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Phytochemical screening and antimicrobial activities of the methanolic leaf extract of *Jacaranda mimosifolia* D. DON and *Sansevieria liberica* THUNB

Adelanwa, E.B.* and Ismail Habibu.

Biological Sciences Department,
Ahmadu Bello University, Zaria.

Abstract

In this study, the phytochemical screening and antimicrobial activities of the methanolic leaf extract of *Jacaranda mimosifolia* D. Don (Bignoniaceae) and *Sansevieria liberica* Thunb (Asparagaceae) were carried out. The phytochemical screening revealed the presence of carbohydrate, flavonoids and cardiac glycosides; absence of anthraquinones and alkaloids in both plants. However tannins, saponins and steroids were present in *J. mimosifolia* which were found to be absent in *S. liberica* but there is the presence of triterpenes in *S. liberica*. The methanolic leaf extracts of these two plants were also subjected to antimicrobial screening in accordance with agar well diffusion method. The extracts were tested against clinical isolates of *Escherichia coli, Salmonella typhi, Bacillus cereus* and *Staphylococcus aureus* with ciprofloxacin as a positive control. The zone of inhibition, Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were determined. The result showed that all the test organisms were sensitive to the standard drug (control) as well as the methanolic leaf extract of *J. mimosifolia* though varied at different concentration of the extract. The result also showed that *Bacillus cereus* and *Staphylococcus aureus* were sensitive to the methanolic extract of *S. liberica* while *Salmonella typhi* and *Escherichia coli* were resistant to the extract.

Keywords: Phytochemical Screening, Antimicrobial, *Jacaranda mimosifolia*, *Sanseviera liberica.*

* Corresponding Author: Email: estherlanwa@yahoo.com, Phone: 08036185814, 090854536120

Introduction

The use of traditional plants as herbal medicine dates back to the beginning of creation whereby trial and error were led by instinct and past experience. The primitive man was able to distinguish between foods, medicine and poisonous plants. Some knowledge also came from observation of animals that voluntarily consumed such plants in case of sickness.

Early man was able to differentiate plants into edible and non-edible types (Ivan, 1999). Plants have been used by man for food, shelter, clothing and medicinal purposes (Sofowora, 1993). Plants have traditionally served as man's most important weapon against pathogens (Solecki, 1985). They are important to man in all aspect of life including provision of food which is man's basic need for survival. He was totally dependent on green plant for his day to day needs of medications (Sofowora, 1982).The history of traditional medicine was traced to the stone age when humans used plants and other natural substances for prayer and rituals to overcome various diseases (Ghani, 1990).

Traditional medicine can be said to involve all knowledge and practices whether explicable or not, used in diagnosing, preventing or eliminating

physical, mental or social diseases and which may rely exclusively on past experiences and observations handed down from generation, verbal or written. All over the world, plants use for traditional medicines are known as medicinal plants. Parts of these plants like leaves stem bark, roots, seeds and some parts of animal metaphysical phenomena have been used in traditional medicine (Tella, 1968). Concoctions of these plants are used in variety of dosage forms such as liquid, semi-solid, solid or gaseous. According to an estimate by World Health Organisation, 80% of the people in developing countries rely cheaply on traditional medicine for their primary health care needs of which the major portion involves the use of plant extracts or their active principles (Farnsworth *et al*., 1985). Infectious diseases such as ear and systemic diseases due to bacteria, fungi and other parasitic agents have being treated through the use of medicinal plants (Ogunlana and Rainstad, 1975).
The objective of this study is to determine the phytochemical constituents of the leaf extract of *Jacaranda mimosifolia* and *Sansevieria liberica* nd to evaluate their antimicrobial activities.

Materials and Method

Study Area

The research was conducted at the Department of Pharmacognosy and Drug Development, Faculty of Pharmacy and the Department of Microbiology, Faculty of Science, A.B.U., Zaria.

