Phytochemical Screening and Antimicrobial Activity of *Striga hermonthica* and *Nigella sativa* seeds

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Abstract

Medicinal plants constitute are an effective source of both traditional and modern medicines, herbal medicine has been shown to have genuine utility. 80% of rural population depends on natural products as primary health care.

Striga hermonthica (Scrophulariaceae) and *Nigella sativa* seeds (Ranunculaceae) are widely used in the different areas of Sudan for treatment of various diseases.

The chemical constituents of each plant were identified. The results of *S. hermonthica* and *Nigella sativa* seeds exhibited presence of Flavonoid, Tannin, Steroid and Triterpine, Saponin, Alkaloid, Cardiac glycoside and Reducing compound.

The antimicrobial activity of all extracts of each plant were tested against four standard strains of bacteria : *Staphylococcus aureus* , *Bacillus subtiles*, *Escherichia coli*, *Pseudomonas aeruginosa* and two standard strain of fungi : *Candida albicans* , *Aspergillus niger*.
A maximum antibacterial activity was observed by the Glacial acetic acid extract of *Striga hermonthica* while the ethanol extract of whole plant reflected moderate activity. All extracts showed no activity against all fungal strains tested.
The ethanol extract of *Nigella sativa* seeds showed a moderate activity against bacteria strains tested.

KeyWords: Phytochemical; Antimicrobial; *Striga hermonthica*; *Nigella sativa*; Scrophulariaceae; Ranunculaceae

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Introduction

***Striga hermonthica*: Family (Scrophulariaceae)**

S. hermonthica is a well-known Medicinal plant that has been used widely in folkloric Medicine in some parts of Africa in the tropics and subtropics of Gambia, Ghana, Mali, Nigeria, Niger Republic, Senegal, Sudan, etc. [1, 2 , 3].

It is used traditionally as dermatosis, leprosy ulcer, pneumonia and jaundice remedy, Trypanocidal, antibacterial and anti-plasmoidal. These activities have been reported by [1, 3, 4, 5, 6]. The plant has also Revealed antioxidant property due to its diverse content of Phenolic compounds, e.g., luteolin, apigenin, anthocyanins and tannins [7 , 8] .

***Nigella sativa* seeds:** Family (Ranunculaceae **)**

Nigella sativa is an annual flowering plant, native to southwest Asia , The seeds, on account of their aromatic nature, are used as a spice in cooking, particularly in Italy, Germany, Southern France and Asia. In folk medicine, it is used by the Egyptian public as a diuretic and carminative, while the expressed oil is used in the infiltration into the airways treatment of asthma, respiratory oppression and coughs [9]. The volatile oil of the seeds was also used in the treatment of ulcer when mixed with honey . *N. sativa* has been used for medicinal purposes for centuries, both as a herb and pressed into oil, in Asia, Middle East, and Africa. It has been traditionally used for a variety of conditions and treatments related to respiratory health, stomach and intestinal health, kidney and liver function, circulatory and immune system support, as analgesic, anti inflammatory, anti allergic, antioxidants, anticancer, antiviral and for general well -being so the investigation of its chemical constituent is very important.

Materials and Methods

Collection and identification of plant

Striga hermonthica (whole plant) was obtained from (Bara) North Kordofan while *Nigella sativa seeds* were obtained from Omdurman Markets. Both plants were identified and authenticated by the Medicinal and Aromatic plants Research Institute (2010).

Preparation of the plant material

Plant part was cleaned, freed from dust and foreign material, and then dried under the shade and finally powdered using an electric house-hold spice grinder.

Preparation of the crude extracts

A weight of 100 grams of the coarsely powdered shade – dried sample was successively extracted using different methods. Continuous extraction **,** Maceration [10] **.**

Phytochemical Screening

Phytochemical screening were Perfomed using standard procedures [11] .

Preparation of standard bacterial suspensions

One-ml aliquots of a 24-hours broth culture of the standard organisms were aseptically distributed onto nutrient agar slopes and incubated at 37ºC for 24 hours. The bacterial growth was harvested and washed off with sterile normal saline The suspensions were stored at 4°C until used [12] .

Testing for Antibacterial Activity

The cup-plate agar diffusion method [12] was adopted to assess the antibacterial activity of the prepared extracts.

