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The Effect of Geographical Location on the Content and Antimicrobial Activity of *Cyperus rotundus* Rhizomes Essential Oil

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ABSTRACT

The present paper represents an attempt to investigate the effect of the geographical location on the yield percent and antimicrobial activity of the essential oils of Cyperus rotundus. The essential oils of the plant were collected in five different locations in Sudan, namely Dongola (northern Sudan); Darfour (western Sudan); Aljazeera and Khartoum (central Sudan) and Sinnar (eastern Sudan) and prepared by hydro -distillation technique. The percentage yields were found to be variable according to the growing location. The highest yield was found in the Dongola sample (1.2%) and the lowest in Khartoum and Aljazeera samples (0.5%). The antimicrobial activities of the prepared essential oils were also variable with regard to the sample tested .The highest antimicrobial activity was found in Khartoum oil sample followed by Darfour oil sample; Dongola oil sample; Aljazeera and Khartoum oil samples and finally Sinnar oil sample.

Keywords: Geographical location, Effect, Essential oil, Antimicrobial activity, Oil content, Cyperus, rotundus

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INTRODUCTION

Cyperus rotundus (Family: Cyperaceae), commonly known in Sudan as *Seeda* is a perennial weed with slender, scaly creeping rhizomes, bulbous at the base and arising singly from the tubers. The tubers are externally blackish in colour and reddish white inside, with characteristic odors. It is widely distributed in tropical, subtropical and temperate regions [1].

The plant rhizomes are used in traditional medicine systems to cure a number of ailments around the world. They are refrignant, demulcent and tonic, sedative, analgesic, antipyretic, aphrodisiac, hypotensive agent, emmenagogue in uterine complaints. They are used for treatment of colic, diarrhea, vomiting in children and flatulence, as an antidote to poison, promote the milk production, improve memory and the cognitive processes, and to improve the functions of the liver, spleen and pancreas[2]. The plant showed many pharmacological activities such as; anti-inflammatory, antipyretic, analgesic, sedative, gastroprotective, antidiarrhoeal, antiemetic, antispasmodic, tranquilizing activity, anticonvulsant, anti-obesity, hypoglycemic effect, anti-malarial, anti-cancer and antimicrobial [2- 13].

Many compounds were reported in the Cyperaceae family such as: volatile oils, tannins, phenolic acids, flavanoids, sesquiterpenoids, hydrocarbons, epoxides, ketones, saponins and alkaloids [14].

The present paper reports the results of the yield percent determination of the volatile oils prepared from five samples of *Cyperus rotundus* rhizomes growing in different locations in Sudan. The antimicrobial activity results of the prepared oils from the five samples against six microorganisms are also reported.

MATERIALS AND METHOD

Plant Materials Collection and Preparation

Cyperus rotundus rhizomes were collected in five different locations in Sudan Khartoum, Sinnar, Aljazeera, Darfour and Dongola and identified at the National Centre for Research, Medicinal and Aromatic Plants Research Institute (MAPRI), Khartoum, Sudan. The voucher specimens were deposited at Pharmacognosy Department, Faculty of pharmacy, University of Medical Science and Technology (UMST).The plant materials were dried and crushed by using mortar and pestle.

Preparation of Essential Oils

One hundred grams of the dried crushed rhizomes of each sample was subjected to hydro - distillation for 4 hours using Clavenger apparatus. The distilled essential oils were, collected and stored in sealed vials at 4°C. The yield per cent of the prepared essential oils (v/w %) was calculated based on the plant dry matter.

Antimicrobial Activity Test

Antimicrobial testing was carried out at The National Centre for Research, MAPRI, (Medicinal and Aromatic Plants Research Institute), Khartoum, Sudan using agar diffusion method with some minor modifications [15].

Nutrient agar powder (2.8g) was dissolved in 100ml of distilled water for bacterial growth, while6.5g of Sabouraud dextrose powder was dissolved in 100ml of distilled water for fungal growth. The media was then placed in the autoclave at 121°C, 15 Ibs pressure for 15mitues for sterilization. The media (20ml) was poured in a Petri dish aseptically and 0.2ml of the intended microorganism was introduced. To the solid media, two disks were added in each plate using seizer.

