Effects of powder solutions of Umm Shutour Tree (*Kigelia Africana L.*) on *Aspergillus niger* mycelia radial growth

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تأثير مستخلصات شجرة آم شطور (Kigelia Africana) على النمو الفطري الميسليومي لفطر (Aspergillus niger).

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الملخص:

استخدام النباتات ومستخلصاتها كعلاجات للعديد من الأمراض قد حفز الدراسات للتحقق من وجود مواد فعالة مضادة للميكروبات فيها. تناولت هذه الدراسة النشاط المضاد للفطريات لشجرة آم شطور (*Kigelia Africana*) من خلال المستخلصات المائية عل فطر (*Aspergillus niger*). تم استخدام طريقة النمو الميسليومى للفطريات على وسط غذائي PDA. وجد أن المستخلصات المأخوذة من أجزاء مختلفة من الشجرة تثبط النمو الميسليومى للفطر *Aspergillus niger* , ان النتائج أوضحت أن مستخلصات اللحاء كانت الأكثر فعالية حيث أعطت 0.4سم و 1.6 سم كأقطار للنمو الميسليومى عند التركيزات العالية (75 و 100) ملغ / مل على التوالي, تلاها مستخلص قشور الثمار الذي أعطى حوالي 1.2سم عند التركيز العالي, ثم البذور 2.3سم . بينما كانت الأوراق واللب الأقل فعالية إذ أعطت حوالي مقارنة بالشاهد. نوصي بضرورة إجراء المزيد من الدراسات قبل تطبيق النتائج في المجال الطبي.

الكلمات المفتاحية: المستخلص المائي , الاسبيرقلس نايقر , العلاج التقليدي , شجرة ام شطور (*Kigelia Africana*).

Abstract:

The use of plants and their extracts as remedies for curing many diseases have stimulated studies for investigating the presence of effective antimicrobial substances in them. The present study investigated the antifungal activity of Umm shutour tree (*kegelia africana)* aqueous extracts against fungi (*Aspergillus niger*).

The radial growth methods were used for mycelia growth using (PDA) media. The extracts of the different parts of the tree were found to inhibit mycelia radial growth of *A.niger* . However, the results showed that the bark extracts were highly effective giving about (0.4 cm) and (1.6 cm) radial growth diameter at the higher concentrations (100 and 75 mg/ml, respectively). This was followed by the extracts of the fruit peel which gave about (1.2 cm) radial growth at the higher concentration, then followed by the seeds (2.3 cm), while, leaves and pulp are the lowest effective giving about (2.5 cm) and (3.1 cm) radial growth compared to the control. We recommended that, further studies should be made before the application of these findings, in the field of medicine.

Keywords: *Kigelia Africana***,** traditional medicine , *Aspergillus niger* , aqueous extract.

Introduction

Kigelia africana belongs to the family Bignoniaceae also called kigelia pinnata is a tree that is widely distributed in Africa (west , south and central) , India (Sharma *et al*., 2010) and Sudan (southern , central) (Elchazali et al.,2004). The tree is sometime domesticated and most often propagated by seeds (Komakech and Omujal ,2020) Because of the huge fruits (average 0.6 m in length and 4 kg in

weight), which hangs from long fibrous stalks but do not splits easily , It is locally known as Umm shutour, Cucumber or Sausage tree (Sharma *et al*., 2010).

The tree provides a nutritious food source during famine. While, the hard seeds are roasted and eaten (Nsubuga ,2018). The fruits can be consumed only after being dried, roasted, or fermented (Nabatanzi *et al*., 2020). Fruit and bark are in the brewing process to aid fermentation and enhance the flavor of traditional beers (Burkill,1985). *Kigelia africana* is among the most popular and important plants in traditional medicine of sub-Saharan Africa (Van Wyk, 2015). Different parts of the tree have been claimed to serve various purposes in different parts of the world. Fruits mostly used plant part preparations, followed by stems bark, roots and leaves (Nabatanzi *et al*., 2020). The fruits and barks, ground and boiled in water are also taken orally or used in treating stomach ailments. Some people tend to use the bark as powder or infusion for application to ulcers, or applied in treatment of pneumonia (Sharma *et al*., 2010). Venereal diseases are commonly treated with the extracts of K. africana, usually in palm wine as oral medications. (Oyebanji *et al*, 2015).

