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Research Article

CHEMICAL COMPOSITION AND ANTIMICROBIAL ACTIVITY OF ESSENTIAL OIL OF EGYPTIAN OCIMUM BASILICUM L.

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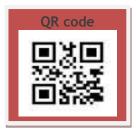
Abstract:

This study aimed to determine the chemical composition and antimicrobial activity of the volatile oil of Egyptian Ocimum Basilicum L. Forty two volatile compounds were identified by using gas chromatography-mass spectroscopy (GC-MS). The abundant chemical Constituents were Linalool (33.9%), Eugenol (8.31%) and 2,6-Dimethyl-6-(4-methyl-3-pentenyl)-bicyclo[3.1.1]hept-2-ene (8.04%). Antimicrobial activity were studied at two different concentrations of oil extract (100 μ L) and (200 μ L) against three bacterial strains Escherichia coli, Staphylococcus aureous and Bacillus cereus, and three fungal strains, Aspergillus niger, Candida albicans and Saccharomyces cerevisial. The volatile oil showed good inhibitory effect for all bacterial strains especially E. coli and weak activity against fungal species.

Keywords: Ocimum Basilicum, Volatile oil, Chemical composition, GC-MS, Antimicrobial activity.

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INTRODUCTION:

Ocimum Basilicum L. (basil) is an annual, herbaceous, white to purple flowering plant, 20-60 cm tall, that originated in Iran and India [1-2]. The taxonomy of Ocimum is complex due to interspecific hybridization and polyploidy of the species in the genus [3], recognized more than 150 species; however, Paton [4] proposed that Ocimum had only 65 species and other attributions should be considered as synonyms. Among the species of the genus, Ocimum Basilicum L. (basil) is the major essential oil crop around the world and cultured commercially in many countries. Basil (Ocimum Basilicum L.) is aromatic herb that is used extensively to add a distinctive aroma and flavor to food. The leaves can be used fresh or dried for use as a spice. Essential oils extracted from fresh leaves and flowers can be used as aroma additives in food, pharmaceuticals, and cosmetics [5]. Indian basil (Ocimum Basilicum), is an economical essential oil producing industrial crop used in flavor and fragrance industries [6]. The essential oil had a significant toxic effect against late third-stage larvae of Culex tritaeniorhynchus, Aedes albopictus and Anopheles subpictus with LC₅₀ values of 14.01, 11.97 and 9.75 ppm and LC₉₀ values of 23.44, 21.17 and 18.56 ppm, respectively [7]. Sweet basil (Ocimum Basilicum L.), one of the most popular aromatic plants, shows great variation in both morphology and essential oil components. The composition of 18 Turkish basil essential oils by gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS) were studied [8].

The essential oil of basil (*Ocimum Basilicum* L.) investigated, exhibited good antioxidant activity as measurements by 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical-scavenging ability, bleaching β -carotene in linoleic acid system and inhibition of linoleic acid oxidation [9].

The comparison of chemical composition of volatile aglycones with the chemical composition of essential oil reveals four common compounds: eugenol, chavicol, linalool and α -terpineol [10]. Six samples of essential oils from four *Ocimum* species (*O. Basilicum, O. Kilim and Scharicum, O. Lamiifolium,* and *O. Suave*) were analyzed by GC and GC-MS. The major compounds were either phenyl propane derivatives or terpenoids, including methyl eugenol, 1,8-cineole, camphor, bornyl acetate, germacrene-D, E-myroxide, germacrene-B, caryophylene oxide and *p*-cymene [11-12]. In continuation of our studies, [13-15] we report herethe chemical composition and antimicrobial activity of the volatile oil of Egyptian *Ocimum Basilicum* L., from the family *Lamiaceae*.

MATERIALS AND METHODS:

Plant Material:

The plant was collected from Aswan city (south Egypt) in 2012 and dried in closed room in shadowthen was identified by Botany Department, Faculty of Science, Zagazig University (Zagazig, Egypt).

