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Research Article

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Preliminary Phytochemical and Antimicrobial Screening of *Daniela oliveri* Exudate Gum

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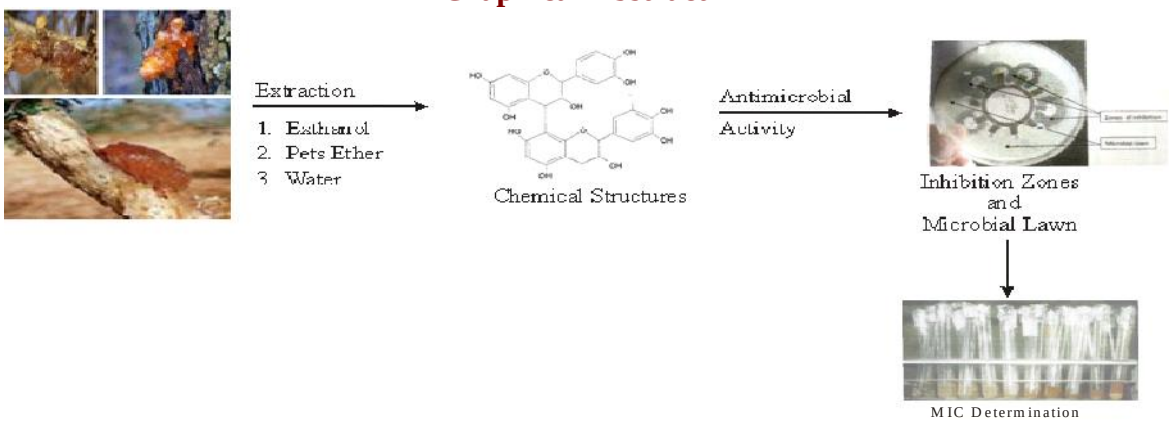
Abstract

Ethanolic, aqueous and petroleum – ether extracts of the exudate gum from *D. oliveri* were screened for their phytochemisry and antimicrobial activities against *Staphylococcus aureus, streptococcus pyogens, Escherichia coli, salmonella typhi* and *Shigella dysenteriae* The results indicated that the extracts inhibited the growth of one or more test pathogens. The ethanolic extract showed a broad spectrum of antibacterial activities. Phytochemistry study revealed the presence of tannins, alkaloids, glycosides, flavonoids, carbohydrates and terpenes. The zone of inhibition (mm) ranges from 12.4±0.04mm to 333.0± 0.58mm.

Keywords: Antimicrobial activities, Phytochemical, Exudate gum, *Daniella oliveri*

Graphical Abstract



Introduction

Exudate gums are hetero-polysaccharide complex carbohydrate with high molecular weight. They are sticky substance which exude from certain plants either as a result of microbial infection or as a result of mechanical injury (Adeyanju et al., 2014). According to Samai et al., (2009), exudate gum are formed as a result of microbial infection on the plants and in turn the plants synthesize the liquid substance as a defence mechanism to seal off the wound and prevent further invasion of the tissue. The use of exudates gums in pharmaceutical formulation and drugs release system have been reported by many researchers. (Adeyanju et al., 2012: Huang et al., calinescu et al., 2007; Brouillet et al., 2008 and Adeyanju et al., 2016). Antimicrobial substances are agent that inhibit the growth and existence of microorganisms.

Quite a number of antimicrobial substances exists, mainly from plants, animal and chemical sources. (Gasnellin and Robert, 1999). Plants have a greater potential for producing new drugs of great benefit to mankind. Medical uses of these plants range from the administration of the plant's roots, bark, stem leaves, fruits and seeds. There are many approaches to the search for new biologically active principles in higher plants. This search for new antimicrobial properties of natural products cannot be ignored because this can be found in the most remote parts of the world where medical doctors are not present (Olukemi and Kandakai, 2004).

Daniella oliveri (Rolfe) Hutch gum is a tree exudate of a plant growing naturally in the forest of Nigeria. (Adeyanju and Olatoyinbo, 2018).

D. oliveri (Leguminose) is a small tropical tree known by its twisted trunk, ascending branches and which often forms flat topped triangular crown with conspicuous masses of whitish flowers among the levels at the summit. (Adeyanju and Olatoyinbo, 2018). The plant is locally known as Iya (Yoruba), Oziyato (Benin), ozabwa (Igbo), Kaharlatii (Fulani), Maje (Hausa) and Chihar (Tiv). (Adeyanju and Olatoyinb0, 2018a). Medicinal and pharmaceutical significance of the tree (bark, stem, leaves and root) had been investigated. (Adeyanju and Olatoyinbo, 2018a).in our previous study, the acute toxicity test for the safety of the gum exudates was investigated had also be utilized as an excipient in paracetamol tablet formulation (Adeyanju and Olatoyinbo, 2018b). Also recently the physicochemical and structural characterization of the exudate gum from *D. oliveri* was studied (Adeyanju and Olatayinbo, 2018a). Evidently, all parts (bark, stem, leaves and root) of *D. oliveri* tree had been studied for their antimicrobial properties against gram positive and gram negative microorganism except the exudate from the bark of the tree. There are no sufficient studies that confirm the antimicrobial properties of the gum from *D. oliveri* tree. Therefore this study is designed to evaluate whether *D. oliveri* exudate gum have some active principles that could be used for chemotherapeutic purposes.

Materials and Methods

Plants used for this study were collected from Maiduguri metropolis, Borno State, Nigeria. The plant material were identified by Professor S. S. Sanusi of the Biological Science Department, University of Maiduguri and a Voucher specimen No. 46BA was deposited in the research laboratory of chemistry Department, University of Maiduguri.

