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Antibacterial activity and physicochemical evaluation of roots of *Butea monosperma*

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ABSTRACT

Objective: To evaluate the antibacterial activity of the petroleum ether extract of root of *Butea monosperma* (*B. monosperma*). **Method:** *In vitro* antibacterial activity of petroleum ether i.e. *B. monosperma* was studied against *Staphylococcus faecalis* (*S. faecalis*), *Sterptococcus faecalis* (*S. faecalis*), *Aeromonas hydrophilia* (*A. hydrophilia*), *Salmonela typhae* (*S. typhae*), *Stphylococcus cohni* (*S. cohni*), *Escherichia coli* (*E. coli*) and *Serratia ficaria* (*S. ficaria*) by using well diffusion method. **Results:** Petroleum ether extract of root of *B. monosperma* exhibited a prominent inhibitory effect against bacterial strains. **Conclusion:** From the result it can be concluded that the *B. monosperma* extract has potent *in vitro* antibacterial activity.

1. Introduction

Despite of tremendous progress in human medicines, infectious diseases caused by bacteria, fungi, viruses and parasites are still a major threat to public health. There impact is particularly large in developing countries due to relative unavailability of medicines and the emergence of widespread drug resistance[1]. During the last two decades, the development of drug resistance as well as the appearance of undesirable side effects of certain antibiotics[2] has lead to the search of new antimicrobial agents mainly among plant extracts with the goal to discover new chemical structures, which overcome the above disadvantages[3]. Medicinal plants have been known for their healing or disease-curing qualities for centuries[4]. Herbal drugs have gained importance in recent years because of their efficacy and cost effectiveness. The characteristics of the plants that inhibit microorganisms and are important for human health have been researched in laboratories since 1926[5]. Bacterial diseases are a type of infectious diseases caused by pathogenic bacteria. It is notable that majority of bacteria are non pathogenic and are not harmful to human health. Some bacteria are even helpful and necessary for the good health. Millions of bacteria normally live in the intestine, on the skin and the genitalia. Bacterial diseases results when the harmful bacteria get into a body area, multiply their and thrash the body's defensive mechanism. Pathogenic bacteria can invade in the body through various routes like inhalation into nose and lungs, ingestion in food or through sexual contact. Once bacteria enter the body, the immune system of the body recognizes the bacteria as foreign intruder and tries to kill or stop them from multiplying. However, even a healthy immune system is not always able to stop the bacteria from reproducing and spreading. As a result bacteria thrive in the body and emit toxins which damage cells and tissues that consequently results in the symptoms of bacterial disease. Commonly occurring pathogenic bacteria are *Neisseria meningitides* (*N. meningitidis*), which can cause meningitis, *Streptococcus pneumoniae* (*S. pneumoniae*), which can cause pneumonia, *Helicobacter pylori* (*H. pylori*), which can cause gastric ulcers, *Escherichia coli* (*E. coli*) which can cause food poisoning, *Salmonella typhi* (*S. typhi*), which can cause typhoid, and *Staphylococcus aureus* (*S. aureus*), which can cause skin and other infections[6]. It is one of the most beautiful tree has been put to some useful purpose. *Butea monosperma* (*B. monosperma*) is extensibly used in Ayurveda, Unani and Homeopathic medicine and has become a cynosure of modern medicine. The plants of this genus are well known for their colouring matters. Commonly *B. monosperma* is used as tonic, astringent, aphrodisiac and diuretics[7]. Roots

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are useful in filariasis, night blindness, helminthiasis, piles, ulcer and tumours[8]. It is reported to possess antifertility, aphrodisiac and analgesic activities[9].

2. Materials and method

2.1. Plant collection

The *B. monosperma* roots were collected in the summer season of year 2010 from Bilaspur, Chhattisgarh, India. The plant specimen were identified and authentificated from Raipur Institute of Technology, Raipur, Chhattisgarh. Roots of *B. monosperma* were collected locally from Bilaspur, Chhattisgarh, India.

