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Short communication

FLAVONOID CONTENT AND ANTIBACTERIAL ACTIVITY OF ALBIZIA JULIBRISSIN. DURAZZ LEAF, STEM AND FLOWER EXTRACTS AGAINST CLINICALLY ISOLATED BACTERIAL PATHOGENS

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ABSTRACT

Objective: To test the antibacterial efficacy of leaf, stem, and flower extracts of *Albizia julibrissin* against bacterial pathogens.

Methods: Extraction of active metabolites was carried out by using six different solvents, and total flavonoid content in each extract was determined by Aluminium chloride method. To determine the antibacterial activity of extracts, disc diffusion method and tube dilution method were carried out. Zone of inhibition and Minimum inhibitory Concentration (MIC) were calculated.

Results: Methanolic extracts of leaf samples of *A. julibrissin* showed highest extractive value (5.14g/100g) and total flavonoid content (35.14mg/g). In overall leaf extracts of *A. julibrissin* showed maximum zone of inhibition towards *P. vulgaris* (10.1 mm*) and least susceptible microorganism is *S. typhi* (3.5 mm*). Stem and flower extracts inhibited bacterial growth only at higher concentrations (MIC, 160-215 and 65-180µg/ml respectively).

Conclusion: Apart from the energy crop, based on the results and value-added compounds present in *A. julibrissin*, it may be considered as antibacterial agent in future.

Keywords: *Albizia julibrissin,* Antibacterial, Flavonoids.

INTRODUCTION

Resistance of bacterial pathogens to antibacterial drugs is a global concern. Human infections, particularly affected by antimicrobial drug resistance include tuberculosis, malaria, severe acute respiratory infections, and sepsis caused by gram-negative bacteria [1]. This problem is even more pressing because, in a globalized world, there is increasing evidence that particularly persistent, relapsing, and difficult-to-treat infections caused by microorganisms are associated with either change in their phenotype [2] or genotype which, travel faster and farther than even before and the pipeline of new drugs is faltering.

Plants are used traditionally to treat infections in humans or animals. But the safety and effectiveness of many plants used in traditional medicine by rural people is yet to be evaluated [3]. The use of herbal extracts as therapeutic agents for bacterial infections may be an interesting area for developing countries and has aroused the interest of the population in developed countries [4]. Specifically, plants of *Albizia* genus have been used for several purposes, including the treatment of various infections [5] and inflammatory pathologies [6].

Albizia julibrissin Durazz is a leguminous tree which has become an excellent energy crop candidate used as biomass feedstock for ethanol production [7]. The combination of frost tolerance, nitrogen fixation and lack of toxic metabolic compounds are some characteristics supporting the adoption of *A. julibrissin* as an agricultural plant [8]. Anti-angiogenic [9] and anti-tumor compounds such as terpenoid saponins [10], and julibroside [11] occur in *A. julibrissin* extracts. *A. julibrissin* foliage also contains value-added compounds such as flavonoid glycosides [12], and flavonol acyl glycosides [13]. With this in mind and support in knowledge of use of *A. j.u.librissin* in traditional medicine, the present study focussed towards successive extraction and estimation of flavonoids present in *A. j.u.librissin* extracts and extracts were tested against bacterial pathogens. Leaves, stems, flowers and roots of *Albizia julibrissin* were collected from Tiruchengode area, TamilNadu, India and the specimens were identified by Botanical survey of India (BSI), Southern circle, Coimbatore, India. Hundred grams of dried plant part were extracted using a maceration method with six different solvents (Petroleum ether, benzene, chloroform, acetone, ethanol, and methanol). The overall extractive value was ranged between (1.35 ± 0.01 to 5.14 ± 0.02 g/100g) and the lowest extractive value was observed in benzene and highest value was shown by methanol (Table.1). Among plant parts, leaf extracts showed higher extractive value than flower (4.26±0.01 g/100g) and stem extracts (3.25±0.01 g/100g). From the results it was inferred that extractive value of solvents increased firstly with an increase in polarity of the solvent, but then rapidly decreased with non-polar solvents like petroleum ether, benzene and chloroform. Consequently the recovery of active constituents with polar solvents like methanol was more than two or three times higher as compared to less polar ones. *In vitro* antimicrobial screening of research permits the selection of crude plant extracts with potential properties to be used for further chemical and pharmaceutical studies [14].

Total flavonoids in selected plant extracts were determined using the aluminum chloride colorimetric method [15]. In *A. julibrissin* extracts, the total flavonoids content in the leaves (35.14 mg/g) was higher than the flowers (32.0 mg/g) followed by stem extracts (25.26 mg/g). Regardless of the plant part, methanolic extracts showed maximum extraction of flavonoids than any other solvent used (Table.1). The highest flavonoid content was determined in the methanolic extracts followed by ethanol, acetone, petroleum ether, chloroform and benzene. Hence methanolic extracts of *A. julibrissin* (Leaf, stem and flower) at different concentrations were tested for antibacterial activity.

Ten different clinical isolates of bacterial pathogens were used for this study, which includes *Bacillus cereus, Escherichia coli, Enterococcus faecalis, Klebsiella pneumonia, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi, Staphylococcus aureus,* and *Staphylococcus epidermis.* Antibacterial activity of *A. julibrissin* extracts was tested by disc diffusion method [16] and determination of the Minimum Inhibitory Concentration (MIC) [17]. At the least concentration of 50µg/ml leaf extract (Table. 2) showed antibacterial activity against the gram positive organisms,

B. cereus (3.2 mm*) and *S. aureus* (2.9 mm*) and gram negative organisms *E. c.o.li* (4.7 mm*) and *P. aeruginosa* (2.1 mm*). The evaluation of the antimicrobial activity of leaves, stem and flowers of *A. julibrissin* revealed that total loss of activity at lower concentration (50 and 100µg/ml) of stem and flower extracts against all the bacteria tested except *S. aureus*. At higher concentration (200µg/ml), leaf and flower extracts were effective against all bacterial pathogens tested, and the most susceptible microorganism is *P. vulagaris* (10.1 mm*) and least one is *S. typhi* (3.5 mm*).

