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GC-MS ANALYSIS AND ANTIMICROBIAL ACTIVITY OF *CINNAMOMUM VERUM* GROWN IN SUDAN

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ABSTRACT

Common bean (Phaseolus vulgaris L.) is a legume com- monly grown in sub-Saharan Africa for food, cash, ani- mals' food, and as soil improver.[1] Common bean (Phaseolus vulgaris L.) is a legume com- monly grown in sub-Saharan Africa for food, cash, ani- mals' food, and as soil improver.[1] *Cinnamomum verum* is considered as a natural remedy for respiratory, digestive and gynecological ailments. It is also useful for treatment of bronchitis, itching, urinary tract and digestive tract related diseases . In this study *Cinnamomum verum*. seed oil was analyzed by GC-MS The analysis revealed the presence of 25 components. In the well diffusion bioassay the oil showed significant activity against *Staphylococcus aureus, Bacillus subtilis, Escherichia coli* and the yeast *Candida albicans.*

KEYWORDS: *Cinnamomum verum*., Oil, GC-MS analysis, Antimicrobial Activity.

INTRODUCTION

Cinnamomum verum is a a plant in the family *Lauraceae*. The genus *Cinnamomum* belongs to the spices.[1-3] It can tolerate harsh conditions of soil and temperature, and its height is 2–3 m. Ideal high quality seeds are small, flat, uniform, and yellowish in color.[3] The inner bark of the genus *Cinnamomum* is used as a spice for cooking purposes across the globe.[4] *Cinnamomum* trees are used traditionally for the treatment of diabetes and other human disorders. The aqueous extract of *Cinnamomum verum* enhances the glycogen synthase activity. It also activates the insulin receptor.[5] *Cinnamomum verum* contains essential oils beside cinnamaldehyde, eugenol, cinnamic acid and cinnamate.[6-8] One constituent of *Cinnamomum verum*- cinnamon - is used traditionally as an anti-inflammatory, anti-emitic, larvicidal, insecticidal, antimycotic and anticancer. The plant is also used as tooth powder to treat toothaches, dental problems, oral microbial and bad breath.[9-10]

MATERIALS AND METHODS

Plant material

Seeds of *Cinnamomum verum*. were purchased from the local market, Khartoum - Sudan. The plant was authenticated by The Medicinal and Aromatic Plants Research Institute-Khartoum (Sudan).

Instruments

GC-MS analysis was performed on a Shimadzo GC-MSQP2010 Ultra instrument with a RTX-5MS column (30m, length; 0.25mm diameter; 0.25 µm, thickness).

Test organisms

The following organisms were used for the antimicrobial assay: *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeroginosa, Escherichia coli* and *Candida albicans.*

Methods

Extraction of oil

Powdered seeds (400g) was macerated with n-hexane. The solvent was removed under reduced pressure to give the oil.

GC-MS analysis

The target oil was analyzed by Gc-MS. A Shimadzo GC-MS-QP2010 Ultra instrument was used. Chromatographic conditions are: Column oven temperature: **150.0 °C**; Injection temperature: **300.0° C**; Injection mode: **Split;** Flow control mode: **Linear velocity;** Pressure: **139.3KPa;** Total flow: **50.0ml/ min**; Column flow: **1.54ml/sec.**; Linear velocity: **47.2cm/sec.;** Purge flow: **3.0ml/min.**; Spilt ratio: **- 1.0.**

Antimicrobial assay

Antimicrobial activity was performed by the cup plate agar diffusion bioassay.[11] *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeroginosa and Escherichia coli*) and one yeast(*Candida albicans*) were used in the antimicrobial assay. The bacterial and yeast strains were inoculated into Mueller Hinton agar plates. Test sample (20 µL) was applied into 6.0 mm diameter wells. The plates were kept at room temperature for 2 hours to allow diffusion of test sample into the agar. Then they were incubated at 37 °C for 24 hours. The diameters the inhibition zones were measured (in millimeters mm) as average of two replicates.

RESULTS AND DISCUSSION

Cinnamomum verum. seed oil was analyzed by GC-MS. Figure 1 shows the total ions chromatograms, while the constituents of the oil are displayed in Table.

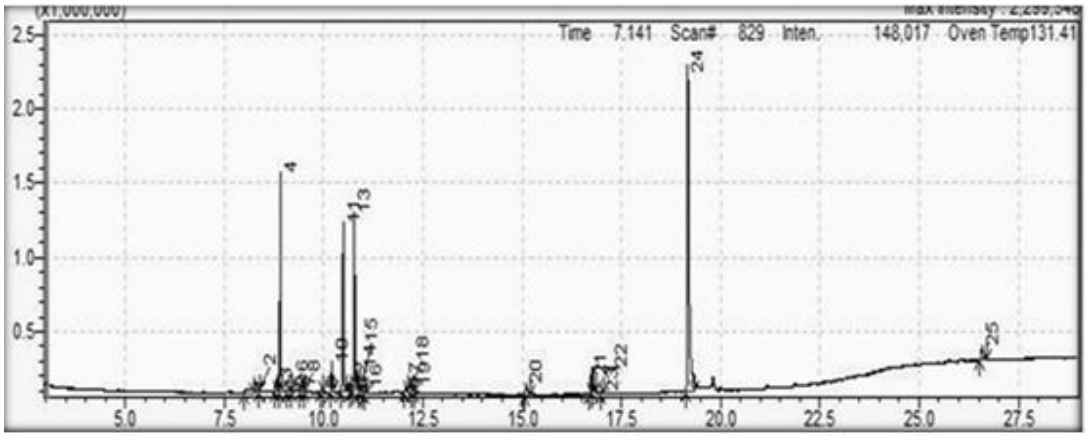

Fig. 1: Total ions chromatograms.