Preparation of Plant Extracts

The plant material was dried at room temperature and then powdered using a grinder. The powdered sample (100 g) was subjected to soxhlet extraction using 300 ml of each of the solvents(water, petroleum ether and ethanol).The resulting extracts were concentrated on a hot water bath and kept for further investigation.

Phytochemical Screening

Phytochemical screening for major constituents was undertaken using standard qualitative methods. The extracts were screened for the

presence of glycosides, alkaloids, tannins, flavonoids, saponins, anthrax - quinones and terpenes.

Testing Organism

Standard strains of *S. aureus, S. pyogens, E. coli, S. typhi* and *S. dysenteriae* were obtained from the department of medical microbiology, university of Maiduguri teaching hospital, Maiduguri, Nigeria.

Antimicrobial Screening Test

The paper disc diffusion method was used to determine the antimicrobial activity of the extract from *D. oliveri* using standard procedures (Erickson et al., 1960; Bauer et al., 1996) Solutions of the extract of varying concentrations, ranging from 200 to 500 mg/ml were prepared. Nutrient agar was prepared, sterilized and used as the growth medium for the microorganisms. 20 ml of sterilized medium was poured into each sterilized petri- dish covered and allowed to solidify. The Mueller-Hinton sensitivity agar plate was then seeded with the test microorganisms by the spread plate technique, and was left for about 30m.nto d* The sterilized paper discs were soaked in the prepared solution of the extracts with varying concentration and were dried at 50°C. The dried paper discs were then planted on the nutrient Agar seeded with the test microorganisms. The plates were incubated at 37°C for 24 h and then inspected for zones of inhibition of growth. The zones of inhibition were measured and recorded in millimeters. A control experiment was also set up using pure DMSO for each tested organism.

Results

Table 1: Phytochemical screening of *D. oliveri* exudate gum water, petroleum – ether and ethanolic extracts

Phytochemicals	Water extract	Pet-ether extract	Ethanolic extract
Tannius	-	-	+
Carbohydrate	+++	++	+++
Alkaloid	-	-	+
Glycoside	+	+	++
Flavonoid	+	+	++
Terpenes	++	-	++
Saponins	+	-	++
Anthraquinones	+	-	++

+++ = High concentration;
++ moderate concentration,
+ = low concentration,
- = absent

Table2: Inhibition Zones of *D. oliveri* exudates gum water, Pet – ether and Ethanolic extracts against the tested microorganisms.

Extract	Conc	S.a	S.p	E.coli	S.d	S.t
	Mg/ml					
Ethanol	500	30.0±0.0	30.0±00	33.0±0.58	30.0±0.00	31.0±1.15
	400	25.3±0.58	27.0±0.05	30.0±0.00	28.0±2.16	29.0±1.73
	300	22.6±0.58	25.2±0.29	27.0±0.00	26.0±0.56	24.7±0.58
	200	18.0±0.05	14.5±0.01	22.4±0.15	16.4±1.15	14.6±0.14
Pet ether	500	R	20.0±1.00	18.0±1.00	18.0±1.00	16.5±0.05
	400	R	15.4±0.20	13.2±0.3	13.2±0.3	12.4±0.04
	300	R	R	R	R	R
	200	R	R	R	R	R
Distilled water	500	29.0±1.53	20.0±1.0	30.0±0.00	31.7±2.89	30.0±0.00
	400	22.4±0.2	18.0±0.2	25.0±0.10	28.0±0.20	24.7±0.58
	300	18.0±0.05	14.1±0.58	22.0±0.00	25.0±0.00	22.0±0.01
	200	14.0±0.04	10.4±0.2	20.0±0.00	23.0±2.33	19.7±0.58
Gentamicin	250	25	28	27	10	13

S.a =*Staphilocccus aureus* S.p = *Streptococcus pyogens*
E.coli: *Escherichia coli* S.d = *Shigella dysenteriae*
S.t = *Salmonella typhi* R = Resistance (-ve)
All data were average of 3 values (x ±ESM)

Discussion

The results of the phytochemcial screening and antimicrobial *D. oliveri* gum exudate extracts are presented in table 1 and 2.

The phytochemcial screening (table 1) revealed the presence of tannins, alkaloids, glycoside, flavonoid anthraquione, carbohydrate and terpenes. These chemical constituents present in the extracts have many therapeutic values (Adeyanju et al., 2011). Tannins are plants metabolites well known for their antimicrobial properties. Flovonoids have both anti fungal and antibacterial properties. They posses anti-inflammatory activity (Adeyanju et al., 2011).

Flavonoids terpenes and steroids are known to have antimicrobial and bactericidal proprieties against several pathogens (Usman et al., 2007 and Hassan, et al., 2004). Antimicrobial activity test (table 2) revealed that the ethanolic extract of the gum edudate possess the highest antimicrobial activity against *E. coli* (33mm), followed by *S. aureus* (30mm) and *S. pyogens* (30mm), when compared to pet – ether extract against *E. coli* (18mm), and resistant against *S. aureus* and *S. pyogens*. Ethanol is known to extract some phytochemicals like tannins and polyphenols. The high antimicrobial activity of the ethnolic extract may be due to the extraction of higher amounts of phytochemicals compared to that of petroleum – ether and water. These findings are consistent with the findings of Adeyanju et al., (2014) and Olusale et al., (2011) who reported that the leaves and the bark of *D. oliveri* antibacterial activity in vivo. Previous report have demonstrated the antidiarrhea activity of tannins, flavonoids and saponins.

Conclusion

The results of the experiment showed that the exudates gum from *D. oliveri* may have some valuable anti-microbial activities against gram positive and gram negative microorganisms. This property tends to support the traditional medical stage in the treatment of bacterial infection. The result of the study justified the use of the plant exudate gum in the treatment of diseases of microbial origin in herbal medicine.

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