Collection, Identification and Processing of Plant Materials

Jacaranda mimosifolia leaves were collected within the Department of Biological Sciences, Faculty of Science, A.B.U Samaru, Zaria. *Sansevieria liberica* were collected in the botanical garden of the Department of Biological Sciences, A.B.U Zaria. These plant materials were identified with scientific and common names. The plant materials were air dried for two weeks in well ventilate room. The dried leaves were then pulverised into powder using wooden pestle and mortar.

Experimental design

Extraction procedure

100 grams of each ground plant material was soaked in 1000ml of methanol and was left for 24 hours to macerate. Then, the methanolic leaf extract of each sample was evaporated to dryness over a boiling water bath. The dried crude extract was weighed and stored in dry sterile sample bottles. The yields of extracts were 15.96% and 19.32% for *S. liberica* and *J. mimosifolia*, respectively.

Preliminary Phytochemical Screening of the Methanolic Extracts

About 2 grams each of the dried methanolic leaf extracts were dissolved with small amount of the methanol. The resultant suspensions were then subjected to phytochemical screening to identify some of the important chemical components by means of qualitative chemical test using various chemicals and reagent in accordance with the method of Trease and Evans (1998; 2002).

Antimicrobial Screening

Screening of the Extracts for Antimicrobial Activity

The antimicrobial activities of the methanolic leaf extract of *J. mimosifolia* and *S. liberica* were checked against the selected pathogenic microorganisms in accordance with the agar well diffusion method described by Irobi *et al.* (1994).

Determination of Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC)

The MIC of the methanolic leaf extract was determined using the methods of Akinpelu and Kolawole (2004). The MIC was taken as the lowest concentration that prevents the growth of the test microorganism. The MBC of the methanolic leaf extracts was determined by modification of the method of Spencer and Spencer (2004).The MBC was taken as the lowest concentration of the extract that did not show any growth on new set agar plates.

Analysis of variance (ANOVA) using general linear model was used to test for significant difference between the zones of inhibition of the control (ciprofloxacin) and that of *J. mimosifolia* as well as that of *S. liberica* against the test organisms.

Results and Discussions

The result of the phytochemical screening of the methanolic leaf extract of *Jacaranda mimosifolia* and *Sansevieria liberica* reveals that, there is the presence carbohydrate, flavonoids and cardiac glycosides, but anthraquinones and alkaloids were absent in both extract of the plants (Table 1). There is the presence of tannins, saponins and steroids in the methanolic leaf extract of *J. mimosifolia* and this is in line with the work of Rojas *et al.*(2006) and Eze *et al.* (2011), where they discovered that there is the presence of these constituents in *J. mimosifolia* and *S. liberica* respectively. Tannins have been shown to have antimicrobial properties in that it coagulates bacterial cell wall protein, hence resulting in bactericidal activities. Triterpenes were found to be present while saponins were absent in the methanolic extract of *S. liberica* which disagrees with the work of Eze *et al.* (2011), where they found that both triterpenes and saponins were present in *S. liberica* they worked with.

Table 1: Phytochemical screening of the methanolic leaf extract of *Jacaranda mimosifolia* and *Sansevieria liberica.*

Constituent	Test	Observation	*Jacaranda. mimosifolia*	*Sansevieria liberica*
Carbohydrate	Molisch	Purple colouration at the interface	+	+
	Fehling	Brick red precipitate	+	+
Anthraquinones	Bonstrager	No precipitate	-	-
Saponins	Frothing	A honey comb formed for more than 30mins	+	-
Tannins	Lead sub-acetate	Brown precipitate	+	-
	Ferric chloride	Blue-black precipitate	+	-
Steroids	Leiberman-Burchard	A colour change to blue green	+	-
Triterpenes	Leiberman-Burchard	Colour change to red, pink or purple	-	+
Flavonoids	Shinoda	Red or orange colouration	+	+
	Sodium hydroxide	Yellow colouration	+	+
Alkaloids	Dragendorff	No precipitate	-	-
	Meyer	No precipitate	-	-
	Wagner	No precipitate	-	-
Cardiac glycosides	Kell-Kiliani	Purple ring at the interface	+	+
	Salkowski	Reddish-brown colour at the interface	+	+