Table 1: Constituents of the oil.

No.	Name	Ret.Time	Area%
1.	Cinnamaldehyde, (E)-	8.134	1.82
2.	.beta.-ylangene	8.387	0.10
3.	1,2,4-Metheno-1H-indene, octahydro-1,7a-dimethyl-5-(1-methylethyl)-, [1S-(1.alpha.,2.alpha.,3a.beta.,4.alpha.,5.alpha.,7a.beta	8.801	0.80
4.	Copaene	8.910	13.84
5.	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-4a,8-dimethyl-2-(1-methylethenyl)-, [2R-(2.alpha.,4a.alpha.,8a.beta.)]-	9.107	0.64
6.	Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-(1-methylethenyl)-, [1R-(1.alpha.,7.beta.,8a.alpha.)]-	9.200	0.53
7.	Isosativene	9.399	0.41
8.	Aromandendrene	9.508	0.28
9.	Humulene	9.945	0.24
10.	Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-	10.202	1.94
11.	.alpha.-Muurolene	10.494	12.26
12.	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [S-(E,E)]-	10.683	0.28
13.	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-	10.773	13.95
14.	Naphthalene, 1,2,3,4,4a,7-hexahydro-1,6-dimethyl-4-(1-methylethyl)-	10.901	1.44
15.	.alfa.-Copaene	10.965	0.32
16.	.alpha.-Calacorene	11.056	0.32
17.	trans-Sesquisabinene hydrate	12.071	0.57
18.	.tau.-Muurolol	12.238	0.91
19.	1-Naphthalenol, 1,2,3,4,4a,7,8,8a-octahydro-1,6-dimethyl-4-(1-methylethyl)-, [1R-(1.alpha.,4.beta.,4a.beta.,8a.beta.)]-	12.278	0.43
20.	Hexadecanoic acid, methyl ester	15.093	1.50
21.	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	16.731	1.40
22.	9-Octadecenoic acid (Z)-, methyl ester	16.772	2.31
23.	Methyl stearate	16.998	0.16
24.	Benzene, 1,1'-(2,4-cyclopentadiene-1,2-diyl)bis-	19.175	41.30
25.	.beta.-Sitosterol	26.585	2.25

Major components of the oil are :
i) Benzene, 1,1-(2,4-cyclopentadiene-1,2-diyl) -bis- (41.30%).
ii) 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-,(1S-cis)-(13.95%)
iii) Copaene (13.84%)
iv) alpha.-Muurolene (12.26%)

Fig. 2 shows the mass spectrum of benzene, 1,1 -(2,4-cyclopentadiene-1,2-diyl) bis-. The peak at m/z 218 (RT. 19.175) corresponds the molecular ion $M^+[C_{17}H_{14}]^+$. The mass spectrum of naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)- is depicted in Fig. 3. The peak at m/z 204 (RT. 10.773) corresponds the molecular ion M^+ $[C_{15}H_{24}]^+$. The mass spectrum of copaene is presented in Fig.4. The peak at m/z 204 (RT. 8.910) corresponds the molecular ion $M^+[C_{15}H_{24}]^+$. Fig. 5 shows the mass spectrum of alpha.-muurolene. The peak at m/z 204 (RT. 10.494) corresponds the molecular ion $M^+[C_{15}H_{24}]^+$.