0.5 ml of *C. rotundus* oil was dissolved in 4.5ml of methanol to give the concentration 10 % (100mg/ml). Then, 20µl of the oil was added to the disks using micropipette and incubated at 37ºC for bacteria and 30ºC for fungi overnight. The zone of inhibition was then measured.

Determination of minimum inhibitory concentrations (MICs)

C. rotundus oil were taken for MICs determination using agar diffusion [14].After the media was prepared as described above,1ml of (100mg/ml) *C. rotundus* oil was dissolved in 1ml of methanol to give the concentration of 50%. Serial dilutions were made to the concentrations: 25%; 12.5; and 6.25%, then 20µl of *C. rotundus* oil were added to the disks using micropipette. and, incubated at 37ºC for bacteria and 25ºC for fungi for 18 hours. The zones of inhibition were measured and the MICs were determined.

RESULTS AND DISCUSSION

The prepared oils were pale yellow in colour, with spicy characteristic odor. The percentage yields were shown in table 1 and figure 1. The highest yield was found in Dongla oil sample followed by Darfour oil sample , while the lowest yield were determined in Khartoum and Aljazeera oil samples located in central Sudan.

Table 1: The yield percentage of C. *rotundus* rhizome essential oils

Collection area	Oil yield (ml)	Oil yield (%)
Khartoum	0.5	0.5
Sinnar	0.6	0.6
Aljazeera	0.5	0.5
Darfour	0.7	0.7
Dongola	1.2	1.2

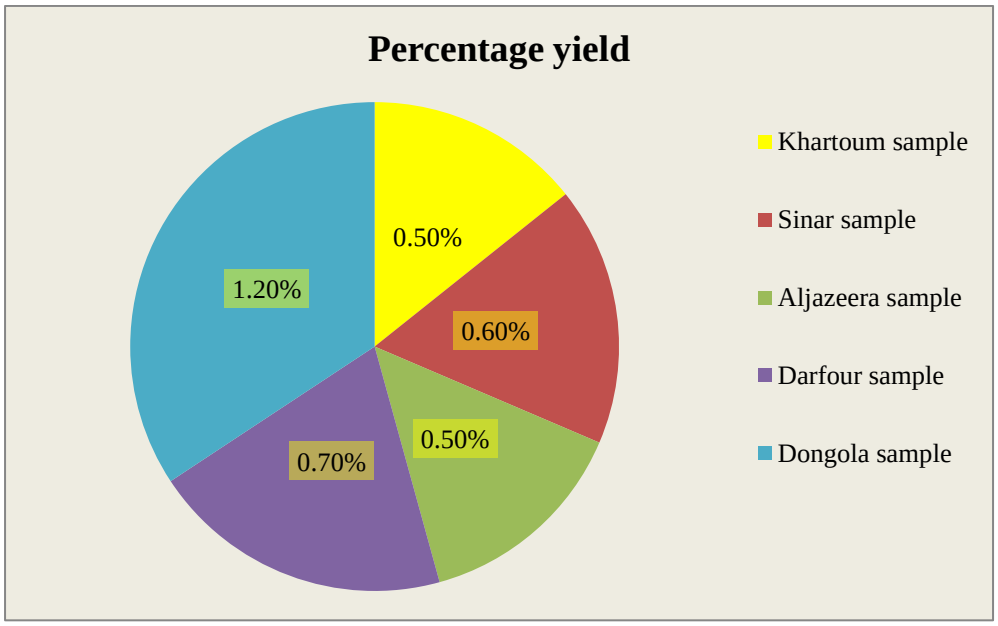

Figure 1: The yield percentage of C. *rotundus* rhizome essential oils

The antimicrobial activity results of the five prepared essential oils were reported in table 2 and figure 2. The highest activity of all essential oil samples were found to be against *S. aureus*. These findings are compatible with the reported antimicrobial activity of the plant essential oil [16]. The activities were different according to the geographical location of the plant sample collection area. All essential oil samples were found to be variable in activity against six tested organisms. The highest activity was found in Khartoum oil sample followed by Darfour oil sample, Dongola oil sample, Aljazeera oil sample and finally Sinnar oil sample.

