ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 10, Issue, 10, pp.74412-74415, October, 2018

DOI: https://doi.org/10.24941/ijcr.32454.10.2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

STUDIES ON ANTI-BACTERIAL PROPERTIES OF *SIDARHOMBIFOLIA* PLANT

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ARTICLE INFO

Article History:
Received 29th July, 2018
Received in revised form
26th August, 2018
Accepted 05th September, 2018
Published online 31st October, 2018

Key words:
Anti-Bacterial Properties,
S. rhombifolia, Extracts,
diameter of Inhibition Staphylococcus aureus,
Streptococcus Pyogenes.

ABSTRACT

The antibacterial properties of fabrics are being considered to be an important and inevitable parameter for garment especially those that are in direct contact with the body. The main aim of this research is to investigate the antibacterial activity of ethanol extract of *Sidarhombifolia* against bacterial strain *Staphylococcus aureasand Streptococcus pyogene* and evaluate the phytochemical screening of the extract. Extract from 3 different parts of *sidarhombifolia* was extracted using ethanol as solvent. The bacterial inoculum was prepared to activate the bacteria growth and the activated bacterial were cultured using well diffusion method and incubated for 24 hours. The quantities of extract yielded from the leaves, stems and retted fibre were 2.13%, 1.8% and 1.0% respectively. The extracts were tested on *Staphylococcus aureus* and *Streptococcus pyogenes* at 4 different concentrations using wells diffusion method and the diameter of inhibition was measured and recorded. From the value of diameter of inhibition obtained, it was noticed that extracts from the leaves, stems and retted fibre inhibit the growth of *S.pyogenes* and *S. aureus*. In addition the inhibition of the growth of *S. pyogenes* was more than that of *S. aureus* and the antibacterial properties of *S. rhombifolia* are more concentrated in the stem than other parts of plant. Results of phytochemical screening also revealed abundant presence of saponins, glycosides and moderate presence of steroid in *sidarhombifolia* plant. The antibacterial property in the plant extract was due to the presence of various plant phytochemical compounds which were synthesized by plant parts in response to bacteria

Citation: Nkemaja Dydimus Efeze, Nantia Akono, E., Murugesh Babu Njeugna Ebenezer, K. and Zipo Rodulf. 2018. "Studies on Anti-bacterial Properties of *Sidarhombifolia* plant", *International Journal of Current Research*, 10, (10), 74412-74415.

INTRODUCTION

Most textile materials currently used in hospitals and hotels are conducive to infections or transmission of diseases caused by microorganisms. The antimicrobial medical textiles are widely used for hygienic products, first aid items, advanced bandages, products for the treatment and the prevention of various infections, (Diana et al., 2015). The antimicrobial protective agents can be natural compounds and synthetic agents. Textile materials (woven, nonwoven, knitted, and composites) have found different end-uses in medical and healthcare applications. Depending on the specific end-use, different products have to meet the demands for the specific end-use performances.

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Irrespective of their applications, internal (surgical threads and various implants) or external (gauzes, bandages, surgical masks, gowns and apparel, nappies, tampons, and so on), medical textiles have to be comprised of basic bioactive properties, especially antimicrobial. In this line, it is suggested that fibres (jute, flax, kenaf, hemp, sisal, and bamboo) with antibacterial properties display some sort of hygienic advantages (Belas, 2014). Preliminary studies on the tensile propertiesof *sidarhombifolia* (Nkemaja *et al*., 2012) revealed similarities with jute, hemp and kenaffibres but the difference lies in the medicinal value of *S. rhombifolia*. It is an example of bastfibre as the fibres are obtained from the outer layer, i.e the inner back or phloem of bast surrounding the plant stem. The fibres are usually very long (as long as the stem) and are relatively strong. The fibres are extracted through water retting process.

Sida is a large genus with about 200 species e.g. *Sidaacuta, Sidaalnifolia, Sidacordifolia, Sidarhombifolia* etc are distributed throughout the world and are very popular in Indian traditional medicine (Ajithabai and Rani, 2006). Modern research carried out on the S. *rhombifolia* family, *Malvaceae* plants, revealed that most of the plants belonging to this family are medicinally important as they contain biological active compounds (Sulaiman *et al.,* 2008).*S. rhombifolia* is used for treating ulcers, inflammation, swellings, wound healing and antinociceptive (Oboh and Onwukaem, 2005). Earlier studies on the ethanolic extract of the roots of *S. rhombifolia* revealed antioxidant, antimicrobial, anti-inflammatory, hepatoprotective and antibacterial activity (Sarangi *et al.,* 2010).

