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# Evaluation of Antimicrobial Activity of Crude Methanol Extract of *Solanum nodiflorum* Jacq (Solanaceae)

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Ethno botanical survey of medicinal plants has always serve as a rich source of valuable information that has been transmitted through generations. Ethnomedical use of *Solanum nodiflorum* as claimed by traditional healers was investigated. The methanol extract of *S. nodiflorum* (whole plant) was screened in-vitro for antifungal and antibacterial activity using pathogenic strains that are implicated in man and animal diseases. The plant extract significantly inhibited the growth of infectious dermatophytes namely *Candida albicans*, *Trichophyton tonsurans* and *Aspergillus flavus*. The extract effectively inhibited the growth of *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella* Paratyphi A, *Pseudomonas aeruginosa* and *Proteus mirabilis*, but inactive against *Klebsiella pneumoniae*. Preliminary phytochemical screening of the plant extract revealed the presence of alkaloids, saponins, anthraquinones, cardiac glycosides. Tannins and flavonoids were not detected in the extract. *Solanum nodiflorum* possess broad spectrum antimicrobial activity.

**Keyword:** Folkloric Medicine, Phytochemicals, Antifungal, Antibacterial Activity, *Solanum nodiflorum*, Leprosy

### 1. Introduction

The search for newer generation multidrug therapy (MDT) regimens, to provide powerful bactericidal drugs against *Mycobacterium leprae* remains a continuous assignment, even after the year 2005, the new target date for global elimination of leprosy.

Previous experience demonstrated that screening of existing antibacterial agents is only cost effective way to develop drugs for leprosy<sup>[1]</sup>.

The most productive approach to achieve this is by screening of plants that have been reported in folkloric medicine for the treatment of leprosy, consequently, isolation and characterization of compounds that display powerful activity against either a wide spectrum of gram-positive

microorganisms in general or cultivable mycobacterium in particular, or that exhibit pharmacokinetic properties more favourable than those exhibited by the class presently employed for the treatment of leprosy<sup>[2]</sup>.

*Solanum nodiflorum* (synonym- *S. americanum*, *S. caribaeum* Dunal) belong to the plant family Solanaceae. The family comprises of 2800-3000 species belonging to 85-90 genera of herbs, shrubs, and a few trees<sup>[3]</sup>; cosmopolitan, occurring around the world except in the Arctic area<sup>[4]</sup>. In Hausa, *S. nodiflorum* is referred to as *Gaetan Kakudji*, *Odu*, *Ogumo*, *igba yinrin elegun* in Yoruba and in Urhobo as *ebe-akpe*. Black

Night shade, black berried, white night shade are the common English name of *S. nodiflorum*<sup>[3]</sup>.

It is an annual or short-lived perennial herbaceous plant. It is low and much branched, generally making a bushy-looking mass. The leaves are dull-green alternate leaves are overall rhomboidal or ovate rhomboidal pointed at both ends, slender and slightly pubescent with wavy margins [fig.1]. In Urhoboland, the leaf juice is used as remedy for convulsion. A paste made from the leaves is used as remedy to air skin diseases. Poultice of the leaves is very efficacious for rheumatic and gouty joints. A paste of the unripe fruit is prescribed as a remedy for ringworms.

The matured berries are diuretic, tonic and alterative. They are used in diarrheal and heart disease conditions<sup>[5]</sup>. People of Barkin Ladi (in Plateau State, Nigeria) use decoction of the whole plant and applied its powder to eruptions in the treatment of leprosy<sup>[6]</sup>. Sapogenin (tigogenin), steroidal alkaloids - solasodine and solasonine, alpha-solamargine and anthocyanins have been isolated from *S. americanum* Mill<sup>[7-9]</sup>.

This study was conducted as part of effort to validate the use of traditional medicine in Nigeria, and investigate plants that are used locally, particularly for antimicrobial activity. This paper reports on phytochemicals, antifungal and antibacterial activity of the *S. nodiflorum*.

## 2. Material and Methods

### 2.1. Plant Collection

The fresh sample of the plant (whole) was collected from a bush in Barkin Ladi, in Plateau State, Nigeria. The plant was authenticated by Dr. Ibrahim Abdulkarim, of Federal College of Forestry, Jos, Nigeria.

### 2.2. Extraction

The fresh plant was air-dried in the laboratory for six weeks, crushed into coarse form. 100 g of the plant material was extracted with methanol using Soxhlet extractor. The extract was concentrated and stored in refrigerator for use.

The crude methanol extract was screened for secondary metabolites – alkaloids, tannins, glycoside, steroid, triterpenes, flavonoids,

saponins and anthraquinones using standard methods<sup>[10], [11]</sup>.

### 2.4. Micro Organisms

The following strains of bacteria and fungi were used in this study:

**Bacteria** – *Bacillus cereus*, *Pseudomonas aeruginosa*; *Staphylococcus aureus*; *Proteus mirabilis*, *Klebsiella pneumonia*, *Salmonella paratyphi A.*;

**Fungi** – *Trichophyton tonsurans*, *Aspergillus flavus* and *Candida albicans*.

Both bacteria and fungi used in this study were clinical isolate obtained from School of Medical Laboratory Technology, NVRI, Vom and Department of Dermatophilosis, NVRI, Vom.