The result for the antimicrobial screening showed that the leaf extract of *J. mimosifolia* was active against all the bacterial isolates used in this work. This is in agreement with the work of Binutu and Lajubutu, (1994) and Eze *et al.* (2011) who reported that *J. mimosifolia* extracts were active against *S. aureus*, *E. coli* and *B. cereus* isolates. The methanolic leaf extract of *S. liberica* was active against only gram positive bacteria (i.e. *B. cereus* and *S. aureus*) while it was resistant to the gram negative bacteria (*E. coli* and *S. typhi).* The resistivity of these gram negative bacteria against the extract may be attributed to the absence of saponins and steroids in the plant which are responsible for the antimicrobial and anti-fungal actions in plants. This is reported by Eze *et al.*, (2011) reported *A. Niger* and *C. albicans* were not sensitive to both crude extracts and all the fractions of the aqueous leaf extract of *S. liberica.*

The minimum inhibitory concentration (MIC) of the methanolic leaf extract of *J. mimosifolia* against the bacterial isolates ranged between 31.25 and 125mgml^{-1} (Table 2), while that of the methanolic leaf extract of *S. liberica* against *B. cereus* and *S. aureus* was 62.5mgml^{-1} (Table 3). MIC is lowest concentration of an antibiotic agent that can inhibit the growth of a microorganism and it is a measure of the type and amount of antibiotic that a patient will receive under treatment (Andrews, 2001). The MBC of both extracts against the bacterial isolates ranged between 125 and 250 mgml^{-1} (Table 4 and 5). However, *E. coli* showed no activity against both extracts. The MBC is the lowest concentration of an antibiotic agent required to kill the germ (French, 2008). The inhibitory effect of the extracts of these two plants against these pathogenic bacteria isolates can introduce the plants as potential candidates for drug development for the treatment ailments caused by these pathogens.

Table 2: Minimum Inhibitory Concentration (MIC) of the methanolic leaf extract of *Jacaranda mimosifolia*

Concentration (mg/ml)	**250**	**125**	**62.5**	**31.25**	**15.625**
E.coli	-	+	++	+++	++++
S.typhii	-	+	++	+++	++++
B. cereus	-	-	-	+	++
S.aureus	-	-	+	++	+++

Table 3: Minimum Inhibitory Concentration of the methanolic leaf extract of *Sansevieria liberica*

Concentration (mg/ml)	**250**	**125**	**62.5**	**31.25**	**15.625**
E. coli	++	++	+++	+++	+++
S. typhii	++	++	+++	+++	+++
B. cereus	-	-	+	++	+++
S. aureus	-	-	+	++	+++

Table 4: Minimum Bactericidal Concentration of the methanolic leaf extract of *Jacaranda mimosifolia*

Concentration (mg/ml)	**250**	**125**	**62.5**	**31.25**	**15.625**
E. coli	+	++	+++	++++	+++++
S. typhii	-	+	++	+++	++++
B. cereus	+	++	+++	++++	+++++
S. aureus	-	-	+	++	+++

Table 5: Minimum Bactericidal Concentration of the methanolic leaf extract of *Sansevieria liberica*

Concentration (mg/ml)	**250**	**125**	**62.5**	**31.25**	**15.625**
E. coli	+	++	+++	++++	+++++
S. typhii	+	++	+++	++++	+++++
B. cereus	+	++	+++	++++	+++++
S. aureus	-	-	+	++	+++

Key:
- = No turbidity (no growth)
+ = Light turbidity (light growth)
++ = Moderate turbidity
+++ = Heavy turbidity

Conclusion

The study concluded that the methanolic leaf extract of *J. mimosifolia* is active against both gram positive and gram negative bacteria of *E. coli*, *S. typhi*, *B. cereus* and *S. aureus*. Hence the extracts from these plants could be constituted as basic ingredient for the development of drugs that will cure infectious diseases caused these bacteria such as severe nausea, skin infections, dysentery, typhoid fever and some urinary tract infections.

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