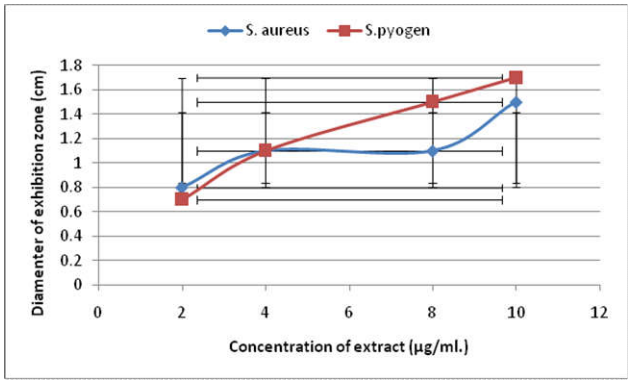


Figure 1: Inhibition zone of *S. aureus* and *S.pyogenes* on the leaf extract of *S. rhombifolia*

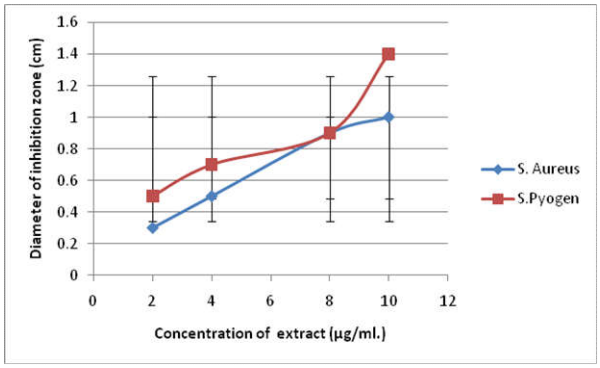


Figure 2. Inhibition of *S. aureus* and *S. pyogenes* on the retted fibre extract

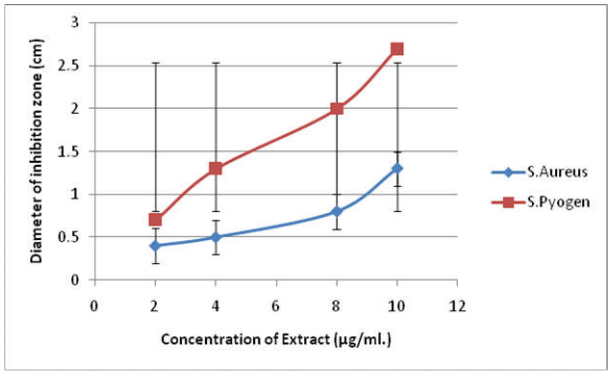


Figure 3. Inhibition of *S. aureus* and *S. pyogenes* on the stem of *Sidarhombifolia*

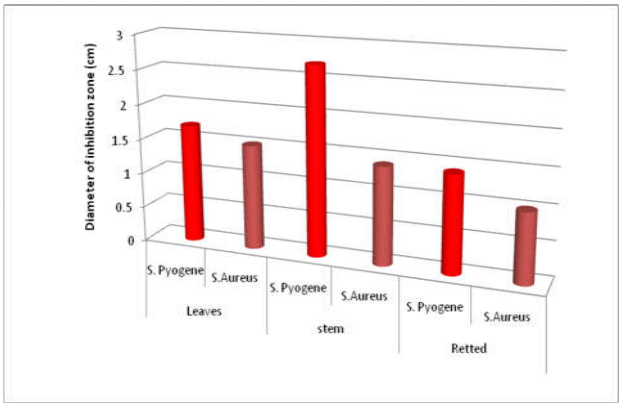


Figure 4. Effects of extracts from different parts of the plant on bacteria

MATERIALS AND METHODS

Materials

Plant materials and preparation of extracts: *S. rhombifolia* plants were harvested in Lebialem division, South West region of Cameroon in February 2017. Retted fibres, leaves and peelings from the stem were the principal raw materials obtained from the plants. The plant parts (leaves, stems and roots) were dried, grinded into powders. The respective powders were macerated into quantity of 95 ° C ethanol incubated for 4 days. The mixture was filtered and filtered using a What man filter paper N°1 and the filtrate obtained was evaporated at 37°C till a pure extract was obtained.

Reagents, culture media and bacterial strains: Ethanol, sulphuric acid, glacial acetic acid, and ferric chloride were obtained from Sigma (St Louis, MO, USA). Mannitol salt agar and potato dextrose agar were purchased from Yaounde. The bacterial strains *Staphylococcus aureus, Streptococcus pyogenes* and *Eschirichia coli* were offered by the centre Pasteur Yaoundé (Cameroon).

Methods

Preparation of bacterial suspensions: Potato dextrose agar was prepared and homogenously mixed with mannitol salt agar and used for activation of bacteria. To this end, the mannitol salt agar broth was used to prepare bacterial suspension, and 1.5 × 106 CFU / ml obtained from the standard McFarland turbidity No. 0.5. The suspension was standardized by adjusting the optical density from 0.1 to 600 nm using the spectrophotometer according to (Tereschuk *et al*., 1997).

Bacteria Culture: This process was prepared in order to activate the bacteria. Potato dextrose agar was used for the preparation of the culture medium. The culture medium was then sterilized in an auto-clave at the temperature of 121°C for 90minutes the culture medium was allowed for 30 minutes to get cool. The petri dishes were washed, sterilized and dry in an incubator while the Bunsen burner was set up and the culture medium was poured in to the petri dishes. Table 1 shows the amplification of the bacteria culture before and after.