A wide variety of bioactive compounds with relevant phyto-constituents like irdoids, flavonoids, napthoquinines, coumarins, terpenes and terpenoids are reported (Houghton, 2002). Also. *K. africana*, all phytochemicals (phenols, flavonoids, saponins, terpenoids and glycosides, steroids, quinones and anthraquinones) were found in the hot water and distilled water extract except alkaloid (Omoregie *et al*, 2023).

A.niger is a haploid filamentous fungi and is a very essential microorganism in the field of biology. In addition to producing extracellular enzymes and citric acid, *A. niger* is used for waste management and bio-transformations. The fungus is most commonly found in mesophilic environments such as decaying vegetation or soil and plants (Schuster *et al*, 2002).

Objective: to investigate the effect of different extracts from Umm shutour (*Kigelia africana*) tree parts (Bark, Leaves, Fruit peel, Pulp and Seeds) against (*Aspergillus niger*) using different concentrations.

Materials and Methods:

1- **Plant Materials:** Samples from different parts of Umm Shutour tree {*kigelia africana*) were collected from the Nile street in Wad Medani city, Gezira state, Sudan and then blended into a powder using a blender. Five different concentrations (0, 25, 50, 75 and 100%) were prepared for each part separately using PDA media. The cultures of *Aspergillus niger* was obtained from the food Science and Technology laboratories, faculty of Science and Technology, University of Gezira. The media used in this study were prepared locally, using chemicals from Oxoid Corporation.

2- **Preparation of extracts:** A direct cold extraction procedure of the prepared powder material was developed, based on phytomedicine extraction program (Eloff, 1998) using ethanol and water. Accordingly, 500grams of leaves were weighted after drying, and ground in pistil and mortar. The leaves were extracted with 1000 ml of distilled water, respectively, using a shaker for overnight at room temperature. The filtrate was concentrated in a rotary evaporator, and kept for further analysis and bioassay.

3- **Potato Dextrose Agar (PDA) media:** This medium was used for isolation and maintenance of fungi, and for other experiments whenever needed. The medium consists of the following materials: potato (peeled and diced) 200g, D-Glucose 20g, Agar 20g and Distilled water 1000ml.

4- **Preparation of the medium:** The potato samples were peeled, diced and boiled for 1 hour in 800 ml distilled water, then the extract was filtered and made up to 1 liter. The medium was then dispensed in 100 ml samples in conical flasks covered with cotton plugs and aluminum foil before being sterilized in the autoclave at 121^0 C (15Ib/ in2)for 15 minutes . It was then stored at 4^0 C in a refrigerator. When needed, the medium will be melted in a water path and poured into sterilized Petri dishes.

5- **Evaluation of extracts on fungal radial growth:**

The five concentrations under test were prepared by serial dilution of the extract with the medium. The medium was then sterilized and poured in Petri-dishes and left to solidify at room temperature (280C – 300C) , each solidified Petri-dish was inoculated by a fungal growth disc cut by a sterile cork-borer (2.0 mm diameter) from the edge of an actively growing culture of A. niger or P. italicum grown on PDA. The inoculated Petri-dishes were then incubated at room temperature for 8 days. All treatments were done in triplicates. The diameter of growth was measured, every 48 hours by taking the average of two crossed dimensions for each disc in a Petri-dish. The radial growth was calculated as a percentage from the diameter of the Petri-dish.