Chemicals:

Diethyl ether, dimethyl sulfoxide (DMF) and anhydrous sodium sulfate were supplied from El-Gomheria Company for chemicals (Egypt).

Microbial Strains:

The bacterial and fungal strains were obtained from the microbiology Laboratory, micro analytical center, Faculty of Science, Cairo University. The tested bacterial strains were *Escherichia coli* (KQ 103), *Staphylococcus aureus* (LC 405) and *Basillus cereus* (Laboratory collection strains), and fungal strains were *Saccharomyces Cerevisial, Aspergillus niger* and *Candida albicans* (Laboratory collection strains).

Isolation of the Volatile Oils:

The dried plant about 0.5 kg was subjected to steam distillation for three hours using the method described by Marcus and Lichtenstein and Weaver *et al.*, [16-17]. The volatile oils were obtained by diethyl ether from aqueous solution and dried over anhydrous sodium sulfate and stored under N_2 atmosphere in amber vials at 4°C until they were analyzed.

GC-MS analysis:

For qualification, the essential oil was analyzed on Gas Chromatography Mass Spectrometry HP 6890 Series A (Agilent) by using A Thermo Scientific (TR-5MS), (5% Phenyl Polysil Phenylene Siloxane) capillary column (30 m x 0.25 mm i.d.; 0.25 μ m film thickness). Helium (He), having a flow rate of 1.00 ml/min, was used as carrier gas. The GC oven temperature was kept at 50°C for 5 minutes and programmed to 250°C. The injector temperature was 250°C. The amount of injection was 1 μ L.

Retention indices for all compounds were determined according to the Van Den Dool method [18]. While, Identification of the components was based on comparison of their mass spectra with those of internal (computer) library, Wiley7n.1 and PMW_Tox3.1 libraries and some reference compounds.

Antibacterial Activity:

The susceptibility test of the crude extract of the plant was determined using the agar disc diffusion method as described by Penduka *et al.*, and Jayanthi and Lalitha [19-20], with some modifications. A 6 mm sterile Whatt-mann filter paper was impregnated 3 times with 100 μ L and 200 μ L of the bio-active extracts dissolved in Dimethylsulfoxide (DMSO) and then dried up. One ml of 24 hours old bacterial suspension was mixed with 30 ml of 45 - 50°C, sterile melted Nutrient agar and poured plate in sterile Petri dish. The plate was allowed tosolidify and the filter paper containing the extract was placed in the center of the plate. Inhibition zone around the paper disk was measured after incubation for 18-24 hours at 37°C.

Antifungal activity:

Antifungal activity of the crude extract was determined using agar well diffusion method as described by Jin *et al.*, [21]. In brief 100 μ L and 200 μ L of the plant extract were transferred to two pores

in Czapek's agar medium previously seeded with the tested fungi. Inhibition zones diameter were measured after 2-4 days of incubation at 28°C.

RESULTS:

Chemical Composition of the Volatile Oil:

Forty two compounds were characterized and identified by using GC-MS for the oil of *Ocimum Basilicum* L. Cultivated in Egypt. The most predominant compounds were Linalool (33.9%), Eugenol (8.31%) and 2,6-Dimethyl-6-(4-methyl-3-pentenyl)-bicyclo [3.1.1]hept-2-ene (8.04%) of the oil constituents (Table 1 represents the chemical composition of the oil).

