Photochemical Screening and Antifungal Activity of *Faidherbia albida* Roots

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Abstract

Faidherbia albida Dell. (**Mimosodceae**), locally known as alharaz. All plant parts have an important role in traditional medicine except for the root part. The study aims to quantify the alkaloids in the *Faidherbia albida* root chloroform extract and to assess the antifungal activity of the roots chloroform extract against three pathogenic fungi: Aspergillus fusarium, Aspergillus fulvus, and Candida albicans. The primary phytochemical analysis of chloroform extract showed the presence of alkaloids, diterpenes and flavonoids, Saponins and phytosterols, but glycosides were not detected. The yield percentage of the raw maceration extract is 3.8%. In thin-layer chromatography (TLC), it revealed the detection of one compound under U V light as light blue spots (R_F 0.833). The total alkaloid content in the chloroform roots extract was 121.142mg AE/g, while the total phenol content is 53.960mg GAE/g. The extract at concentration 200mg/ml revealed no inhibition effect against all microorganisms tested except Candida albicans (17mm). This study found that *Faidherbia albida* contains a high concentration of alkaloids compared with the other plant parts and moderate phenol content compared with the leaves part, as well as anticandidal activity against both the standard and isolated strain tested.

Keywords: *Faidherbia albida, Mimosoideae, Alkaloids, Antifungal*

I. Introduction

Faidherbia albida Del. A. Chev. (syn. Acacia albida) is a unique member of the Acacieae tribe of the Mimosoideae. It is mainly a species of Sudan and Sahelian zones of Africa, reaching into the Sahara and beyond, along watercourses. It is particularly well adapted to use as an agro forestry tree, and its ecological optimum is on sites with deep sandy soils and an annual rainfall of 5001000 mm. This applies equally to western, eastern, and central Africa. It is a plant that loses much water by evaporation and therefore can only develop on moist soils or on soils that allow the development of an extensive root system down to the water table where it can obtain adequate moisture [(1)]

The Roots can reach aquifers up to 80 m below the surface. Young trees have an inverted cone-shaped crown, old trees with a hemispherical large canopy. Young branches and twigs are creams colored to whitish, stipular spines are whitish, straight in auxiliary pairs somewhat at the base up to 5 cm long with a brown tip[(1,2,3)]. The root part of F.albida and we found that it's very important and special part; due to distinguished role in fertilization of soil and rich in a variety of secondary metabolites especially: Diterpenes, Flavonoids and alkaloids [(2,4)]

Alkaloids are naturally occurring chemical compounds containing a basic nitrogen atom. The name derives from the word alkaline and was used to describe any nitrogen containing base. Alkaloids are produced by a large variety of organisms including: bacteria, fungi (psilocybin), plants, and animals[(5)]. Many alkaloids can be purified from crude extracts by acid-base extraction. Many alkaloids are toxic to other organisms. They often have pharmacological effects & are used as medication [(6)].

Faidherbia albida has many traditional uses. The seeds can be boiled and eaten as a source of nutrition as well as the pods may be dried and ground into flour, which is edible [(7)]. The leaves have a psychoactive chemical compound "Dimethyltryptamine", the extract is used to treat ocular infection in farm animals. [(8)]. Also used as an emetic, diarrhea, hemorrhage, and ophthalmia in East & West Africa [(9)]. Namibians use its bark for toothbrushes & is reputed to contain fluoride. Some people used for the treatment of colds, pneumonia and other respiratory condition and as antimalarial[(9)]. The decoction of the stem bark is taken orally for the management of the sleeping sickness (10).

This research aimed to detect alkaloids qualitatively and quantitatively as well as the evaluation of the antimicrobial activity of chloroform extract.

I.Materials and Methods

Plant material

Fresh roots of three years old *Faidherbia albida* were collected from a local farm in Khartoum, Sudan. The roots were authenticated and identified by taxonomist Dr. Maha Kordofane, Department of Botany, Faculty of Science, University of Khartoum, Khartoum, Sudan.

The authenticated roots were cleaned, dried under the shade and pounded into a coarse powder using mortar and pestle.

Extract preparation

A weight (500gms) of coarse F.albida root were macerated in 1000 ml of $CHCL_3$ solvent for 7 days at room temperature. Then filtrated using filter paper (What man No1) and dried to constant volume using a rotary evaporator. The dry extract was kept at 4ºC[11].

Preliminary Phytochemical screening

The root extract and fractions were prepared in suitable forms for the screening of saponins, alkaloid, glycoside, carbohydrate, terpenoids, flavonoids and phenols [12].

Chromatographic analysis

Thin Layer Chromatography was used to detect alkaloids. Precoated silica gel plates were used with moving phase $CHCL_3$: methanol: ammonia at different ratios. The Rf was determined as a ratio between the distance traveled by the substance divided by the distance traveled by the solvent. The alkaloids were detected using Dragendroff reagent under vacuum area, the yellow color appeared which indicated the presence of alkaloids[5,10]

Total Alkaloidal Content

The plant extract (1mg) was dissolved in Dimethyl sulphoxide (DMSO) and added to 1ml of 2 N HCl for 5 min and filtered. This solution was transferred to separating funnel, 5ml of phosphate buffer were added. The mixture was shaken with 4 ml chloroform by vigorous shaking and collected in a 10 ml volumetric flask and diluted to the volume with chloroform. A set of reference standard solution of atropine (20, 40, 60, 80 and 100 microgram /ml) was prepared. The absorbance for test and standard solutions were determined against the reagent blank at 470 nm with a UV Double Beam. The total alkaloid content was expressed as mg of AE mg/g of the extract [13].