6- Statistical analysis:

The statistical analysis methods used in this work was the ANOVA

Results and Discussions:

The results of the extracts of the different parts of Umm shutour (*Kigelia africana*) tree parts (Bark, Leaves, Fruit peel , Pulp and Seeds) on *A. niger* are shown on Tables (1, 2 , 3, 4 and 5).and Fig. (1) The results showed that the bark extracts were highly effective giving radial growth of about (0.4cm) and (1.6cm) in diameter at the higher concentrations (100 and 75 mg/ml), respectively, The effect was statistically significant from that of the control and the lower concentrations (table,1). It was followed by the extracts of the fruit peel which gave about (1.2cm) in radial growth at the higher concentration (Table,3). This is followed by the seeds (2.3cm). However the leaves and the pulp are the lowest effective which giving about (2.5cm) and (3.1cm) reduction in radial growth (Tables 2 and 4), respectively. However the effect from all parts and at the higher concentrations was statistically different compared to the control. Fig. (1) Compared the effects of the different tree parts concentrations on *A. niger* at the 8th day, only. From the results it is clear that the bark was the effective in reducing the radial growth of the fungus. Different Umm shutour (*Kigelia Africana)* tree part extracts, were investigated against (*A. niger*). The results of the study indicated that the different extracts parts were highly effective in reducing mycelial radial growth of fungi. The results also showed that the bark extracts were highly effective compared to the other part in reducing radial growth, followed by Fruit peel, seeds while the leaves and pulp are the lowest effective. The reductions by the higher concentration of different parts were statistically significant compared to the control.

Roodt (1992), Reported antibacterial activity of *Kigelia africana* bark extract (aqueous, methanol and chloroform) against Escherichia coli, *Enterobacter aerogens, Klebsiella pneumoniae*, *Salmonella typhi*, *Proteus vulgaris, Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Bacillus cereus. Also* showed that the methanolic bark extracts were highly effective against *Salmonella typhi* and *Proteus vulgari*. Extracts of the bark, wood, roots and fruits.

possess antibacterial and antifungal properties. These extracts exhibit significant inhibitory effects in vitro against common Gram-negative and Gram-positive bacteria, and the yeast *Candida albicans*. Of the naphtha-quinones isolated in fruit and root extracts, kigelinone has shown notable antimicrobial activity. Iridoids and dihydroisocoumarins in extracts of the bark, fruits and roots may enhance the antimicrobial activity of naphthoquinones (Grace and Davis, 2002). However there is no report on the antibacterial and antifungal properties of the stem bark of this plant, this is needful as the organism; *S. aureus* is the most implicated organism in atopic eczema (Burkill,1985).

Table (1): Effects of different concentration of (*Kigelia Africana)* bark extracts on radial growth (cm) of *Aspergillus. Niger*

Concentration%	Incubation period (days)			
	2	**4**	**6**	**8**
0.0	1.4	3.1	3.7	4.7
25	0.7	2.2	2.7	2.8
50	0.5	1.3	2.0	2.1
75	0.3	0.9	1.5	1.6
100	0.0	0.3	0.3	0.4

SE = 1.13 SD = 1.59

ROW/ F = 22.78 Fcrit = 3.26

Columns = 11.38 = 3.49

R^2 = 0.95

Table(2): Effects of different concentration of (*Kigelia Africana)* leaves extracts on radial growth (cm) of *Aspergillus. Niger*

SE = 0.36 SD = 0.95

ROW/ F = 22.05 Fcrit = 3.26

Columns = 78.21 = 3.49

R^2 = 0.96

Concentration %	Incubation period (days)			
	2	**4**	**6**	**8**
0.0	1.4	3.1	3.7	4.7
25	0.9	1.9	3.4	4.5
50	0.6	1.7	3.1	4.1
75	0.5	1.3	2.1	2.3
100	0.3	0.8	1.6	1.2

Table (3): Effects of different concentration of of *Kigelia Africana* fruit peel extracts on radial growth (cm) of *Aspergillus. niger*

SE = 1.05 SD = 1.54

ROW/ F = 22.85 Fcrit = 3.26

Columns = 11.38 = 3.49

R^2 = 0.90

Table (4) :Effects of different concentration of of *Kigelia Africana* pulp extracts on radial growth (cm) of *Aspergillus. Niger*

