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Antimicrobial Activity of Crude Extracts from *Lonchocarpus sericeus* Roots

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ABSTRACT

Lonchocarpus sericeus is a plant genus in the legume family (Fabaceae). It is cultivated and used in folk medicine for its antitumor, antimicrobial, antiviral, antimycotic, and hepatoprotection properties. This study investigates the phytochemical composition and antimicrobial efficacy of the crude extracts of *L.sericeus*. Standard phytochemical screening methods were applied to both methanol and ethyl acetate extracts. Antimicrobial activities were assessed through inhibition zone assays, and minimum inhibitory concentration (MIC) testing against several microbial strains. The phytochemical analysis revealed the presence of alkaloids, triterpenes, cardiac glycosides, saponins, tannins, steroids, coumarins, amino acid and resins. Antimicrobial assay of the methanol extract demonstrated varying degrees of inhibition against different microbial strains, suggesting potential broad-spectrum activity. Both extracts exhibited similar MIC profiles for most bacterial strains suggesting comparable antimicrobial activity. These findings show the significant medicinal properties of *L.sericeus* and support its traditional use in treating infectious and metabolic ailments.

KEYWORDS: Antimicrobial, *Lonchocarpus sericeus,* Phytochemical.

1. INTRODUCTION

Microbial infections and antibiotic resistance pose severe threats to global health, contributing significantly to mortality rates across the world. In 2013, infections accounted for 9.2 million fatalities, constituting approximately 17% of total deaths.[1,2] The rise of antibiotic resistance has compromised the efficacy of existing antibacterial treatments.[3,4] The prevalence of microbial infections has led to the exploration of plants for potential antibiotic compounds.[5,6] Medicinal plants harbor compounds which are active that can serve as cost-effective and efficient herbal antibiotics for common bacterial illnesses. The plant *Lonchocarpussericeus* which falls under the family of fabacea has been explored traditionally to treat several illnesses. In Nigeria, the leaves are employed for broad-spectrum healing while the bark is exploited for management of body pains, arthritis, rheumatism, cutaneous and subcutaneous parasitic infection, malnutrition, debility, paralysis and convulsions. The roots are notably employed for the treatment of leprosy. The fruit and seeds are used as insect repellants and arachnicides.[7]

A decoction or infusion of the plant leaves is used for gastrointestinal and hepatic disorders and for alleviation of malaria. It is also used in folk medicine for its antitumoral, antimicrobial, antiviral, antimycotic, choleretic-cholagog, hepatoprotector properties. The plant is also consumed as a diuretic and a tonic to maintain wellness. The leaves, the bark and roots of this plant are being employed as an anti-inflammatory, antimicrobial and anticancer plant.[8] This study evaluates the phytochemical constituents and antimicrobial efficacy of ethyl acetate and methanolic extracts of *L. sericeus* roots against selected microbial strains using both the disk diffusion method and MIC assays.

2. MATERIALS AND METHODS

2.1 Plant identification and collection

Roots samples of *L. sericeus* were collected from Saye village in Zaria, Kaduna State, and was authenticated and verified at the Botany division of the Department of Biological Sciences, Ahmadu Bello University Zaria, Kaduna, Nigeria with the identification number; ABU01085.

2.2 Sample Treatment for Extraction

The root samples were carefully cleaned, dried, and pulverized using wood milling machine. The powdered sample was weighed and stored in a polythene bag at room temperature.

2.3 Extraction of Crude Extracts

Cold maceration was employed to obtain the plant extracts. 100g of the pulverized root sample was immersed in 500 ml of ethyl acetate for 72 hours at room temperature, followed by filtration and

evaporation at 78°C using a rotary evaporator. The same procedure was repeated using methanol as the solvent.