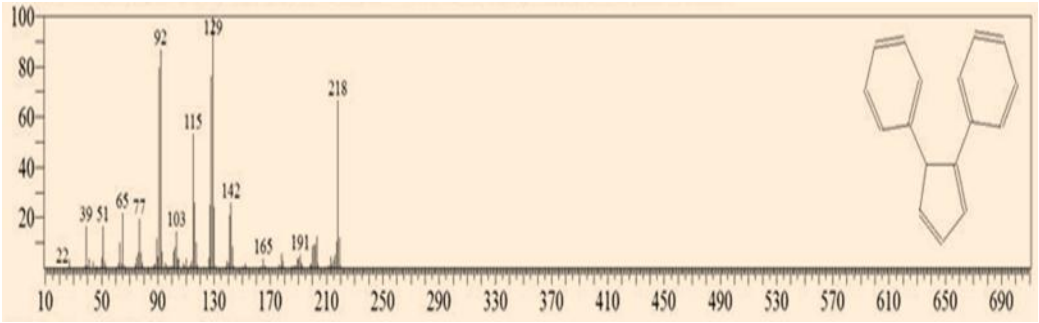

Fig. 2: mass spectrum of benzene, 1,1-(2,4-cyclopentadiene-1,2-diyl) - bis-

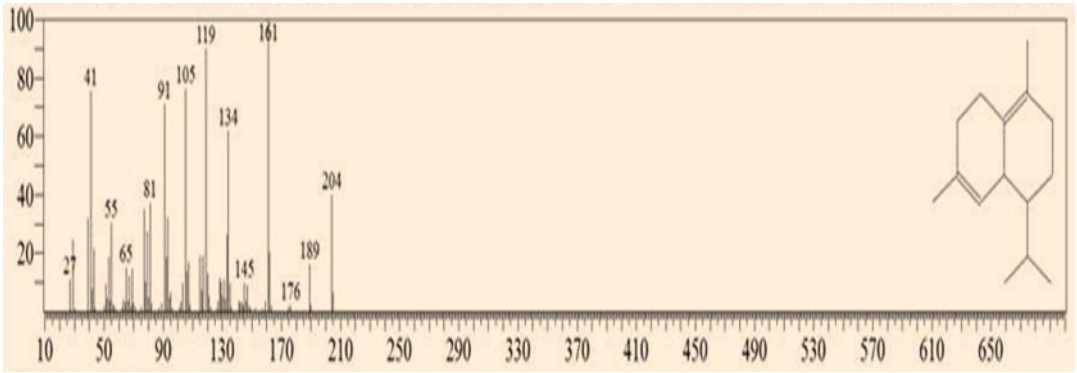

Fig. 3: mass spectrum of naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-

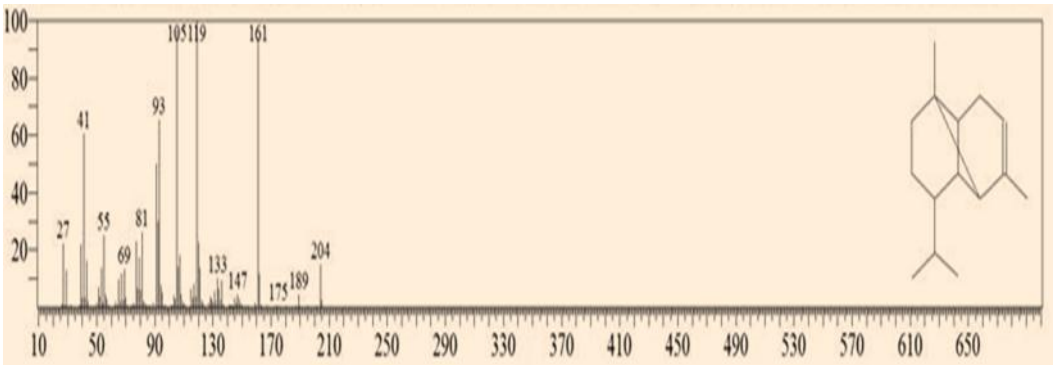

Fig. 4: mass spectrum of copaene.

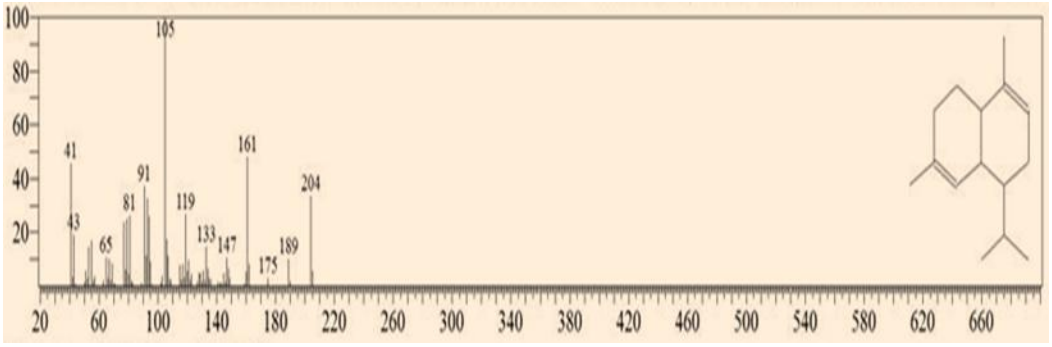

Fig. 5: the mass spectrum of .alpha.-muurolene.

Antimicrobial activity

Cinnamomum verum oil was screened for antimicrobial activity against five standard human pathogens. The inhibition zones are displayed in Table 2. The oil showed significant activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*. and the yeast *Candida albicans*.

Table 2: Inhibtion zones of *Cinnamomum verum* oil.

Sample	Sa	Bs	Ec	Pa	Ca
Oil 100mg/ml	26	26	25	16	36

Sa.: Staphylococcus aureus.
Bs.: Bacillus subtilis.
Ec.: Escherichia coli.
Pa.: Pseudomonas aeroginosa.
Ca.: Candida albicans.

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