Concentration %	Incubation period (days)			
	2	**4**	**6**	**8**
0.0	1.4	3.1	3.7	4.7
25	1.2	2.9	3.5	4.1
50	0.9	2.4	3.2	3.8
75	0.8	1.9	2.8	3.6
100	0.8	1.7	2.7	3.1

SE = 0.16 SD = 0.59

ROW/ F = 25.05 Fcrit = 3.26

Columns = 212.36 = 3.49

$R^2 =$ 0.97

Concentration %	Incubation period (days)			
	2	4	6	8
0.0	1.4	3.1	3.7	4.7
25	1.1	2.9	3.6	4.6
50	0.8	2.5	3.3	3.4
75	0.6	2.1	2.7	2.9
100	0.4	1.8	2.1	2.3

Table (5):.Effects of different concentration of *Kigelia Africana* seeds extracts on radial growth (cm) of *A. niger*

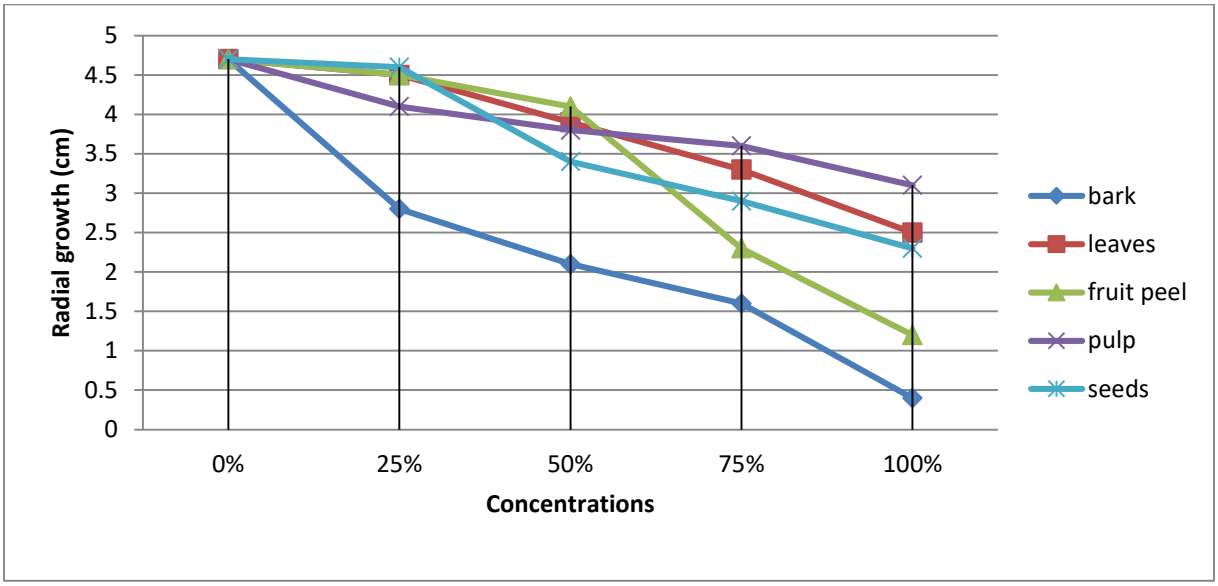
SE = 0.49 SD = 1.05

ROW/ F = 18.70 Fcrit = 3.26

Columns = 75.48 = 3.49

$R^2 =$ 0.95

Figure (1): Effect of different concentration of *Kigelia Africana* parts extracts o radial growth (cm) of *A.niger* (8 days).



Conclusion

The aqueous extracts of *Kigelia africana*, exhibited a varying degree of activities against the fungi organisms. The aqueous extracts have antimicrobial activity against the tested fungi. The effects included, mycelia radial growth .The study indicated that the bark extracts were highly effective giving high reduction in radial growth compared to the other tree parts.

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