2.2. Method of extraction

Roots were washed; air dried under shade and powdered with the help of Grinder. Powdered roots were weighed and packed in soxhlet. Solvent used for soxhletion was mixed with petroleum ether. Extraction was continued at the temperature of 50 ℃ till clear solvent was observed in siphon tube. Extract was concentrated by vacuum evaporation. Concentrated extract was further dried at 40 ℃ in hot air oven. Dried extract was packed in an air tight container.

2.3. Physiochemcal evaluation

Physicochemical parameters of *B. monosperma* root powder were determined and reported as total ash, water-soluble ash, acid-insoluble ash, and sulfated ash values. Alcohol and water-soluble extractive values were determined to find out the amount of water and alcohol-soluble components. The moisture content and pH was also determined.

2.4. Antibacterial activity

The test solution of extracts and standard solution were prepared. The concentration of extract was set to 12.5 mg/mL to 50.0 mg/mL. (12.5 mg/mL, 25.0 mg/mL, 37.5 mg/mL, and 50.0 mg/mL in dimethylsulphoxide. The drug used in standard preparation was chloramphenicol of IP grade. The antibacterial activity was performed using 24 h cultures of *Staphylococcus faecalis* (*S. faecalis*), *Sterptococcus faecalis* (*S. faecalis*), *Aeromonas hydrophilia* (*A. hydrophilia*), *Salmonela typhae* (*S. typhae*), *Stphylococcus cohni* (*S. cohni*), *Escherichia coli* (*E. coli*) and *Serratia ficaria* (*S. ficaria*) developed in nutrint agar media. The aliquot of 1ml quantity of test and standard solution was transferred in 6 mm well. The stringent aseptic conditions were maintained during microorganism inoculation and the plates were labeled. The test and standard solution were allowed to diffuse in wells for 2 h at room temperature. The Petri plates were incubated at (37±1) ℃ for 24 h. The diameter of zone of inhibition of each well was recorded.

3. Result

3.1 Physicochemical evaluation

It was clear from the experimental data presented in Table 1 that the quantitative ash content value suggest the presence of inorganic component in leaves *B. monosperma*. The quantitative solubility of ash was checked in dilute acid solution and water. The solubility of ash in dilute acid solution was found lower than water. The water soluble and alcohol soluble extractive were checked quantitatively. The water soluble extractives were found higher than alcohol soluble extractives. The petroleum ether extract confirms the presence of sterols, triterpenes, and triterpenes as glycosides, flavonoids and proteins. *B. monosperma* root powder showed the presence of total ash – 8.77% w/w, acid-insoluble ash – 8.36% w/w, water-soluble ash – 0.77% w/w, water-soluble extractive – 12.3% w/w, alcohol-soluble extractive – 6.7% w/w, and pH – 6.2 The results of physico-chemical test were tabulated in Table 1.

Table1.
Physicochemical analysis.

Sr. No	Parameters	Result (%w/w)
1	Total ash	8.77
2	Acid insoluble ash (8)	8.36
3	Water soluble ash (8)	0.77
4	Water soluble extractive	12.30
5	Alcohol soluble extractive	6.70
6	pH	6.20

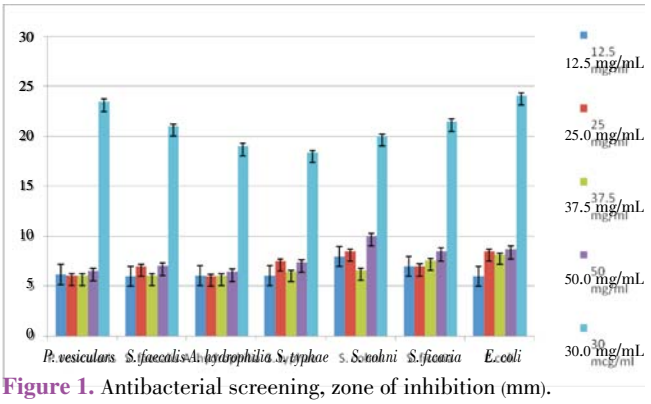

Figure 1. Antibacterial screening, zone of inhibition (mm).