One ml of the standardized bacterial stock suspension 10^8 –10^9 C.F.U/ ml were thoroughly mixed with 100ml of molten sterile nutrient agar which was maintained at 45 ºC. 20 ml aliquots of the inoculated nutrient agar were distributed into sterile Petri-dishes.

The agars was left to set and in each of these plates 4 cups (10 mm in diameter) were cut using a sterile cork borer and agar discs were removed. Alternate cups were filled with 0.1 ml samples of each of the extracts using automatic microlitre pipette, and allowed to diffuse at room temperature for two hours. The plates were then incubated in the upright position at 37 ºC for 18 hours.

Two replicates were carried out for each extract against each of the test organisms. Simultaneously positive controls involving the addition of petroleum ether and methanol instead of the extracts were carried out seperately. After incubation the diameters of the resultant growth inhibition zones were measured, averaged and the mean values were tabulated.

Preparation of standard fungal suspensions

The fungal cultures were maintained on Sabouraud dextrose agar, incubated at 25^{o}C for three days. The fungal growth was harvested and washed with sterile normal saline, and and the suspensions were stored at 4^{o}C until used.

Results

Phytochemical Screening of Plant Extracts

Chemical constituents of *S. hermonthica*:

The Phytochemical screening of *S. hermonthica* extracts was examined using methods described by [11]. The results as in table (1) were exhibited the present of flavonoids, tannins , terpenes, saponins, coumarins, reducing compound and sterol ,triterpene, but Anthracenoside (emodols) was not detected in all plant parts.

Chemical constituencies of *N. sativa* seeds

The Phytochemical screening of *N. sativa* seeds extracts was examined using methods described by [11] The results as in table (2) were exhibited the present of Flavonoids ,Alkaloids , Tannins , reducing compounds , cardiac glycosides , saponins and coumarins.

Table 1: The Chemical Constituent of *S. hermonthica*

Part Used	Extract	Metabolite								
		1	2	3	4	5	6	7	8	9
Whole plant	Petrolium ether extract	+	+	+	+	+	+	+	-	+
	Ethanol extract	+	+	+	+	+	+	+	-	+
	Aqueous extract	+	+	+	-	+	-	+	-	+
Flowers	Petrolium Ether extract	-	+	+	+	+	+	-	-	+
	Ethanol extract	+	+	+	+	+	+	+	-	+
	Aqueous extract	-	+	-	+	+	+	+	-	+
Stem &Leaf	Petrolium ether extract	+	+	+	-	+	+	-	-	-
	Alcohol extract	+	+	+	+	+	+	+	-	+
	Aqueous extract	-	+	-	+	+	+	+	-	+

Key: 1= Flavonoids ,2=Alkaloids , 3=steroid s& Triterpens ,4= Reducing compound s , 5 = Coumarins , 6 = Cardiac glycosides , 7=Tannin , 8 = Emodols , 9 = Saponins .
* (+) = detected and (-) = not detected.

Table 2: Chemical Constituent of *N . sativa* seeds

Plant extract	Metabolite								
	1	2	3	4	5	6	7	8	9
Ether extract	+	+	+	-	-	-	-	-	+
Alcohol extract	+	+	+	+	+	+	+	-	+
Aqueous extract	-	+	-	+	+	+	+	-	+

Key:1= Flavonoids ,2=Alkaloids , 3=steroid & Triterpens ,4= Reducing compound , 5 = Coumarins , 6 = Cardiac glycosides , 7=Tannins , 8 = Emodols , 9 = Saponins .(+) = detected and (-) = not detected.

Biological studied

Antibacterial activity of *S.hermonthica*

The whole plant acetic acid extract of *striga hermonthica* showed a maximum activity against all bacterial strains tested the MIZD exhibited amaximum activity against *B.subtilis* (30.6mm), *Ps. aerugenosa* (29mm), *E. coli* (27.6mm) and *S.aureus* (26mm).

On the other hand the ethylacetate extracts of flowers reflected a moderate activity against one or two tested bacterial strains. But the maximum activity was observed against *S. aureus* which is give MIZD (19.3mm).

The hexane extracts of the different plant parts used was reflecting a moderate activity against all bacterial strain tested with MIZD ranging from (14 -15mm).

The ethanol and ethylacetate extracts of Stem with leaves of this plant reflected a maximum activity against *B. subtilis*. as 22.3 mm and 20.3mm respectively.