**Media:** Sabroud dextrose Agar (SDA, product of Oxoid Ltd, Basingstoke, Hampshire England, pH =5.6 + 0.2) and Nutrient Agar, Product of i.d.g.topley House, 52 Wash lane, B196 UK, pH= +7.3.+0.2) were used for testing the antifungal and antibacterial activities respectively using standard methods.

The strains were maintained and tested on nutrient agar (bacteria) and sabroud dextrose agar. The antimicrobial activity screening was carried out using agar well diffusion and dilution technique as described<sup>[12]</sup>.

## 3. Results and Discussion

Plants belonging to the solanum genus have been reported to have remarkable pharmacological activity. Steroidal alkaloids, solanidine has been isolated from *Solanum nudum*<sup>[13]</sup>, and (23S)-23-hydroxylsolasodine and (23R)-23-from solanum panduriforme<sup>[14]</sup>. Chrogonone neochlorogenic from *Solanum torvum*<sup>[15]</sup> and solarmargine from *Solanum marginatum*<sup>[16]</sup> Morpholine a known carcinogenic compound has been isolated as a white crystalline substance from *Solanum nigrum*<sup>[17]</sup>, a comprehensive review on phytochemicals and pharmacological activity of *Solanum nigrum* has been reported<sup>[18]</sup>. The result of antimycotic activity of the methanol extract of

*Solanum nodiflorum* presented in Table 1 indicates that the extract inhibited the growth of *Candida albicans*. The crude extract of the plant also demonstrated significant antifungal activity against *Trichophyton tonsurans* and *Aspergillus flavus* at the highest concentration tested (Table 2). Table 3 presents the antibacterial activity of the methanolic extract. The antibacterial activity was more pronounced on *Bacillus cereus* and *Proteus mirabilis*. The growth of *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella paratyphi A* were moderately inhibited at the concentration tested. The extract was inactive against *Klebsiella pneumoniae*.

The molluscicidal activity of *S. nodiflorum* against Puerto Rican lymnaeid snails that serves as intermediate hosts of *Fasciola hepatica* has been reported. All part of the plant were toxic to the snails *Fossaria (Lymnaea) cubensis*, *Lymnaea*

*columella*, *Biomphalaria glabrata* and *Physa cubensis*<sup>[19]</sup>.



Fig 1: *Solanum nigrum*

Preliminary phytochemical screening of the extract revealed the presence of alkaloids, anthraquinones, cardiac glycosides but tannins and flavonoids were not detected.

**Table 1.** Result of The Antimycotic Activity of Crude Methanolic Extract of *Solanum nodiflorum* Methanolic on *Candida albicans*.

	Stock of the Organism				Control
	ICFU	1/2CFU	1/4CFU	1/8CFU	
200mg/ml	MG	TG	TG	TG	DG
100mg/ml	MG	TG	TG	TG	DG
50mg/ml	MG	MG	MG	MG	DG
25mg/ml	DG	DG	TG	TG	DG

CFU-Colony Forming Unit =  $1 \times 10^6$ , DG-Dense growth, MG-Moderate growth, TG-Tiny growth, No growth, Control-Methanol

**Table 2.** Result of The Antifungal Activity of Crude Methanol Extract of *Solanum nodiflorum*

Fungi	Growth Diameter Extract Dilution (mg/ml)				Nizoral	Solvent
	200 mg/ml	150 mg/ml	100 mg/ml	50 mg		
<i>Trichophyton tonsurans</i>	9.0	22.0	19.0	28.0	85.0	10.0
<i>Aspergillus flavus</i>	NG	25.0	54.0	60.0	80.0	10.0

Chemo-Nizoral (2.5  $\mu$ g/ml); Control-Methanol

**Table 3.** Result of The Antibacterial Activity of The Crude Methanol Extract of *Solanum nodiflorum*

Microorganism	Concentrations				CHEM	SOLV	MIC	MBC
	200 mg/m	100 mg/ml	50 mg/ml	25 mg/ml				
<i>S. aureus</i>	11.0	8.0	8.0	10.0	21.0	NI	ND	12.5
<i>B. cereus</i>	19.0	15.0	14.0	14.0	26.0	NI	12.5	ND
<i>S. paratyphi A</i>	11.0	11.0	10.0	10.0	25.0	NI	ND	ND
<i>K. pneumoniae</i>	NI	NI	NI	NI	17.0	NI	ND	ND
<i>P. aeruginosa</i>	12.0	10.0	9.0	8.0	NI	NI	25.0	ND
<i>P. mirabilis</i>	16.0	15.0	12.0	8.0	11.0	NI	25.0	ND

Chemotherapeutic agent-(Streptomycin 2.5 mg/ml); NI-No inhibition; ND-Not determined; MIC-Minimum inhibitory concentration; MBC- Minimum bactericidal concentration.

#### 4. Conclusions

The crude methanol extract of *S.nodiflorum* exhibit concentration dependent antibacterial activity against gram-positive and gram- negative bacteria used in this study. The results obtained in this study showed that the folkloric use of this plant in some of the above mentioned conditions is justified. The findings in this research reveal that *S. nodiflorum* is another promising antimicrobial plant of solanaceae family which needs further studies to reveal the pharmacological potentials of the secondary metabolites present in the plant as reported on its twin sister-*Solanum nigrum*. The findings in this research provide justification for the use of *S. nodiflorum* in trado-medicine (TM). Effort is ongoing on the isolation of active principles from this plant.

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