Determination of inhibition diameter: The diffusion method as described by Berghe and Vlietnick (1991) and Gatsing et al. (2006) was used. A volume of 100 µlof each bacterial suspension was introduced into the sterilized 90 mm diameter petri dishes (Table 2), and 20 ml of mannitol salt agar was

added and the mixture was homogenized to allow a uniform distribution of the microorganisms in the medium. Concentric wells with a diameter of 6 mm were hollowed out (using a sterilized punch) onto the medium and then 100 µl of each concentration (2, 4, 8,10 µg/mL) of plant extract were introduced in different wells. After 45 min pre-diffusion at room temperature the dishes were incubated at 37 ° C for 24 hrs in a standard incubator and the inhibition diameters were measured using a graduated scale ruler.

Phytochemical screening of plant: The phytochemical screening of the extracts on classes of bio active compounds such as tannins, glycosides, steroid and saponins was done according to the standard methods of Harbone (1973), Trease and Evans (1989).

RESULTS AND DISCUSSION

The effect of leaf extract of *S. rhombifolia* on *S. aureus* and *S.pyogenes:* Figure 4.1 presents diameter of inhibition zone of the leaf ethanol extract of *S. rhombifolia* tested on 2 bacterial strains *S. aureus and S. pyogenes* and expressed in (cm). The figure 1 indicates that at lower concentrated dose of 2ug/ml and 4ug/ml, there was no significant difference in the inhibition of the growth of *Staphylococcus aureus* and *Streptococcus pyogenes*. At the higher concentrated dose of 8ug/ml and 10 ug/ml the growth of *Streptococcus pyogenes* inhibited more than *Staphylococcus aureus.*

The effect of retted extract *of S. rhombifolia* on *S. aureus* and *S.pyogenes:* Figure 2 presents diameter of inhibition zone of the leaf ethanol extract of *S. rhombifolia* tested on 2

Table 1. Amplified bacteria strain with potato dextrose agar (culture before and after).

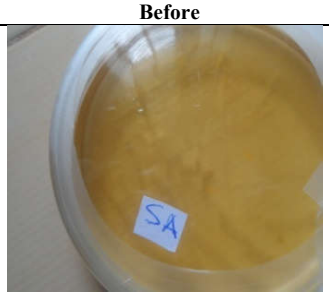
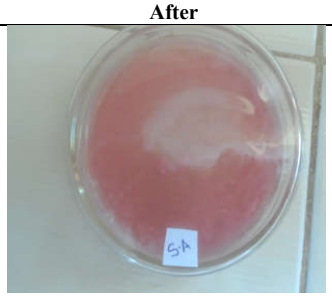
Bacteria	Before	After	Time	Temperature
Staphylococcus aureus			24 hours	37°C
Streptococcus pyogenes			24 hours	37°C

Table 2. Procedure to determine an Inhibition zones of bacterial with ethanol extract

Bacterial	Leaf	Stem	Retted fibre
Staphylococcus aureus			
Streptococcus pyogenes			

bacterial strains *S. aureus and S. pyogenes* and expressed in (cm). The results on figure 2 indicate in general that the inhibition zones of the 2 bacteria increases with the corresponding increase in the concentration of the extract. It is also noticed that there is great significant difference in the inhibition zone of the 2 bacteria at the concentration of 10µg/ml. That is, at the highest concentrated dose of 10ug/ml, *Streptococcus pyogene s*inhibited more than *Staphyloccocus aureus.*

The effect of stem extract of *S. rhombifolia* on *S. aureus* and *S.pyogenes:* Figure 3 presents diameter of inhibition zone of the stem ethanol extract of *S. rhombifolia* tested on 2 bacterial strains *S. aureus and S. pyogenes* and expressed in (cm). Figure 3 indicates that there is significant difference between *S. pyogenes* and *S. aureus* as concentration of the extract increases. The increase of inhibition of the growth of *S. pyogenes* becomes more prominent at the concentration of 10µg/ml.

Comparison of the effects of extracts from different parts of sidarhombifoliaon the growth of 2 bacterial: Figure 1, 2 and 3 indicate that at the concentration of 10 µg/ml, there is a considerable increase in the inhibition of *S. pyogenes* compared to *S. aureus* (Figure 4).It is also noticed that the antibacterial properties of sida rhombifolia is more concentrated on the stem than on other parts of the plant.

Conclusion

Results obtained from the study of antibacterial properties of sida rhombifolia showed that it can be confirmed that sida rhombifolia is medicinal plant. This is justified by the fact that extract from it can inhibit the growth of bacterial. In addition, the presence of phytochemical compounds such as glycosides, steroid and saponins are also a proof of medicinal nature of sidarhombifolia plant. It is also concluded that sidarhombifolia could be used as antimicrobial reagent for the production of medical healthcare products due to the presence of medicinal ingredients in the retted fibres.

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