The ethanol extract of *N. sativa* seeds showed moderate activity against all strains tested and a maximum measuring of MIDZ was observed by hexane extract against *B. subtilis* (29mm). Ethyl acetate extract was exhibited activity against *E.coli.* (21mm) while the hexane extract exhibited no activity against *E. coli. and Ps. aeruginosa*.

There is no study represent the biological activity of the acetic acid extract all thougth it is the most common extract use traditionally .

Table 3: Anti Microbial activity of *Striga hermonthica* and *Nigella sativa* Seeds Against Standard Microorganisms

Plant species	Part used	Type of extract	Microorganism Standard Strains MIDZ (mm)					
			S.a.	*B.s.*	*E.c.*	*Ps.a.*	*C.a*	*A.n.*
Striga hermonthica	Whole plant	Hexane	15	-	15.3	-		-
		Ethyl acetate	15.6	18.3	-	-	-	-
		Ethanol	18.3	15.6	14.3	16.6	-	-
		Glacial Acetic Acid	26	30.6	27.6	29	-	-
	Flowers	Hexane	15	-	-	-	-	-
		Ethyl acetate	19.3	-	-	-	-	-
		Ethanol	16	15.6	-	-	-	-
	Stem with Leaf	Hexane	14.6	14.6	-	-	-	-
		Ethyl acetate	16.6	20.3	-	-	-	-
		Ethanol	15.3	22.3	-	14.3	-	-
Nigella sativa	Seeds	Hexane	15	29	-	-	-	-
		Ethyl acetate	15.3	19.3	21	-	-	-
		Ethanol	14	15.6	19.3	16.6	-	-

Results of standard organisms Strains used, (-) = no inhibition , *Sa =Staphylococcus aureus, Bs = Bacillus subtiles , Ec = Escherichia coli ,Pa = Pseudomonas aeruginosa , Ca = Candida albicans , An = Aspergillus niger* .High activity = < 20mm , Moderate activity = 19 – 20mm , Low activity = > 15mm

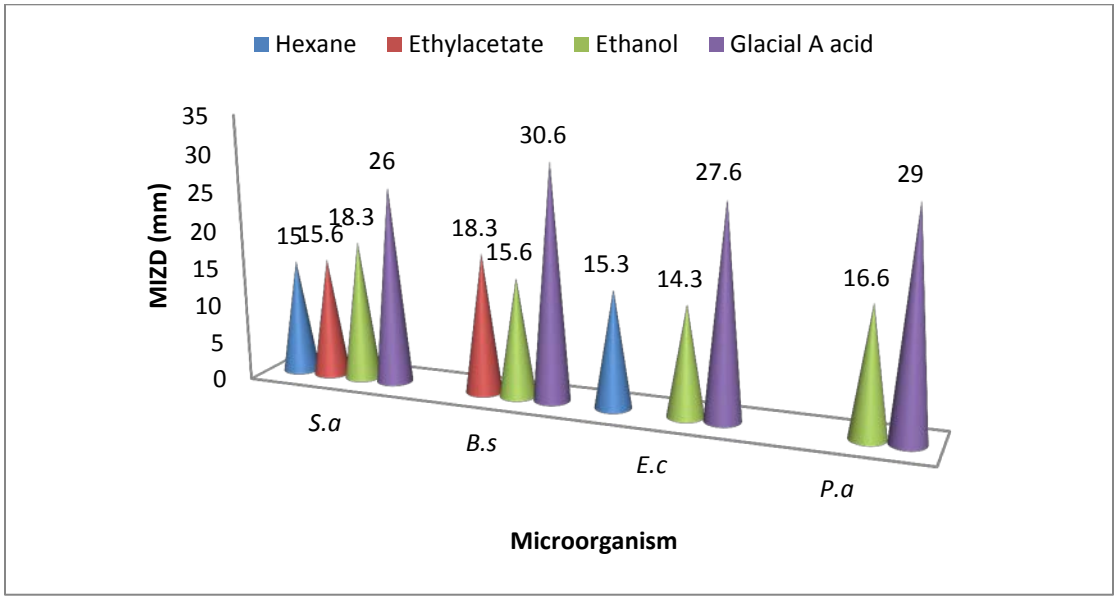

Figure 1: Antibacterial activity of *S. hermonthica* whole plant extracts against standard bacterial strains.

