National Journal of Biological Sciences, (2020), Volume 1, Issue I

Antibacterial Activity of Extracts of *Albizia lebbeck* Against *Staphylococcus aureus, Escherichia coli* and *Proteus mirabilis*

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Received: 28th January, 2020 / Revised: 27th February, 2020 / Accepted: 5th March, 2020 / Published: 24th June, 2020

Abstract

Herbs and medicinal plants have widely been used as the first medicines. The development of new antibacterial drugs got more attention recently because of the continuous development of resistance of bacteria to the current antibiotics. Albizia lebbeck is a type of deciduous tree that has compound leaves, flat oblong fruit and round cream-colored seeds. It grows in wild and is also planted in many parts of South Asia and Africa. There is a significant amount of data to support the healing and curing properties of Albizia lebbeck. A lebbeck has been used in the treatment of various pain and inflammatory conditions in various traditions. Here we used the extracts of Albizia lebbeck against three different bacterial strains namely Staphylococcus aureus, Escherichia coli and Proteus Mirabilis. Methanol and Ethanol extracts were used to check their antibacterial activity. Results indicated that Albizia lebbeck showed growth inhibition pattern against the tested species, when compared with gentamicin. The results authenticated its traditional use and indicated promising potential of this plant to be developed as antibacterial agent. Further work is needed for isolation, structure elucidation and characterization of bioactive constituents responsible for this activity. These isolated natural products should be screened in vivo and in vitro for antibacterial activity and may be developed as cheap alternatives to costly synthetic antimicrobial agents available in market.

Keywords*: Albizia lebbeck L., antibacterial activity, E. coli, Staphylococcus aureus, P. mirabilis.*

Introduction

Plant kingdom is a blessed and honored source of various bioactive constituents that has been used by people of all civilizations throughout the world to cure various ailments from flu to cancer. Since earliest times, man has tagged medicinal plants with classic pharmacological capacity in the light of their curative actions. It is generally accepted that plant based medicines are better than synthetic drugs as these are much safer for man and his environment. The use of synthetic drugs over phytomedicines thrived due to their fast action. However, this skewed notion is now fading due to side effects. It is now conceded that plants based medicines, have more to do with healing than arsenal of synthetic drugs. Herbal medicines

have stolen the show and are being credited due to their safety, efficacy and availability from indigenous sources **(Shahid and Firdous 2012)**. The use of herbs as traditional natural remedies is most popular for 80% of the world's population particularly in Asia, Latin America and Africa and is reported to have minimal side effects **(Seyydnejad *et al.*, 2010)**

A.lebbeck is naturally found in deciduous and semi-deciduous monsoon forests and rainforest, and can also be found in the humid and semi-arid tropics and subtropics under varying conditions. It grows wildly in most parts of Asia. The tree can withstand diverse conditions from high altitudes to heavy rainfall. It is used as a windbreak plant (Singh and Agrawal, 2018). The genus *Albizia* comprises approximately 150 species **(Kokila *et al.*, 2013).** *A.lebbeck* has been widely screened for phytochemicals and is known to contain phenols, flavonoids, saponins, tannins and several other minerals which attributes to the antimicrobial activity of the plant **(Abd El-Ghany *et al.*, 2015; Mishra *et al.*, 2010)**

Besides diverse and broad spectrum ethnopharmacological uses, *A.lebeck* plant possess antimicrobial, antioxidant, anti-inflammatory and anticancer potential. Several studies indicate that *A.lebeck* has vast applications in the medical field from anti-inflammatory to anti-bacterial and antioxidant **(Sharma *et al.*, 2018).** Previously, various authors have done considerable work on indigenous flora of Pakistan **(Haq *et al.*, 2012)**; however, major portion of this green wealth is still unexplored. We have screened crude methanolic and ethanolic extracts of pods, flowers, seeds and roots of *A.lebeck* plants for antibacterial activities against selected bacterial strains. The study will provide a database for these important plants which have not been explored in depth so far.

Materials and Methods

The current study was designed to test the antibacterial activity of extracts from *A.lebbeck* plants samples collected from a local variety grown in wild from Pirano Park Mardan. Leaves, pods, seeds, flowers and roots of *A. lebbeck* were used as plant material. The samples were washed and then dried out at room temperature for two weeks. Then 25gm of powdered sample was taken. Plant material was extracted with ethanol and methanol for 15 days with occasional shaking to prepare extract. It was filtered through a muslin cloth and then through a filter paper. Filtrate was evaporated under reduced pressure to a thick, semi-solid mass. These extract were used in current experiment. A total of three bacterial strains were tested namely *E.coli, S. aureus and P. mirabilis.*

Methodology

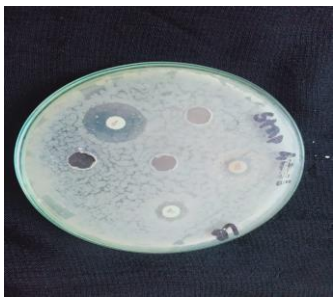
Soy agar Petri plates were prepared for testing the antibacterial activity of crude alcoholic extracts by disc diffusion method **(Biemer, 1973)**. Diluted culture (0.1 ml) was poured on each plate and the plates were dried for 30 min at 37°C. Discs of 6 mm diameter were used and soaked with different concentration of drug solutions, Gentamicin 20 µg, was used as positive control, and distilled water as negative control. The discs were placed on plates and incubated for 24 h at 37°C. At the end of incubation period, the inhibition zones were measured. The bacterial strains used were *E.coli, S. aureus* and *P. mirabilis*. Minimum inhibitory concentration (MIC) was measured as described previously **(Haq *et al.*, 2012)**.