These variations in the quantity and quality of the prepared essential oils are compatible with the fact that, the composition of essential oils is affected by climatic conditions, soil, geographical origin, cultivation techniques, genetic variation, growth stages, part of plant utilized and postharvest drying and storage [17- 21].

Table 2: The antimicrobial activity of C. *rotundus* rhizome essential oils

Essential Oil sample of	Tested organisms / Inhibition zone (mm)					
	E. coli	*P. aeurginosa*	*S. aureus*	*B. subtilis*	*C. albicans*	*A. niger*
Khartoum	-	13	28	13	9	12
Sinnar	9	11	11	11	10	-
Aljazeera	13	11	13	13	-	-
Darfour	14	11	23	13	11	10
Dongola	-	14	22	15	15	11

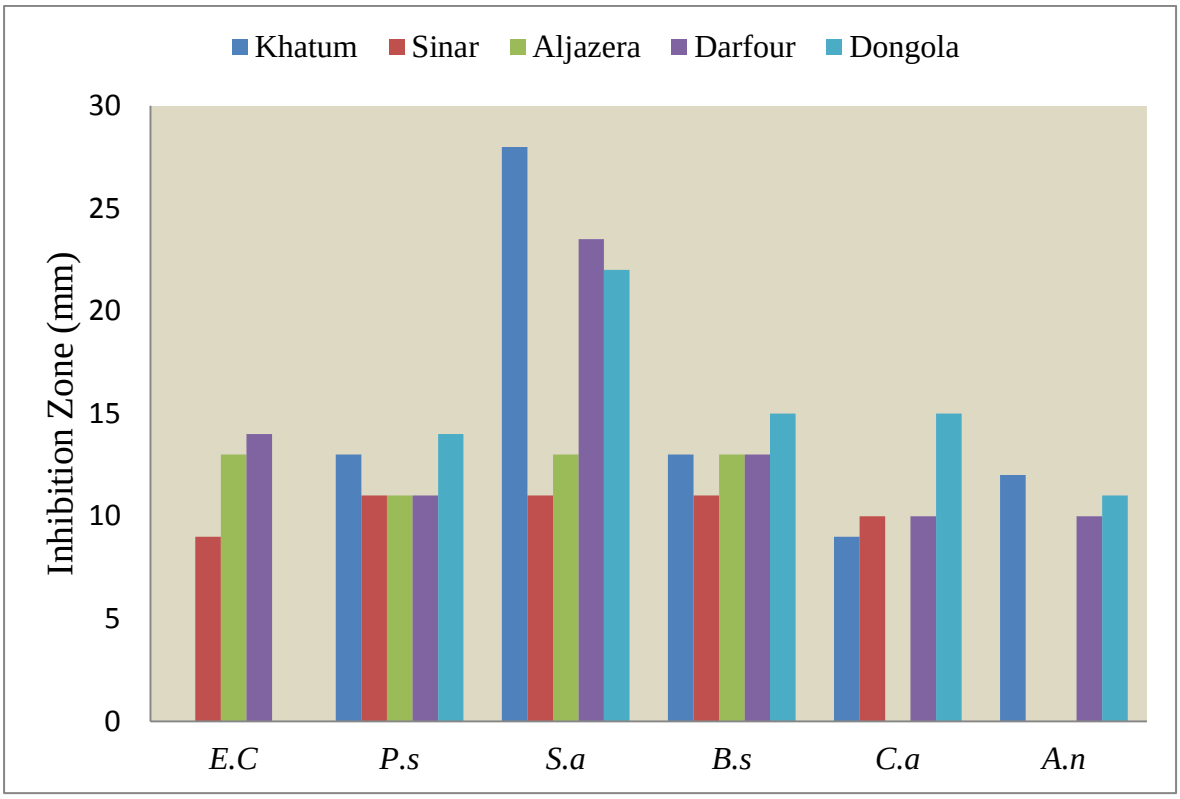

Figure 2: The antimicrobial activity of C. *rotundus* rhizome essential oil

CONCLUSION

This study conclude that, the quantity and quality of *Cyperus rotundus* essential oils are varied and affected by geographical origin, climatic conditions and soil. The study conclude that, the best area for *Cyperus rotundus* collection in Sudan is Darfour area which produce high yield of essential oil with good quality.

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