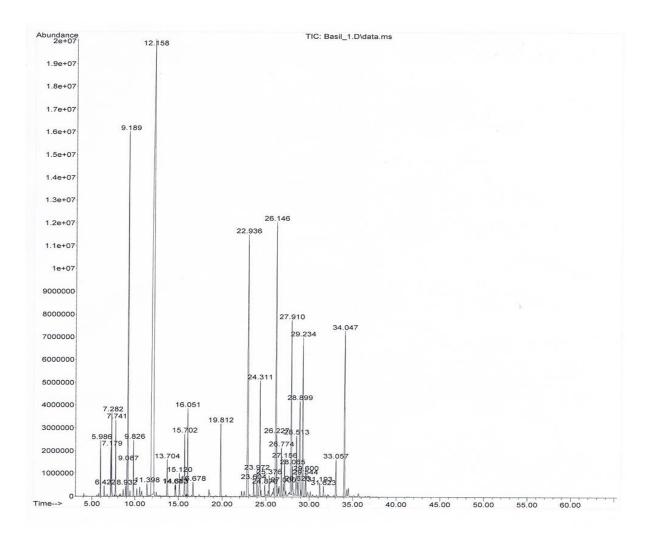


Fig 1: Gas Chromatography-Mass Spectroscopy (GC-MS) of the Volatile Oil of Ocimum Basilicum L.