3.2 Antibacterial activity

In the present study seven different bacteria were used to screen possible antimicrobial activity of *B. monosperma* in petroleum ether root extracts. A result clearly indicates that petroleum ether extract of root showed significant antimicrobial and antifungal activity. The test solution of extracts and standard (chloramphenicol) solution were prepared. The concentration of extract was set to 12.5 mg/mL to 50.0 mg/mL. (12.5 mg/mL, 25.0 mg/mL, 37.5 mg/mL, and 50.0 mg/mL in dimethylsulphoxide. The antibacterial activity was performed using 24 h cultures of *S. faecalis*, *S. faecalis*, *A. hydrophilia*, *S. typhae*, *S. cohni*, *E. coli* and *S. ficaria* developed in nutrint agar media. The bacterial strains were used and obtained from Raipur Institute of Technology, Raipur, Chhattisgarh. The diameter of zone of inhibition of each well was recorded. The zones of inhibition were measured in millimeters using a vernier caliper. At the 50.0 mg/mL. concentration of *B. monsperma* extract, a zone of inhibition of 6.49 mm was obtained, which was the widest zone of inhibition observed among all the 4 different concentrations of *B. monsperma* that were investigated.

Table 2.
Antibacterial screening, zone of inhibition (mm).

Microbial strains	Extracts concentration			Standard solution	
	12.5 mg/mL	25.0 mg/mL	37.5 mg/mL	50.0 mg/mL	30.0 mg/mL
P. vesicularis	6.15±0.30	6.05±0.05	6.05±0.05	6.49±0.20	23.49±0.20
S. faecalis	6.00±0.50	6.95±0.12	6.07±0.09	7.02±0.33	21.02±0.32
A. hydrophilia	6.07±0.05	6.00±0.40	6.07±0.25	6.42±0.09	19.07±0.19
S. typhae	6.02±0.05	7.50±0.21	6.42±0.25	7.37±0.18	18.37±0.82
S. cohni	7.95±0.12	8.50±0.14	6.57±0.09	10.02±0.05	20.02±0.85
S. ficaria	6.95±0.33	7.00±0.21	7.57±0.05	8.52±0.12	21.52±0.22
E. coli	6.00±0.15	8.50±0.14	8.15±0.05	8.72±0.15	24.12±0.54

It was clear from the experimental data that antibacterial activity of petroleum ether extract against all the strains is having better effect. The results of antibacterial activity were graphed and tabulated in Table 2 & Figure 1.

4. Discussion

The bark is reported to possess antitumor and antiulcer activities. The root bark is used as an aphrodisiac, analgesic and antihelmintic whereas the leaves possess antimicrobial property[10] *B. monosperma* flowers contain butin, butein, butrin, isobutrin, palasitrin, coreipsin, isocoreipsin, chalcones, and aurones[11]. Butrin (7, 30, 40-trihydroxy. avanone-7, 30-diglucoside) and isobutrin (3, 4, 20, 40-tetra-hydroxy-chalcone-3, 40-diglucoside) are the well-known antihepatotoxic principles of *B. monosperma*[12]. The qualitative determination of various secondary metabolites like flavonoids, terpenoids, saponins and polysaccharides of *Artemisia* spp. were detected by HPLC, GC-MS and NMR[13,14]. Identification of plants with botanical verifications is essential as contamination due to misidentification of plant species or parts is common. Therefore, it becomes necessary to develop more effective, accurate, reliable and sensitive methods for the authentication of herbs. In the present study an effort has been made to establish physicochemical, and pharmacognostic, parameters which could be helpful in identification of the authentic plant samples and differentiating it from adulterants[15].

Conflict of interest statement

We declare that we have no conflict of interest.

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