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Phytochemical Profile and Antibacterial Properties of the Seed and Leaf of the Luffa Plant (*Luffa cylindrica*)

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Abstract: This study aims at determination of the antimicrobial activity of the seeds extracts of *Luffa cylindria* on certain pathogenic microbes and screening for substances that may be responsible for these actions. *Luffa cylindrica* seeds and Leaves were extracted with ethanol, choloroform and methanol and screened for secondary metabolites. Extracts were found to contain alkaloids, saponnins and cardiac glycosides. The extracts also showed antimicrobial activities against *Escherichia. coli*, *Staphylococcus aureus*, *Salmonella typhi* and *Bacillus subtilis*. The zones of inhibition ranged between 6.00 to 10.00 mm. The inhibitory potentials of the extracts might be ascribed to their content of secondary metabolites. The ability of the extracts to inhibit the pathogens used as indicator organisms holds promise for potential application in the pharmaceutical industry.

Key words: *Luffa cylindrica*, leaf, seed, phytochemicals, antibacterial

INTRODUCTION

Plants produce many substances for self-defense against microbial infection and deterioration. These phytochemicals possess potential significant therapeutic applications against human pathogens such as bacteria and fungi (Perez, 2003). The compounds may be found in a particular part of the plant or all over the whole plant. The active principles of medicinal plants are commonly concentrated in storage organs: Leaves, roots and seeds, while flowers and the woody parts of herbaceous stem are relatively inert (Kochnar, 1981).

The Nigerian climate favours a wide variety of plants with vast antimicrobial and medicinal potentials some of which have been used traditionally for decades without any reference to their phytochemical constituents. *Luffa cylindrica* commonly called sponge gourds plant belongs to the Curcubitaceae family. It is a vigorous climbing annual vine with several lobed cucumber-like leaves. The fruits, which also have a cucumber-like shape, develop at maturity, a network of fibers surrounding a large number of flat blackish seeds. It is reported to have originated from India (Stephens, 2003) but grows luxuriantly in most part of Nigeria as weed. *Luffa cylindrica* has been reported to posses both medicinal and nutritional properties. Its seeds have been used in the treatment of asthma, sinusitis and fever (Nagao *et al*., 1991). Ng *et al*. (1991) also reported that abortifacient proteins such as luffaculin which possess ribosome-inhibiting properties have been isolated from *Luffa* species. The effect of the ribosome inhibiting properties on the replication of HIV infected lymphocyte and phagocyte cells explain its potential as a therapeutic agent for AIDS (McGrath *et al*., 1989). Bailey (1989) reported that juice extracted from the stem has been used in the treatment of respiratory disorders and the seed has emetic action. Apart from the use of the matured fruits as sponge for domestic purposes, there is a dearth of information on the medicinal potentials of the plant *Luffa cylindria* in Nigeria. Hence, this study aims at determination of the antimicrobial activity of the seed and leaf extracts of *Luffa cylindrica* on certain pathogenic microbes and screening for substances that may be responsible for these actions.

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MATERIALS AND METHODS

This aspect was carried out in the Department of Biochemistry, Federal University of Technology, Akure, Nigeria.

Source and Treatment of *Luffa cylindrica*

The dried leaves and seeds of *Luffa cylindrica* were collected from Ado-Ekiti, Nigeria and authenticated at the herbarium of the Department of Botany, University of Ado-Ekiti. The leaves were further air dried for four days and powdered. The seeds were dehulled, air dried and powdered. Powdered seeds and leaves, 100 g each, were separately soaked in 500 mL methanol (100%), 500 mL chloroform (100%) and 500 mL ethanol (100%) for 72 h with occasional shaking. The extracts were separately filtered and the filtrates were evaporated at room temperature to obtain concentrated extracts.

Phytochemical Screening of *Luffa cylindrica*

The extracts were examined for the presence of the following phytochemicals: Alkaloids, tannins, saponins, cardiac glycosides, anthroquinones and phlobatannins. The methods described by Herborn (1998) were used to ascertain the presence of alkaloids, cardiac glycosides and phlobatannins. The presence of saponins was detected using the method of Odebiyi and Sofowora (1978), while tannins and anthroquinones were screened for using the method of Trease and Evans (1985).

Antibacterial Assay of Extracts of *Luffa cylindrica*

The indicator bacteria used for this test were obtained from the stock culture of the Department of Microbiology, Federal University of Technology, Akure, Nigeria. The indicator bacteria used are: *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhi*.

The agar well diffusion assay for antibacterial test described by Schillinger and Lucke (1989) was adapted. Twelve hour broth cultures of the indicator bacteria were used to seed agar plates using pour plate method. Two wells were bored on the seeded agar plates using sterile cork borer of 5 mm diameter. One well contained the extract while the other well that served as control contained sterile distilled water. The extracts were prepared by dissolving 2 g of the concentrates obtained from the different solvent in 1 mL of water and made up to 10 mL with distilled water to give a concentration of 200 mg mL^{-1}.

