



Effects of Ethanolic Stem Bark Extract of *Parkia biglobosa* (Locus Bean) on *Aspergillus niger* and *Aspergillus fumigatus*

Audu Sanusi Kiri ^{a*}, Zubairu Gaddafi Jimeta ^a, Zakari Bawa Gambo ^a
and Abubakar Isa ^b

^a Department of Plant Science, Faculty of Life Sciences, Modibbo Adama University, Yola, Adamawa State, Nigeria.

^b Department of Science Laboratory Technology, Federal Polytechnic, Mubi, Adamawa State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/92650>

Original Research Article

Received 20 August 2022
Accepted 21 October 2022
Published 09 November 2022

ABSTRACT

Parkia biglobosa is used in folk medicine for the treatment of ailments such as cough, pneumonia, diarrhea, otitis, conjunctivitis, leprosy, violent colic, hemorrhoids, wounds, and hookworms. This study aims to investigate the antimicrobial attributes of the stem bark extract of *Parkia biglobosa*. Pure cultures of fungal isolates used for the *in vitro* antimicrobial assay were obtained from the Laboratory of the Department of Plant Science, Modibbo Adama University, Yola. Standard methods were adapted to obtain the plant extract, phytochemical screening, and antimicrobial assay. The diameter of clearance was measured and regarded as being directly proportional to the efficacy of the extract. Experimental studies were carried out in three replicates. Data obtained were subjected to one-way analysis of variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 20, USA. Results were presented as mean \pm standard deviation (SD). Phytochemical screening of the ethanolic stem bark extracts of *P. biglobosa* revealed the presence of alkaloids, saponins, terpenoids, steroids, flavonoids, and tannins but without polysaccharides. The mean zone of inhibition obtained for the ethanolic stem bark extract of *P. biglobosa* against *Aspergillus niger* was higher at 60% concentration with a value of 70.61 mm and lowest at 20% concentration with a value of 33.11 mm for *Aspergillus fumigatus*, the highest zone observed at

*Corresponding author: E-mail: sanusikiri@mau.edu.ng, sanusikiri@mauctech.edu.ng;

60% concentration was 66.89 mm and least at 20% concentration was 29.39 mm. The higher the concentration of plant extracts the higher the antimicrobial action. However, only the least concentration, as well as the highest concentration, were statistically significant for both isolates.

Keywords: Plant extract; antifungal activity; mycelial growth inhibition; phytochemical screening.

1. INTRODUCTION

The plant represents diverse species with antimicrobial and medicinal properties that constitute an abundant source of pharmaceuticals worldwide [1]. *Parkia biglobosa* is used in folk medicine for the treatment of ailments such as cough, pneumonia, diarrhea, otitis, conjunctivitis, leprosy, violent colic, hemorrhoids, wounds, and hookworms [2].

“Parkia plants have been established to be the source of tannins, saponins, and amino acids. Phytochemical analysis reveals a high proportion of flavonoids and phenols” [3]. “They have exhibited a wide range of pharmacological and biological activities which include antimicrobial, anti-allergic, anticancer and anti-inflammatory activities” [4]. The plant is a subdivision of angiosperms belonging to the family Fabaceae (subfamily, Mimosoideae) with wide tropical distribution [5].

“The growing adverse effects of synthetic drugs on humans and their contributions on the development of resistant microbial strains gingered research into plant resources and their derivatives as good apparent therapeutics” [6].

The plant extract has been exploited for antimicrobial activity due to the persistent resistance of pathogenic microorganisms to synthetic drugs [2]. Microorganisms develop resistant genes to support their natural adaptation to antimicrobial agents [7]. This research aims to study the effect of the ethanolic bark extract of *Parkia biglobosa* on some pathogenic fungi.

2. MATERIAL AND METHODS

2.1 Study Area

The research was conducted at the Department of Plant Science, Modibbo Adama University, Yola. The university is located along Yola to Mubi road, Girei Local Government Area, which lies between Latitude 9.3°N and Longitude 12.5°E

with an average altitude 175m above mean sea level covering a total area of 1700ha [8].

2.2 Test Organisms

Pure cultures of fungal isolates used for the in vitro antimicrobial assay were obtained from the Laboratory of the Department of Plant Science, Modibbo Adama University, Yola, Nigeria.. The fungal isolates used were *Aspergillus fumigatus* and *Aspergillus niger*.