1α-Pinene5.980.752Camphone6.420.453Sabinene7.170.714β-Pinene7.281.335β-Myrcene7.281.335β-Myrcene7.731.166O-Cymene8.920.177d1-Limonene9.080.5481.8-Cinnole9.0188.849β-Ocimene8.820.9210α-Terpinolene11.390.2911Linalod12.153.39122-Bornanone13.70.8613Borenol14.410.21143-Cyclohexene-1-methanol14.4610.2115G-Maxieol15.120.4416β-Fenchyl alcohol or α-Terpineol15.120.4416β-Fenchyl alcohol or α-Terpineol15.120.4417Chavicol16.670.2519Bornyl acetate19.811.5720Fagenol23.970.3121α-Copaene23.970.3422Tras-Caryophyllene24.870.2233β-Burbonene24.370.2544Mehyl Eugenol25.370.4725Tras-Caryophyllene26.990.3426α-Gimethyl-3-pentenyl-bicyclo[3.1.1]hept-2-ene26.148.3627a-Gamiene26.971.990.3428α-Humalene26.771.090.3429	No	Compound name	Retention time in min.	Peak area %
3Sabinene7.170.714β-Pinene7.281.335β-Myrcene7.731.1660-Cymene8.920.177d'-Linonene9.080.5481.8-Cincole9.188.49β-Oximene8.820.9210α-Terpinolene11.390.2911Linalod11.390.2911Linalod12.1533.913Borenol14.610.21142-Bornanone13.70.8615Terpinolen-l-intethanol14.610.21143-Cyclohesene-l-methanol15.120.4415Terpinolen-l15.120.4416β-Fenchyl alcohol or a-Terpineol15.71.2517Chavicol16.051.7118Caprylyl acetate19.811.5729Bornyl acetate19.811.5721G-tracene23.970.6623β-Bourbonene23.970.6624β-Bourbonene24.870.2225Trans-Caryophylene25.370.47262.6-Dirnechyl-3-penteryl)-bicyclo[3.1.1]hept-2-ene26.040.3427Grainee26.040.3428n-Hamulene26.771.0929Cis-f-Farnesene28.690.3430Germacene D24.870.2231β-Cubelsene To27.904.3334β-Cubelsene D </th <th>1</th> <td>α-Pinene</td> <td>5.98</td> <td>0.75</td>	1	α-Pinene	5.98	0.75
4β-Pinene7.281.335β-Myrcene7.731.166O-Cymene8.520.177dl-Limonene8.820.1781.8-Cineole9.080.549β-Oximene9.080.549β-Oximene8.820.9210a.Terpinolene11.390.2911Linatool11.370.86122.Bornanone13.710.8613Borenol14.610.21143-Cyclobexner-I-methanol14.680.2415Terpinen-4-ol15.120.4416β-Fenchyl alcohol or a-Terpineol15.712.0517Chavicol or a-Terpineol16.670.2619Bornyl acetate16.670.2619Bornyl acetate2.938.8120Eugenol2.3970.6621β-Enchyl alcohol or -Terpineol1.571.5721Chavicol1.6670.260.3322Bourboaree2.3938.810.3724Methyl Eugenol2.3970.660.3325Trans-Caryophyllene2.5370.4726Casip-Farmesene2.648.8431β-Curbenene2.6570.3432Trans-Caryophyllene2.648.8433Gormanee2.6570.3434β-Curbenene2.8620.3135Trans-Farmesene2.8610.34<	2	Camphene	6.42	0.45
5β-Myrcene7.731.166O-Cymene8.920.177dI-Limonene8.920.177dI-Limonene9.080.5481.8-Cincole9.188.49β-O-Cininene9.188.4210α-Terpinolene11.390.2911Linalool12.1533.9122-Bornanone14.610.2113Borenol14.610.21143-Cyclohexene-1-methanol14.610.2115Terpinen-4-ol15.120.4416β-Fenchyl alcohol or a-Terpineol15.520.4416β-Fenchyl alcohol or a-Terpineol16.6717.1217Charvicol16.671.510.1518Caprylyl acetate19.811.5720Engenol22.938.3121φ-Copaene23.970.6623β-Elemene23.970.6624β-Elemene23.970.6625Trans-Grapolyllene25.370.47262-Gorimethyl-6-(4-methyl-3-pentenyl)-bicyclo[3.1.1]hept-2-ene25.418.8427α-Guaiene22.621.1128α-Elmenene23.970.6623β-Elemene23.970.6624α-Guaiene26.221.1129Guaiene26.221.1120Elemene23.970.6623β-Elemene26.148.0424 </th <th>3</th> <td>Sabinene</td> <td>7.17</td> <td>0.71</td>	3	Sabinene	7.17	0.71
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13Borenol14.610.21143-Cyclohexene-1-methanol14.680.2415Terpinen-4-ol15.120.4416β-Fenchyl alcohol or a-Terpineol15.71.2517Chavicol16.051.7118Caprlyl acetate16.670.2619Bornyl acetate19.811.5720Eugenol23.970.6621α-Copaene33.600.3422β-Bourbonene23.970.6623β-Biemene24.870.2224Methyl Eugenol24.870.2225Trans-Caryophyllene26.148.0427α-Guaiene26.148.0428α-Humulene26.771.0929Cis-β-Farnesene26.990.3430Germacene D27.150.8631β-Cubehene28.060.7933Bicyclo germacene28.911.5434α-Gurjene28.923.3135α-Bulnesene28.923.3136α-Armorphene28.923.3137Cis-Calamene28.923.3138β-Cubehene28.923.3139δ-Cudinene29.540.4138β-Cubehene29.540.4139β-Rumene31.190.3740β-Ruhlenol31.190.3741α-Cubehene or Cadima-1,4-diene31.050.84	11	Linalool	12.15	33.9
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38 δ-Cadinene 29.59 0.57 39 Aromadendrene 31.19 0.37 40 Spathulenol 31.62 0.25 41 α-Cubebene or Cadina-1,4-diene 33.05 0.84	36	α-Amorphene	29.23	3.95
39 Aromadendrene 31.19 0.37 40 Spathulenol 31.62 0.25 41 α-Cubebene or Cadina-1,4-diene 33.05 0.84	37	Cis-Calamenene	29.54	0.41
40 Spathulenol 31.62 0.25 41 α-Cubebene or Cadina-1,4-diene 33.05 0.84	38	δ-Cadinene	29.59	0.57
41 α-Cubebene or Cadina-1,4-diene 33.05 0.84	39			
	40		31.62	0.25
42 α-7-H-Eudesma-3,5-diene 34.04 4.24	41	α-Cubebene or Cadina-1,4-diene	33.05	0.84
	42	α-7-H-Eudesma-3,5-diene	34.04	4.24

Table 1: The Volatile Constituents Identified From the Volatile Oil of O. Basilium by Using GC-MS

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Bacterial Species	Inhibition zone diameter in mm for 100µl and 200µl		
	For 100µl concentrations	For 200µl concentrations	
Escherichia coli	34	54	
Staphyllococcus aureus	24	44	
Bacillus cereus	24	44	

Table2: Antibacterial Activity of Volatile Oil of O. Basilicum Using 2 Different Concentrations.