Results and Discussions

Crude methanolic extracts of pods, seeds, flowers and roots of A. lebbeck. were tested for their efficacy against some common bacterial strains Table 1. The ethanol and methanol extract of *Albizia lebbeck* showed a growth inhibition pattern against the tested microorganism indicating antibacterial activity. Order of antibacterial activity for different plant parts tested against three strains used was seed > pod > flower > roots for all bacterial strains tested. The results indicated that this plant has entibacterial capacity against strains namely E. coli, S. aureus and P. mirabilis.

Table 1. Antibacterial Bioassay

Extracts	Strain	Ethanol	Methanol
Root	*S. aureus*	10mm	9mm
	E.coli	9mm	5mm
	P. mirabilis	10mm	7mm
Flower	*S. aureus*	13mm	12mm
	E.coli	12mm	13mm
	P.mirabilis	12mm	12mm
Pod	*S. aureus*	15mm	15mm
	E.coli	14mm	13mm
	P. mirabilis	14mm	15mm
Seeds	*S. aureus*	17mm	17mm
	E.coli	16mm	16mm
	P. mirabilis	16mm	16mm
Gentamycin	*S. aureus*	17mm	17mm
	E.coli	6mm	7mm
	P. mirabilis	7mm	8mm



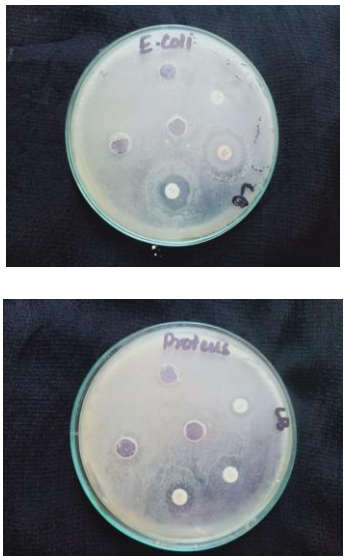


Figure 1. Antibacterial Activity against *Staph.aureus E.coli and Proteus*

Various researchers have shown the antibacterial activities of various plants. Since the plant produces secondary metabolites as a defense against microbes, herbivores and insects, thus it is natural to expect antimicrobial effects for instant namely flavonoids, alkaloids and triter penoide product a better opportunity for testing against a wide range of microorganisms. **Seyydnejad*, et al.* (2010)** studied the antimicrobial activity of *A.lebbeck* and his results showed no significant activity which contradicts the results of the current study, this may be due to genetic variation due to difference in geographic location. Another study was done to test the antimicrobial activity of the given plant against *S. aureus*, *Pseudomonas aeruginosa*, *Bacillus cereus* and *E. coli* **(Chulet *et al.*, 2010)** which showed similar results to the present study. **Umar *et al.* (2019)** studied biosynthetic nanoparticles prepared from the stem bark of *A.lebbeck*

and tested them against various microbes, the results indicated strong activity against gram-negative strains whereas a weaker activity against gram-positive strains but an overall significant antimicrobial activity supporting the results of the present study.

Habiba *et al.* (2021) tested Tris NaCl and PBS buffer protein extracts of the plant to study its effectiveness against bacterial strains and determined that it showed minute inhibition zones. Similarly, **Elshiekh *et al.* (2020)** tested petroleum ether extracts of the plant against several bacterial strains and found significant results. The bark of A. lebbeck has been previously shown to possess antimicrobial activities against *E. coli, S. typhi, P. aeruginosa, S. aureus, Bacillus cereus, Klebsiella aerogenes, Proteus vulgaris, Shigella boydii, Aspergillus fumigatus, Aspergillus flavus, A. niger, C. albicans* **(Dabur *et al.*, 2007).** *Salmonella typhimurium, Salmonella enteritidis, Shigella dysenteria, Shigella flexneri, C. albicans, Candida tropicalis* and *Candida kruse* **(Uma *et al.*, 2009)**. *A. lebbeck* leaves showed potent activity against *E. coli, S. aureus, P. aeruginosa and B. cereus* **(Rahul *et al*. 2010).**

Conclusions and Recommendations

It can be concluded from the present study that *A.lebbeck* is a great candidate as an anti-bacterial drug. Merhanol extracts showed higher antibacterial activity then ethanol extracts, higher antibacterial activity was shown against *S. aureus* followed by *E.coli* and *P. mirabalias*. Order for antibacterial activity of different plant parts was seed > pod > flower > roots. Further studies needs to be done to unlock its full potential and its use on industrial level. The results authenticate their traditional use and indicate promising potential of this plant to be developed as antibacterial agent. Further work is needed for isolation, structure elucidation and characterization of bioactive constituents responsible for this activity. These natural products isolated should be screened *in vivo* and *in vitro* for antibacterial activity and may be developed as cheap alternatives to costly synthetic antimicrobial agents available in market.

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