MIZD (mm) =Mean inhibition Zone Diameter, standard organisms used *; Sa =Staphylococcus aureus ,Bs = Bacillus subtilis , Ec = Escherichia coli ,Pa = Pseudomonas aeruginosa.*

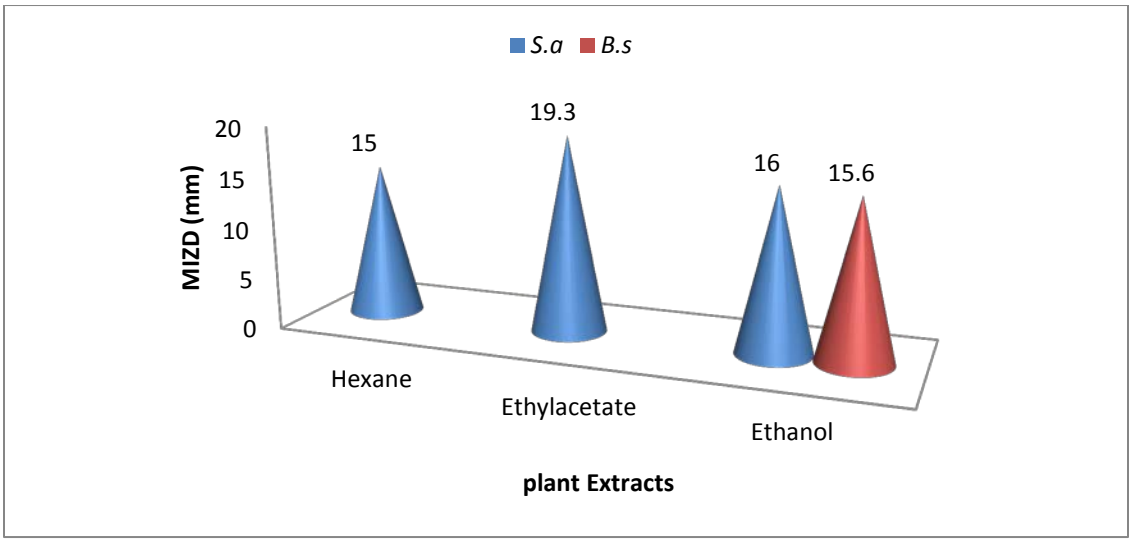

Figure 2: Antibacterial Activity of *S. hermonthica* Flowers extracts Against standard bacterial strains.

MIZD (mm) =Mean inhibition Zone Diameter,*; Sa =Staphylococcus aureus ,Bs = Bacillus subtilis*