2.4 Phytochemical Screenings for Crude Extracts

Both ethyl acetate and methanol extracts underwent qualitative phytochemical tests using established procedures.[9,10]

2.5 Antimicrobial Assay Procedure

Sample Preparation: Concentrations of 1.0 mg/cm^3, 0.5 mg/ cm^3 and 0.25 mg/ cm^{3}were prepared for each extracts by dissolving 0.49 mg, 0.98 mg and 1.96 mg of each extract in 2cm^{3}of the respective solvents of extraction. The solution of the extracts was prepared by dissolving 0.49 mg, 0.98 mg and 1.96 mg of extracts in 2 cm^3 of hexane to give an approximate concentration of 0.25, 0.5 and 1.0 mg/cm^3 respectively. The solvent of extraction was used as control only. Test solutions were individually prepared in triplicates. The same method was employed using Cyprofloxacin, Gentamycin and Amoxacillin which were used as standard drugs.

2.6 Test of Minimum Inhibitory Concentration (MIC)/Minimum Bactericidal Concentration (MBC)

The MIC and MBC of the extract were assessed using the micro dilution agar technique. The extracts underwent serial dilution in sterile distilled water, resulting in a decreasing concentration range from 160 to 1.25 mg/cm³ across nine (9) labeled sterile tubes (1 through 9). Wells were created in Mueller Hinton agar (MHA) plates, solidified after insertion, using a sterile cork borer with an 8 mm diameter. 100 µL was aseptically added of each dilution to the wells in triplicate and a standardized inoculum (1.5 X 108 CFU/cm³) of the microbial isolate was introduced. 100 µL of methanol was added to the wells to serve as a control. All test plates were then incubated at 37°C and observed for growth after 24 hours. The lowest concentration of an extract displaying a distinct zone of inhibition was considered as the MIC. The MBC was determined using a 100 µL aliquot from the tube containing the MIC was placed on an MHA plate and spread. After another 24 hours of incubation at 37°C, examination of the plates were carried out for bacterial growth to identify the extract concentration required to eliminate 99.9% of bacterial isolates.

3. RESULTS AND DISCUSSION

3.1 Result

3.1.1 Phytochemical Analysis

Phytochemical screening analysis of the crude extracts of ethyl-acetate and methanol showed the appearance of various secondary metabolites constituents present in the plant as shown in Table 1

Table 1: Results of Phytochemical screenings of ethyl acetate and methanolic crude extracts of *L. sericeus*

Phytocompounds	Ethyl acetate Extract	Methanol Extract
Alkaloids	+	+
Triterpenes	+	+
Cardiac glycosides	+	+
Saponins	+	+
Condensed tannins	+	+
Steroids	+	+

Quinones	-	-
Anthraquinones	-	-
Tannins	+	+
Coumarins	+	+
Amino Acid	+	+
Resins	+	+

Key: (+) = present, (-) = absent

3.1.2 Antimicrobial test

Analysis of methanol extract of *Lonchocarpussericeus* antimicrobial zone inhibition is presented in table 2 below.

Table 2: Results of crude extracts of *L. sericeus*antimicrobial zone inhibition

Microbial strain	Concentration (x10^2 µg/ml)			
	4	5	6	7
Staphylococcus aureus	3.3	9	11.7	21.7
Streptococcus pneumonia	2.3	4.7	9	15
Salmonella typhi	6.3	10.7	15.3	22
Corynbacteriumulcerans	-	-	-	-
Escherichia coli	5	9.7	16.3	28
Pseudomonas aeruginosa	7.3	14.7	22.3	30
B.cereus	8.6	12.3	17	24.7
Trichophyton rulorrum	4	7.3	11.7	16
Aspergillus niger	8	12.3	17.3	27.7
Candida ablican	4.7	8.7	14	22.7
Control	-	-	-	-