2.3 Plant Material Collection

The stem bark of *P. biglobosa* used in this study was collected from the Botanical Garden of the Modibbo Adama University, Yola, during the dry season. Samples were identified by a taxonomist at the Department of plant science, modibbo Adama University, Yola.

2.4 Plant Extraction

The method [9] was adapted to obtain the plant extract. The bark of *P. biglobosa* was dried at room temperature and milled into powder, weighed and dissolved in a solvent, and allowed to soak for 72 hours at room temperature but stirred regularly every 12 hours. The solvents used were ethanol (70%). Whatman's No. 1 filter paper was used to reinforce muslin cloth as it was filtered into a 500 ml beaker with the resulting suspension. A rotary evaporator was used to concentrate the extracts for the following 4 hours. After that, this was analysed. For further study, the extra extract was kept in the refrigerator.

2.5 Phytochemical Screening

Phytochemical screening for Alkaloids, Saponins, Terpenoids, Steroids, Flavonoids, Tannins, and Polysaccharides (Reducing sugar) was carried out according to Sofowora [10].

2.6 Antimicrobial Assay

The ethanolic plant extract was tested for antimicrobial activity according to Fawole and

Oso [11] using the agar well diffusion technique. The diameter of clearance was measured and was thought to be directly related to the extract's effectiveness.

2.7 Statistical Analysis

Experimental studies were carried out in replicates. Data obtained were subjected to one-way analysis of variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 20, USA. Results were presented as mean \pm standard deviation (SD).

3. RESULTS AND DISCUSSION

Phytochemical screening of the ethanolic stem bark extract of *P. biglobosa* revealed the presence of alkaloids, saponins, TERPENOIDS, steroids, flavonoids, and tannins. While polysaccharides (reducing sugars) are absent as shown in Table 1.

Table 1. Qualitative phytochemical constituent of ethanolic stem bark extract of *Parkia biglobosa* carried out

Phytochemical constituent	Ethanolic extract (Bark)
Alkaloids	+
Saponin (Frothing)	+++
Terpenoids	++
Steroids	+
Flavonoid	+
Tannin	+
Polysaccharides (Reducing Sugar)	-

Note: (+++) = Highly Present, (++) = Present, (+) = Slightly Present, (-) = Absent

The absence of polysaccharides in the ethanolic stem bark extract of *P. biglobosa* is in line with the study of Oluwaniyi and Bazambo [12]. This is also in agreement with the work of Sofowora

[10], which shows that the phytochemical analysis of the stem bark extract of *P. biglobosa* is rich in steroids, terpenoids, saponins, and tannins-reducing compounds. Phytochemicals are specifically latent in the antimicrobial actions of various medicinal plants as supported by different researchers such as Oluwaniyi and Bazambo [12] reported that, phytochemicals are subordinate components of plants that are responsible for biological actions and some have also been reported to possess anti-oxidative potentials.

The antimicrobial activity of *Parkia biglobosa* stem bark extract on the mycelial growth of some pathogenic fungi shows that increasing the concentration tends to increase the mean zone of inhibition as shown in Table 2. The mean zone of inhibition obtained for the ethanolic stem bark extract of *P. biglobosa* against *Aspergillus niger* was highest at 60% concentration with a value of 70.61 mm and lowest at 20% concentration with a value of 33.11 mm for *Aspergillus fumigatus*, the highest zone observed at 60% concentration was 66.89 mm and least at 20% concentration was 29.39 mm.

These results are in agreement with the study conducted by Akintobi et al. [13] which opined that the higher the concentration of plant extracts the higher the antimicrobial action. However, only the least concentration, as well as the highest concentration, was statistically significant for both isolates. This may be due to the fact that the ethanolic stem bark extracts contain phytochemicals such as tannins, alkaloids, saponins, and flavonoids which may be responsible for this effect. This result agrees with the work of Tijani et al. [14] who reported that the aqueous stem bark extract of *P. biglobosa* had an inhibitory effect on some clinical pathogens. This shows that the extract contains some active phytochemicals which when purified could serve as a suitable drug to tackle some resistant microbes.