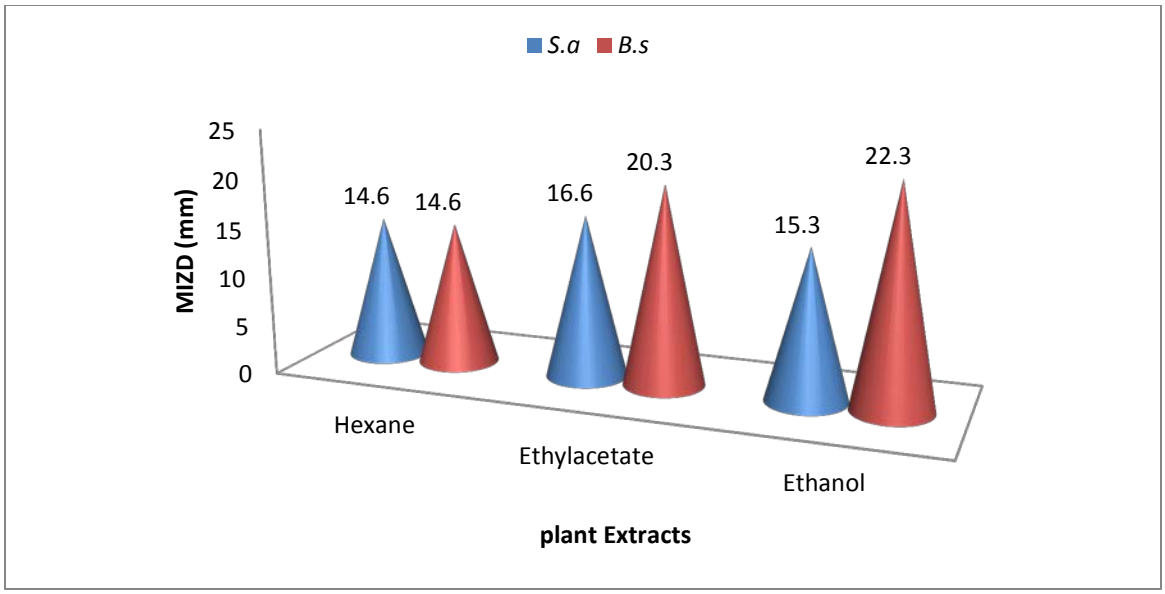

Figure 3: Antibacterial Activity of *S. hermonthica* (Stem with Leaf) extracts Against standard bacterial strains.

MIZD (mm) =Mean inhibition Zone Diameter, standard organisms used ; *Sa =Staphylococcus aureus ,Bs = Bacillus subtilis* .

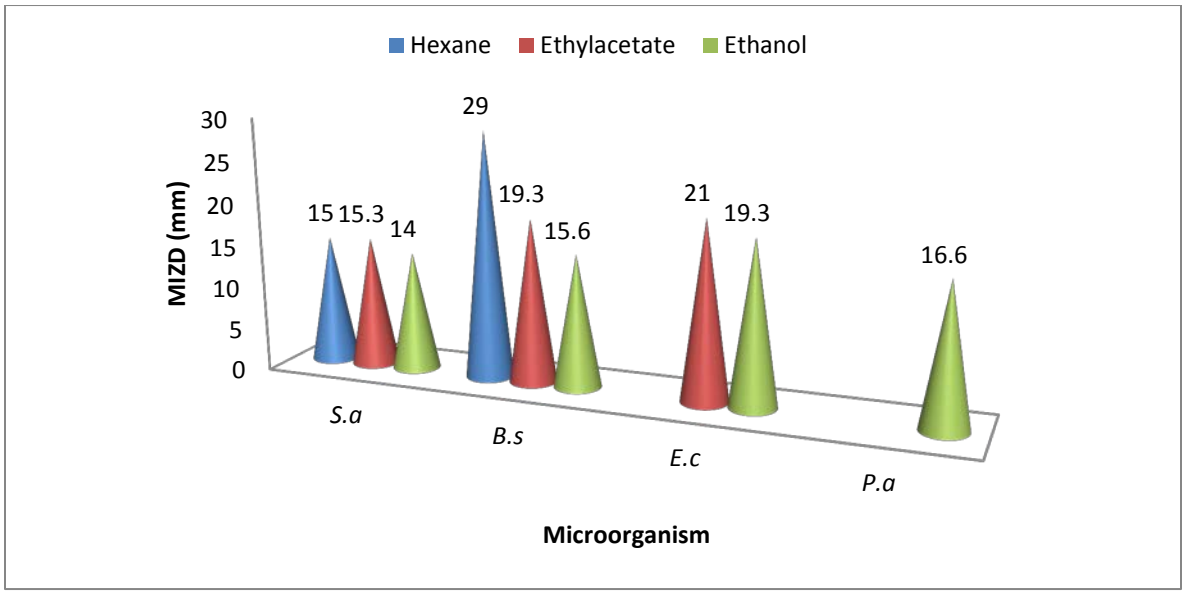

Figure 4: Antibacterial Activity of *N. sativa* (Seeds) extracts Against standard bacterial strains.

MIZD(mm) =Mean inhibition Zone Diameter, standard organisms used ; *Sa =Staphylococcus aureus ,Bs = Bacillus subtilis , Ec = Escherichia coli ,Pa = Pseudomonas aeruginosa* .

Discussion

From this study the presence of Flavonoid, Tannin, Steroid and Triterpine, Saponin , Alkaloid, Cardiac glycoside and Reducing compound was reported and this explained the multi uses of both plant in traditional medicine .

On the other hand ; the results lead to conclude that *S. hermonthica* and *Nigella sativa* (seeds) having antimicrobial activity while there was no antifungal activity observed.

Alkaloids, comprising a large group of nitrogenous compounds ,are widly used as cancer chemotherapeutic agents [13 , 14] alkaloids also interfere with cell division The presence of alkaloids in *S. hermonthica and N. sativa* seeds may be responsible for antimicrobial activity as recorded in this study .

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