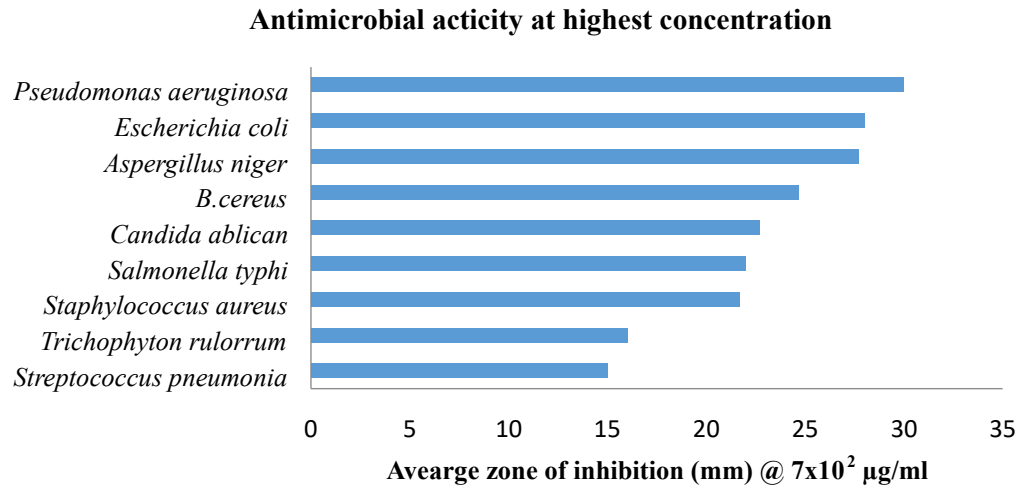

Figure 1: Methanol extract antimicrobial inhibition at highest concentration

3.1.3 Minimum Inhibitory Concentration

The result of MIC of the crude extracts of *Lonchocarpussericeus*Table 3

Table 3: Result of minimum inhibitory concentration of the crude extracts of *L. sericeus*

Bacterial strains	Ciprofloxacin	Ethyl acetate	Methanol
Staphylococcus aureus	0:648×10^{-3}	1.52	1.69
Streptococcus pneumonia	0:648×10^{-3}	6.49	6.49
Salmonella typhi	0:648×10^{-3}	6.49	6.49
B. cerues	0:648×10^{-3}	3.04	3.37
Pseudomonas aeruginosa	0:041×10^{-3}	6.10	6.75
Escherichia coli	0:041×10^{-3}	6.1	6.75
Trichophyton rulorrum	0:648×10^{-3}	3.10	4.75
Aspergillus niger	0:648×10^{-3}	3.10	5.75
Candida ablican	0:648×10^{-3}	6.10	6.75

The MICs of the crude extractson different bacterial strains. β= MIC value (6.250)

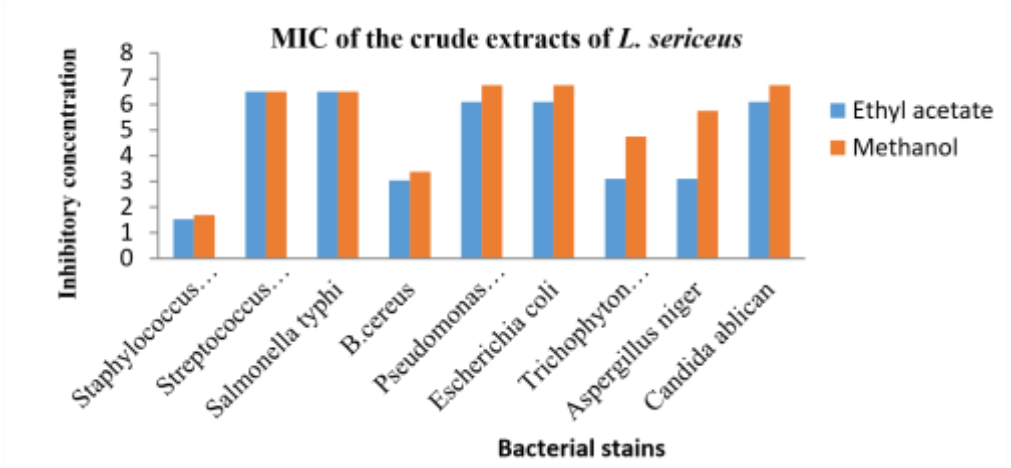

Figure 2:MIC of the crude extracts of *L. sericeus*

3.2 Discussion

Phytochemical screening result showed encompassing alkaloids, steriods, triterpenes, saponins, cardiac glycosides, tannins (both condensed and hydrolysable), coumarins, amino acid, and resins, in both ethyl acetate and methanolic extracts. Notably, quinones and anthraquinones were absent in both extracts (Table 1). The antimicrobial efficacy of the methanolic extract was determined through inhibition zone measurements and MIC determination. The inhibition zones increased with higher concentrations of the extract. *Pseudomonas aeruginosa and Escherichia coli* exhibited the largest inhibition zones (up to 31 mm), indicating strong susceptibility. *Corynebacterium ulcerans* showed no response at any concentration (Table 2). MIC testing showed that *Staphylococcus aureus* was the most susceptible strain to the ethyl acetate extract (MIC = 1.52 mg/ml). Both extracts had MICs between 3.04–6.75 mg/ml for most strains, while ciprofloxacin showed superior activity at nanogram levels (Table 3).