Table 2. The effects of *Parkia biglobosa* bark extract on the mycelia growth of *Aspergillus niger* and *Aspergillus fumigates*

Extract concentration (%)	Fungal spp. Mycelia inhibition rate	
	<i>Aspergillus niger</i>	<i>Aspergillus fumigatus</i>
20	33.11 ^c	29.39 ^b
40	68.97 ^{ab}	31.03 ^{cb}
60	70.6 ^{1a}	66.89 ^A
0	1.43 ^c	4.57 ^d

Mean with different superscript along the column are statistically significantly different at $p < 0.05$

4. CONCLUSION

From this study, the growth inhibition influence by ethanolic stem bark extract of *Parkia biglobosa* on *Aspergillus niger* and *Aspergillus fumigatus* suggest that *P. biglobosa* has antimicrobial activity which may be a result of active phytochemicals present in the extract. This suggests that the extract when purified can serve as a suitable remedy against stubborn microbial agents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Osemwegie OO, Dahunsi SO. In-vitro effects of aqueous and ethanolic extracts of *Parkia biglobosa* (Jacq.) Benth on selected microorganisms. Nigerian Journal of Biotechnology. 2015;29:11-20.
- Nounagnon M, Dah-Nouvlessounon D, N'tcha C, Nanoukon C, Assogba F, Lalèye FOA, Baba-Moussa L. Phytochemical composition, antimicrobial and cytotoxicity activities of *Parkia biglobosa* (Jacq.) benth extracts from Benin. J Pharmacogn Phytochem. 2017;6(2).
- Eboma RN, Ogidi CO, Akinyele BJ. Bioactive compounds and antimicrobial activity of extracts from fermented African locust bean (*Parkia biglobosa*) against pathogenic microorganisms. The North African Journal of Food and Nutrition Research. 2020;4(8):343-350.
- Manner S, Skogman M, Goeres D, Vuorela P, Fallarero A. Systematic exploration of natural and synthetic flavonoids for the inhibition of *Staphylococcus aureus* biofilms. International Journal of Molecular Sciences. 2013;14(10):19434-19451. Available:https://doi.org/10.3390/ijms141019434
- Heymann EW, Lüttmann K, Michalczyk IM, Saboya PPP, Ziegenhagen B, Bialozyt R. DNA fingerprinting validates seed dispersal curves from observational studies in the Neotropical legume *Parkia*. PLoS One. 2012;7(4):e35480.
- Wink M. Medicinal plants: A source of anti-parasitic secondary metabolites. Molecules. 2012;17:12771-12791.
- Reygaert WC. An overview of the antimicrobial resistance mechanisms of bacteria. AIMS Microbiology. 2018;4(3): 482–501. Available:https://doi.org/10.3934/microbiol.2018.3.482
- UBRBDA. Upper Benue River Basin Development Authority Hydrological; Year Book; 2009.
- Parveen Z, Siddique S, Shafique M, Jabeen S, Khannum R. Volatile constituents, antibacterial and antioxidant activities of essential oil from *Nardostachys jatamansi* DC. Roots. Pharmacologyonline. 2011;3:329-337.
- Sofowora A. Medicinal plants and traditional and traditional medicinals in Africa. 3rd Edition, Spectrum Books Limited, Ibadan, Nigeria. 2008;23-25.
- Fawole MO, Oso BA. Characterization of bacteria: Laboratory manual of microbiology. Spectrum Book Ltd., Ibadan, Nigeria. 2004;24.
- Oluwaniyi O, Bazambo I. Antinutrition and phytochemical evaluation of raw and fermented African locust bean (*Parkia biglobosa*) seeds. Global Journal of Pure and Applied Science. 2014;20:105-109.
- Akintobi O, Bamkefa B, Adejuwon A, Fagbola T. Phytochemical analysis and antimicrobial evaluation of the extracts of the root bark and rachis of *Parkia biglobosa* (Jacq.) Benth on some human pathogens. E3 Journal of Scientific Research. 2016;4(1):001-010.
- Tijani A, Okhale S, Salawu T, Onigbanjo H, Obianodo L, Akingbasote J, Salawu O, Okogun J, Kunle F, Emeje M. Antidiarrhoeal and antibacterial properties of crude aqueous stem bark extract and fractions of *Parkia biglobosa* (Jacq.) R. Br. Ex G. Don. African Journal of Pharmacy and Pharmacology. 2009;3(7):347-353.

© 2022 Kiri et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/92650>