Total Phenol Content

The total phenol content was determined by adopting the method as described with some modification. 1mg /ml of the extract was taken in a 10 ml glass tube and made up to a volume of 3 ml with distilled water. 0.5 ml folin coicolean reagent (1%) and 4 ml Na_2CO_3 (7.5 %) were added subsequently in each tube. A blue color was developed in each tube and the intensity of the color is directly proportional to the phenolic content. The blue coloration in the tubes is due to the formation of molybdenum blue as a result of complex redox reaction between phenols and phosphomolybdic acid in Folin Ciocolatean reagent in alkaline media. The test solution kept in dark for 30 minutes and absorbance was measured at 765 nm. The total phenol content was expressed as Folin Ciocolatean reagent equivalent (mg/l) using the following equation based on the calibration curve: $y = 0.0008x+0.0175$ where x = concentration of Folin (mg/l) corresponding to optical density and y= the absorbance [14]

Assessment of Antifungal activity:

The procedure was done by using Agar based disk diffusion method, the agar plates –surface were inoculated by spreading a volume of the fungal strains inoculum over the entire agar surface ; then a hole with a diameter of 6 to 8 mm was punched aseptically with a sterile cork borer and a volume (20-100) of the plant extract solution at specific concentration introduced in to the surface, then agar plates were incubated under suitable condition depending upon the test fungi. The extract of chloroform of *Faidherbia albida* root was diffused in the agar medium and the inhibition zones were calculated .[9]the standard fungal strains (*Asperigulus falvus, Asperigulus fusarium, Candida albicans*) were obtained from the Department of Microbiology, National Institute for Medical Laboratories, Khartoum, Sudan [15].

III. Results

Yield percent

The yield percent of crude chloroform maceration extract was 3.8%. The crude extract was reddish-brown, viscous and have a distinguished odor.

The results obtained from the study of the phytochemical analysis of the Chloroform root extract of *Faidherbia albida* was revealed the presence of alkaloids, diterpenes, flavonoids, saponins, and phytosterol but glycosides were not detected. (Table 1).

Thin-layer chromatography was revealed the presence of one alkaloid compound as an orange spot with R_f value 0.833.

Table 1: Phytochemical screenings of chloroform extract of *Faidherbia albida* roots

Photochemical group	Phytochemical test	Result
Alkaloids	Mayer's test	+
	Hager's test	+
	Wagner's test	+
	Dragendroff's test	+
	Tannic acid	+
Saponin	Foam test	+
Protein and amino acid	Xanthoproteic acid	+
Diterpenes	Copper acetate test	+
Carbohydrate	Molisch's test	+
	Fehling's test	+
Glycosides	Modified Borntrager's Test	-ve
Phytosterol	Salkowski's test	+
Flavonoids	KOH test	+
	Lead acetate test	+

(+) detected (-) not detected

The Antifungal Activity

The Chloroform extract of F.albida roots against three pathogenic fungal species; *Aspergillus fusarium, Aspergillus fulvus, and Candida albicans*, it shows interesting results by inhibiting the growth of the studied pathogenic fungal species (Table 2)

Table 2: Antifungal activity of

Faidherbia albida **root chloroform extract at different concentration**

Fungal strains	The diameter of the inhibition zone (mm)	
	Concentration (mg/ml)	
	50	100
Aspergillus fusarguim	13	11
Aspergillus falvus	7	13
Candida albicnas	10	17

Quantitative analysis

The total phenolic content of the root chloroform extract of *F.albida* was 53.960 mg GAE /g and Total alkaloidal content about 121.142 mg AE /g.

DISCUSSION

The phytochemical analysis of the Chloroform root extract of *Faidherbia albida* was exhibited the presence of alkaloids, diterpenes, flavonoids, saponins, and phytosterol but glycosides and phenols were not detected. These metabolites were reported in the other part of the plant at different concentration [1,2,4,5,9,16].

The root chloroform extract of *Faidherbia albida* root was tested against three pathogenic fungal species; *Aspergillus fusarium, Aspergillus fulvus and Candida albicans.* The extract at concentration 100mg/ml was exhibited moderate growth-inhibiting against Candida albicans and low inhibition activity against the other fungal strains tested. this result did not agree with other studied of different extracts obtained from other plant parts rather than the roots [2,7,13,15,17,18]. This may be due to the variation of metabolites distribution between the different plant parts[19].

In the root part of *Faidherbia albida*, the total phenol content was 53.960 mg GAE /g while the total alkaloid content was 121.142 mg AE /g. the low content of phenols in the chloroform extract supported the result of antifungal activity.

Conclusion

The Root part of *Faidherbia albida* plays a vital role in physiological activity as anticandidal agents.

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