The presence of phytochemicals in the roots of *L. sericeus* makes it advantageous to humans since these compounds have exhibited potent medicinal activities including analgesic, anticancer, bactericidal, wound healing, hepatoprotective, anti-inflammatory and antioxidant properties.[7] Compounds such as alkaloids, tannins, and saponins have been noted for their ability to disrupt microbial membranes or inhibit enzyme systems.[11,12] Alkaloids are also recognized as one of the classes of therapeutically active plant substances. Pure, isolated, and synthetic derivatives are quite useful as basic medicinal agents because of their analgesic, anti-nociceptive, antioxidant and intestinal anti-inflammatory activities.[7] Flavonoids are quite renowned for their anti-oxidant, hepatoprotective and anti-cancer potentials.[13] Also flavonoids are notable for their anti-inflammatory and allergic effect coupled with their gastric mucus production.[14] The antimicrobial screening of *L. sericeus* crude extracts revealed promising inhibitory effects against a spectrum of bacterial and fungal pathogens. The results demonstrated a dose-dependent increase in inhibition zones, and varying minimum inhibitory concentration (MIC) values, consistent with patterns observed in medicinal plant research.[11,15] Ciprofloxacin, used as the reference drug, exhibited superior potency, with MIC values spanning from

0.041 × 10^{-3} to 0.648 × 10^{-3} mg/ml, aligning with its known efficacy in nanogram concentrations.[16,17] In contrast, the MICs of both ethyl acetate and methanolic extracts of *L. sericeus* ranged from 1.52 to 6.75 mg/ml, typical for crude plant preparations. While less potent than ciprofloxacin, the extracts demonstrated broad-spectrum activity, particularly in strains such as *Staphylococcus aureus*, *Bacillus cereus, Escherichia coli,* and *Pseudomonas aeruginosa*. The Grampositive organisms, particularly *S. aureus and B. cereus,* showed strong susceptibility to the extracts, with inhibition zones of up to 25 mm and MICs as low as 1.52 mg/ml. This finding is consistent with previous research indicating that Gram-positive bacteria are generally more vulnerable to plant extracts, due to their simple peptidoglycan-rich cell wall, which facilitates better permeability of bioactive compounds.[12,11] Substantial inhibition was observed against Gram-negative species such as *E. coli* and *P. aeruginosa*, known to be resistant due to their outer lipopolysaccharide membrane.[18] Zones of inhibition reached 30–31 mm, with MICs around 6.10–6.75 mg/ml. This shows that *L. sericeus* contain non-polar phytochemicals, such as flavonoids or terpenoids, capable of disrupting bacterial membranes.[19] The extracts also demonstrated moderate antifungal activity, with *Trichophyton rulorrum* and *Aspergillus niger* exhibiting inhibition zones of 15–28 mm and MICs between 3.10 and 5.75 mg/ml. Fungal organisms are typically more resilient due to their complex chitinous cell walls, however these findings indicate that the extracts may possess broad antifungal compounds, in line with literature on plant secondary metabolites such as phenolics and saponins.[20]

4. CONCLUSION

The integrated phytochemical and antimicrobial evaluation of *Lonchocarpussericeus* roots reveals that the plant contains a diverse array of bioactive compounds that contribute its significant antimicrobial activity and this supports its traditional medicinal use and suggests potential as a natural antimicrobial agent, especially against Gram-positive bacteria and select fungal species. Further studies should focus on phytochemical characterization, synergy with antibiotics, and mechanistic assays to explore its full therapeutic potential.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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