The MIC value of plant extracts showed that among the tested clinical pathogens *B. cereus, E. coli, E. faecalis* and *P. vulgaris* were susceptible to *A. julibrissin* leaf extracts with MIC values ranging from 40-48µg/ml, whereas above species were not easily susceptible to *A. julibrissin* stem extracts (MIC, 150-208µg/ml) (Fig. 1). Flower extracts were less effective against *S. typhi* and *S. paratyphi*, generated an MIC of 180 and 165µg/ml respectively. The most MICs of stem and flower extracts of *A. julibrissin* were clustered around 150-215µg/ml and 65-180µg/ml respectively. Leaf extracts of *A. julibrissin* showed MIC values ranged between 40-78µg/ml, which one is the best antimicrobial agent among the tested extracts. MIC results revealed the fact that organisms may need higher concentrations of extracts to inhibit growth or kill them and it may depend upon their cell wall components. Flavonoids are antimicrobial substances, which present in the extracts tested may affect the synthesis of peptidoglycan around a bacterial cell; the cell wall may be affected by osmotic shock. [18]. In this study differences between the bactericidal activities of plant parts of *A. julibrissin* proposes that changes in the composition of active compounds and functional groups may influence the antimicrobial efficacy.

The need of the hour is to screen a number of medicinal plants for promising biological activity. Differences in the antimicrobial effects of plant groups might be due to phytochemical properties of the selected plant parts. Methanolic extracts of *A. julibrissin* showed higher flavonoid content in plant parts and antibacterial activity, which is reported for the first time. But detailed analysis of compounds present in each part of the *A. julibrissin* plant is needed for the further usage as an antiseptic agent.

Table 1: Extractive value and flavonoid content of *A. julibrissin* plant parts

Solvent	Extractive Value (g/100g)*			Flavonoid content (mg/g of extract)*		
	Leaf	Stem	Flower	leaf	Stem	Flower
Petroleum ether	2.26±0.05	3.23±0.01	1.53±0.01	19.15±0.12	13.70±0.14	16.4±0.12
Benzene	1.35±0.01	1.43±0.02	1.94±0.15	14.15±0.20	7.63±0.17	10.7±0.17
Chloroform	3.51±0.04	2.64±0.01	2.56±0.02	16.26±0.18	8.81±0.18	13.7±0.23
Acetone	3.34±0.02	2.44±0.02	2.81±0.01	21.83±0.15	17.15±0.14	20.2±0.20
Ethanol	4.52±0.01	3.63±0.02	3.54±0.02	29.11±0.18	19.17±0.14	25.1±0.14
Methanol	5.14±0.02	3.25±0.01	4.26±0.01	35.14±0.17	25.26±0.20	32.0±0.17

*Data represents mean± SE of triplicates

Table 2: Antibacterial activity of *Albizzia julibrissin* by disc diffusion method

Microorganisms	Zone of Inhibition (mm)*					
	Leaf extract (microgram)		Stem extract (microgram)		Flower extract (microgram)	
	100	200	100	200	100	200
B. cereus	5.8±0.26	7.4±0.06	-	5.1±0.46	5.1±0.88	6.9±0.78
E. coli	7.4±0.92	9.1±0.79	-	5.7±0.56	6.2±0.75	8.5±0.82
E. faecalis	5.2±0.78	6.5±0.08	-	4.1±0.45	4.0±0.57	5.8±0.86
K. pneumoniae	5.5±0.28	6.9±0.52	-	5.0±0.23	4.8±0.33	6.2±0.48
P. vulgaris	7.8±0.74	10.1±0.48	-	5.3±0.52	6.1±0.18	8.5±0.56
P. aeruginosa	4.0±0.78	5.1±0.79	-	-	3.1±0.4	4.3±0.95
S. typhi	2.7±0.45	3.5±0.02	-	-	-	3.1±0.62
S. paratyphi	3.3±0.56	5.0±0.74	-	-	-	4.1±0.28
S. aureus	5.1±0.09	6.3±0.28	-	4.1±0.43	3.9±0.44	7.1±0.24
S. epidermis	3.1±0.06	4.2±0.92	-	-	-	3.5±0.95

*Data represents mean± SE of triplicates

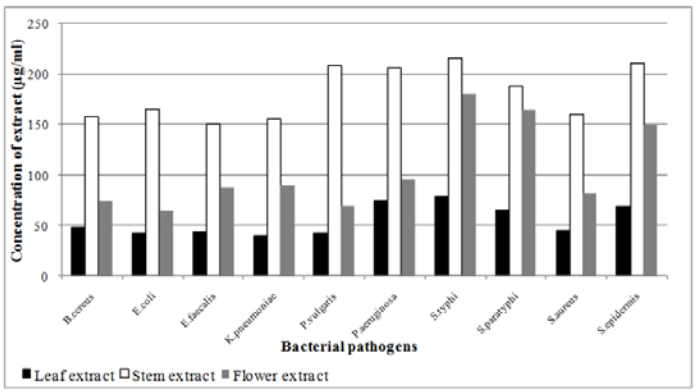

Fig. 1: MIC Value of *Albizia julibrissin* plant extracts.

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