where it has been traditionally used for the treatment of ear pain, swellings, boils and fever. Phytochemical screening with this plant has shown to contain carbohydrates, saponins, glycosides[5] and steroids.[6]

Hydnocarpus kurzii (King Warb) (Family: Achariaceae also placed in: Flacourtiaceae[7-8]) is well known for its chaulmoogra oil, which is expressed from the dried ripe seeds[9] and is also known as hydnocarpus oil, kalaw tree oil, leprosy oil.[10] The oil and the crushed seeds have long been used in southeast Asia to treat various skin diseases like scabies, eczema, psoriasis, scrofula, ringworm, and intestinal worms and it has been shown that the active principles of the oil (hydnocarpic and chaulmoogric acids) exhibited strong antibacterial activity. For this reason *H. kurzii* is employed in Hindu medicine to treat leprosy. The bark contains principles capable of reducing fevers. Seeds are usually applied externally as a dressing for skin diseases; combined with walnut oil and pork lard for ringworm; with calomel

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and sesame oil for leprosy; and with sulfur and camphor for scabies. In India, the seeds are considered to be an alternative tonic.[11]

Kigelia pinnata (Lam. Benth) belonging to the family of Bignoniaceae and has a wide geographical distribution in the west and central Africa. The tree grows on river banks, wet areas along streams and on floodplains of Nigeria, Cameroon, Kenya, Guinea and Senegal.[12] The kigelia plant have medicinal properties not only because of its perceived characteristics such as bitterness, astringent taste or smell but also because of forces that it seems to emit in connection with its location, orientation and association with other plants.[13] *K. pinnata* is widely used for antidiarrhoeal,[14] antileprotic,[15] antimalarial,[16] anti-inflammatory,[12] anticancer,[17] gynecological disorders,[18] anti-microbial[19] and rheumatism.[20]

We, here in, report the results of preliminary antimicrobial screening of the methanolic crude extracts and the corresponding Kupchan partitioning fractions of four Bangladeshi medicinal plants having folklore reputation for the first time.

MATERIAL AND METHODS

Collection and Preparation of the Plant Materials

J. gendarussa, *S. trifasciata*, and *H. kurzii* were collected from Dhaka Botanical garden in February 2011 while *K. pinnata* was obtained from Rangpur in February 2010, voucher specimens (DACB 35489, 35490, 35491 and 34998, respectively) have been deposited in Bangladesh National Herbarium for future reference. Leaves and bark of *J. gendarussa*, whole plant of *S. trifasciata* and leaves of *H. kurzii* and *K. pinnaata* were sun dried for several days after washing. The plant materials were then oven dried for 24 hours at 40 °C and then ground to a coarse powder. The powdered materials (300 gm each) were then soaked in methanol (1.5 liter each) and kept for 10 days at room temperature with occasional shaking. The crude extracts were then filtered through cotton plug followed by Whatman no. 1 filter paper individually and the extracts were concentrated with rotary evaporator.

Extraction and Fractionation

A portion (5 g) of each of the concentrated methanol extract (ME) was fractionated by the modified Kupchan partitioning method[21] into pet-ether (PESF), carbon tetrachloride (CTSF), chloroform (CFSF), and aqueous (AQ) soluble fractions. Evaporation of solvents afforded various organic soluble extractives and aqueous soluble materials as shown in Table 1.

Test Organisms

Both gram positive (*Bacillus cereus, B. subtilis, Sarcina lutea, Staphylococcus aureus*) and gram negative (*Escherichia coli, Salmonella paratyphi, Shigella boydii, S. dysenteriae, Pseudomonas aeruginosa, Vibrio mimicus, V. parahemolyticus*), bacterial strains used for the experiment were collected as pure cultures from the Institute of Nutrition and Food Science (INFS), University of Dhaka, Bangladesh.

Table 1: Amount of different partitionates of *J. gendarussa, S. trifasciata, H. kurzii, K. pinnaata*

Partitionates	*J. gendarussa*	*S. trifasciata*	*H. kurzii*	*K. pinnaata*
pet-ether (PESF)	730 mg	750 mg	720 mg	720 mg
carbon tetrachloride (CTSF)	500 mg	520 mg	550 mg	600 mg
chloroform (CFSF)	480 mg	470 mg	410 mg	580 mg
aqueous (AQ) soluble fractions	1200 mg	1100 mg	1350 mg	1420 mg

Table 2: Antimicrobial activity of crude extracts and Kupchan fractions of *Sansevieria trifasciata*

Test microorganisms	Diameter of zone of inhibition (mm)					
	ME	PESF	CTSF	CFSF	AQ	Kanamycin
Gram positive bacteria						
Bacillus cereus	10.00 ± 1.00	9.33 ± 2.31	12.67 ± 1.15	14.00 ± 1.00	–	32.00 ± 1.00
B. subtilis	12.67 ± 2.08	10.33 ± 1.53	14.00 ± 1.00	13.67 ± 1.53	–	34.00 ± 1.00
Staphylococcus aureus	10.67 ± 1.15	11.67 ± 0.58	11.67 ± 2.08	11.67 ± 0.58	–	34.33 ± 1.15
Sarcina lutea	11.33 ± 2.08	12.00 ± 2.00	10.00 ± 1.00	12.33 ± 2.08	–	33.67 ± 2.31
Gram negative bacteria						
Escherichia coli	11.33 ± 1.53	11.00 ± 2.00	13.67 ± 1.53	12.67 ± 1.15	8.33 ± 1.53	32.67 ± 1.15
Pseudomonas aeruginosa	12.00 ± 3.00	11.67 ± 0.58	11.33 ± 1.15	9.00 ± 1.00	–	33.00 ± 1.00
Salmonella paratyphi	11.67 ± 2.08	11.33 ± 2.31	12.33 ± 1.53	11.67 ± 1.53	–	32.00 ± 2.65
Shigella boydii	12.33 ± 2.52	11.67 ± 2.08	12.00 ± 2.00	12.00 ± 2.65	–	33.67 ± 0.58
S. dysenteriae	11.67 ± 1.15	10.33 ± 0.58	10.33 ± 0.58	11.67 ± 2.08	–	32.67 ± 2.52
Vibrio mimicus	14.67 ± 2.00	11.67 ± 1.53	13.67 ± 1.53	13.33 ± 1.15	–	33.33 ± 2.08
Vibrio parahemolyticus	12.00 ± 2.00	12.00 ± 1.73	12.67 ± 2.08	12.67 ± 1.15	–	33.00 ± 1.00