Table 3: Antifungal Activity of Volatile Oil of O. Basilicum Using 2 Different Concentrations

Fungal Species	Inhibition zone diameter in mm for 100µl and 200µl		
	For 100µl concentrations	For 200µl concentrations	
Saccharomyces cerevisial	4	6	
Aspergillus niger	2	3	
Candida albicans	3	4	

Antimicrobial Activity:

The results of antimicrobial activity of the volatile oil of the *Ocimum basilicum* L. Cultivated in Egypt against the tested strains were shown in table 2 and 3. High activity was noted against *E. coli and Saccharomyces cerevisial*

DISCUSSION:

Basil is used as a medicinal herb in medical treatments of many conditions such as for headache. cough, diarrhea, parasitic worms, and kidney malfunctions. Basil essential oil has been utilized extensively in the food industry as a flavoring agent. and in perfumery and medical industries [22]. The predominant components of the Egyptian Ocimum Basilicum were Linalool and Eugenol; this finding is in agreement with the findings of Duman et al., and Stefan et al., [23-24], who stated that Linalool and Eugenol were the common chemical composition of the Basil, although the compositions were varies in their order and concentration, this variation might be due toseasonal changes [9], variation in the site and environment of cultivation and collection, or variation in the extraction methods.

The oil of the *Ocimum Basilicum* has a good antimicrobial activity against all tested organisms with noted high activity against *Escherichia coli*, and was attributed mainly to its eugenol and linalool content. Eugenol has stronger antibacterial activity than linalool according to Bassolé *et al.*, [25-26].

CONCLUSION:

Forty two compounds were characterized and identified by using GC/MS from the oil of *Ocimum Basilicum* L. cultivated in Egypt. Also it has antimicrobial activities toward the tested microorganism with large zone against bacterial strains especially *E. coli* and small zone against fungi.

REFERENCES:

1. Chalchat J C, Özcan M M. Comparative essential oil composition of flowers, leaves and stems of basil (*Ocimum Basilicum* L.) used as herb. Food Chemistry, 2008; 110(2): 501-503.

2.Özcan M, Arslan D, Ünver A. Effect of drying methods on the mineral content of basil (*Ocimum Basilicum* L.), Journal of Food Engineering, 2005; 69(3): 375-379.

3. Pushpangadan P, Bradu BL. Basil. In: Chadha, K.L., Gupta, R. (Eds.), Advances in Horticulture, Medicinal and Aromatic Plants, vol. 11. Malhotra Publishing House, New Delhi pp., 1995, 627-657.

4. Paton A, Harley RM, Harley MM. *Ocimum* overview of relationships and classification. In: Holm, Y., Hiltunen, R. (Eds.), Medicinal and Aromatic Plants-Industrial Profiles. Harwood Academic, Amsterdam, 1999, 1-38.

5. Javanmardi J, Khalighi A, Kashi A, Bais HP, Vivanco JM. Chemical characterization of basil (*Ocimum Basilicum* L.) found in local accessions and used in traditional medicines in Iran. J. Agric. Food Chem, 2002; 50: 5878-5883.

6.Singh K, Chand S, Yaseen M. Integrated nutrient management in Indian basil (*Ocimum Basilicum*), Industrial Crops and Products, 2014; 55: 225-229.

7.Govindarajan M, Sivakumar R, Rajeswary M, Yogalakshmi K. Chemical composition and larvicidal activity of essential oil from *Ocimum Basilicum* (L.) against *Culex tritaeniorhynchus, Aedes albopictus* and *Anopheles subpictus* (*Diptera: Culicidae*), Experimental Parasitology, 2013; 134: 7-11.

8. Telci I, Bayram E, Yılmaz G, Avcı B. Variability in essential oil composition of Turkish basils (*Ocimum Basilicum* L.), Biochemical Systematics and Ecology, 2006; 34: 489-497.