RESULTS AND DISCUSSION

Focus on plant research has increased in recent times, with a lot of evidence showing immense potentials of medicinal plants in the field of pharmacology. *Luffa cylindrical* had been shown to possess medicinal values (Bailey, 1989). In the present study, the result of phytochemical screening of the leaf and seed of *Luffa cylindrica* is shown on Table 1. All extracts were found to contain

Table 1: Phytochemical constituents of the extracts of *Luffa cylindrica*

Phytochemicals	MTS	MTL	ETS	ETL	CFS	CFL
Saponins	+	+	+	+	+	+
Alkaloids	+	+	+	+	+	+
Tannins	-	-	-	-	-	-
Cardiac glycosides						
(a) Legal test	+	+	+	+	+	+
(b) Keller-killani test	+	-	+	-	+	-
(c) Lieberman test	-	-	-	-	-	-
(d) Salkowski test	+	-	+	-	+	-
Anthroquinones	-	-	-	-	-	
Phlobatinins	-	-	-	-	-	-

+: Present; -:Absent; MTS: Methanol Seed Extract; MTL: Methanol Leaf Extract; ETS: Ethanol Seed Extract; ETL: Ethanol Leaf Extract; CFS: Chloroform Seed Extract; CFL: Chloroform Leaf Extract

Table 2: Zones Inhibition (mm) of indicator bacteria by extracts of *Luffa cylindrical* at 200 mg mL^{-1} concentration.

Indicator bacteria	MTS	MTL	ETS	ETL	CFS	CFL
Escherichia coli	8.00±0.82	7.00±0.47	8.00±0.82	7.00±0.47	7.00±0.67	8.00±0.82
Staphylococcus aureus	7.00±0.94	6.00±0.74	9.00±0.47	7.00±0.22	8.00±0.47	8.00±0.47
Salmonella typhi	8.00±0.47	8.00±0.47	7.00±0.47	8.00±1.56	7.00±0.47	8.00±0.82
Bacillus subtilis	8.00±0.97	7.00±1.61	10.00±1.63	6.00±0.22	7.00±0.47	9.00±1.24

Values are means±standard deviation of three replicates. MTS: Methanol Seed Extract; MTL: Methanol Leaf Extract; ETS: Ethanol Seed Extract; ETL: Ethanol Leaf Extract; CFS: Chloroform Seed Extract; CFL: Chloroform Leaf Extract

saponins, alkaloids and cardiac glycosides. Only the seed extracts contained the steroidals rings, while anthraquinones, tannins and phlobatinnins were not detected in any of the extracts. The presence of secondary metabolites have been proven to be medicinal in nature as they have various protective and therapeutic effects essential to prevent diseases and in the maintenance of a state of well being. Alkaloids are useful in novelty Medicare for the treatment of excessive salivation in the neurodegenerative Parkinson's disease and motion sickness. They find use as spasmolytic, anticholinegenic and anaesthetic agents (Herourat *et al*., 1988). Kadiri and Fasidi (1992) had attributed ethno-medicinal uses of some Nigerian mushrooms to the presence of alkaloids and other secondary metabolites present in them. Alkaloids have been found to inhibit microbial growth by interfering with cell division (Noble, 1990).

Saponins are other major phytochemicals present in all the *Luffa cylindrica* extracts. They are steroidal glycosides which have haemolytic properties. Plant steroidal sapogenins are precursors for the synthesis of steroidal drugs such as sex hormones (Amakaha *et al*., 2002). Moreover, they exhibit a nutritional significance in the control of human cardiovascular diseases by forming complexes with dietary cholesterol or their bile salt precursors which are made unavailable for absorption (Oakenfull and Sidhu, 1983). Hence, the seed and leaf of *Luffa cylindrica* possess untapped hypocholesterolemic properties.

The leaf and seed extract of *Luffa cylindrica* show appreciable inhibitory effect against all the indicator bacteria (Table 2). The extracts had zones of inhibition ranging from 6.00-10.00 mm at concentration of 200 mg mL^{-1}. Several authors had reported that extracts from plants containing chemicals with antibacterial properties had been useful in the treatment of bacterial and fungal infections (Pamploma-Roger, 1999; Tadeg *et al*., 2005; Alanis *et al*., 2005; Oyetayo and Oyetayo, 2006). The extracts were found to have antibacterial activity against gram positive and gram negative bacteria. This is an indication that the extract has the potential to treat infections as a result of gram positive and gram negative bacteria.

Plant extracts with antimicrobial activity may provide the answer to the problem of resistance to antibiotics which is now a common phenomenon. It has been advocated that the use of medicinal plants, extracts or natural products, either alone, combined or together with antibiotics can increase their efficacy (Rios and Recio, 2005). This suggests that the extracts of *Luffa cylindrica* can be used in combination with other natural products or antibiotics for effectiveness. Further screening of the antimicrobial properties of the extracts of *Luffa cylindrica* against clinical bacterial isolates and bioassay-directed fractionations of the active crude extracts for isolation and proper identification of bioactive compounds responsible for antibacterial effects is the subject of further studies.

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