9.Hussain AI, Anwar F, Sherazi STH, Przybylski R. Chemical composition, antioxidant and antimicrobial activities of basil (*Ocimum Basilicum*) essential oils depends on seasonal variations, Food Chemistry, 2008; 108: 986-995.

10.Politeo O, Jukic M, Milos M. Chemical composition and antioxidant capacity of free volatile aglycones from basil (*Ocimum Basilicum* L.) compared with its essential oil, Food Chemistry, 2007; 101: 379-385.

11.Runyoro D, Ngassapa O, Vagionas K, Aligiannis N, Graikou K, Chinou I. Chemical composition and antimicrobial activity of the essential oils of four *Ocimum* species growing in Tanzania, Food Chemistry, 2010; 119: 311-316

12. Calín-Sánchez A, Lech K, Szumny A, Figiel A, Carbonell-Barrachina AA. Volatile composition of sweet basil essential oil (*Ocimum Basilicum* L.) as affected by drying method, Food Research International, 2012; 48: 217-225.

13.Abd El Azim MHM, El-Mesallamy AMD, El-Gerby M, Awad A. Anti-tumor, antioxidant and antimicrobial and the phenolic constituents of *Glycyrrhiza glabra*. Organic Chemistry: An Indian Journal, 2014; 10(10): 410-416.

14.El-Mesallamy AMD, El-Gerby M, Abd El Azim MHM, Awad A. Phytochemical Composition, Antioxidant, Antimicrobial Activities and Volatile Constituents of Clove Flower Buds Oil. Journal of Essential Oil Bearing Plants, 2012; 15(6): 900-907.

15. Abd El Azim MHM, El-Mesallamy AMD, El-Gerby M, Awad A. Anti-Tumor, Antioxidant and antimicrobial and the Phenolic Constituents of Clove Flower Buds (*Syzygium aromaticum*). Journal of Microbial and Biochemical Technology, 2014; S8-007. DOI: 10.4172/1948-5948.S8-007

16. Marcus C, Lichtenstein P.Biological active components of anise toxicity and interaction with insecticide in insects. Journal of Agricultural and Food Chemistry, 1979; 27: 1217-1223.

17.Weaver DK, Wells CD, Dunkel FV, Bertsch W, Sing SE, Sriharan S.Insecticidal activity of floral, foliar and root extracts of Tagetsminuta (*Asteraceae*) against Mexican been weevils (*Coleoptera: Bruchidae*). Journal of Economic and Entomology, 1994; 87(6):1718-1725.

18.Dool VD, Kartz, PD. A generalization of the retention index system including linear temperature programmed Gas-liquid partition chromatography. Journal of Chromatography, 1963; 11: 463-471.

19.Penduka D, Omobola DP, Okoh OO, Okoh AI. In-Vitro Antagonistic Characteristics of Crude Aqueous and Methanolic Extracts of Garcinia kola (Heckel) Seeds against Some Vibrio Bacteria. Molecules, 2011; 16: 2754-2765.

20. Jayanthi P, Lalitha P. Antimicrobial activity of solvent extracts of *Eichhornia crassipes* (Mart.) Solms. Der Pharma Chemica, 2013; 5(3):135-140.

21.Jin S, Liu L, Liu Z, Long X, Shao H, Chen J. Characterization of marine Pseudomonas spp. antagonist towards three tuber-rotting fungi from Jerusalem artichoke, a new industrial crop, Industrial Crops and Products, 2013; 43: 556-561.

22.Simon JE, Quinn J, Murray RG.Basil: a source of essential oils. In: Janick, J., Simon, J.E. (Eds.), Advanced in New Crops. Timber Press, Portland, OR, 1999, 484-489.

23.Duman AD, Telci I, Dayisoylu KS, Digrak M, Demirtas I, Alma MH. Evaluation of bioactivity of linalool-rich essential oils from *Ocimum basilucum* and *Coriandrum sativum* varieties Nat Prod Communication, 2010; 5(6): 969-974.

24. Stephan M, Zamfirache MM, Padurariu C, Truta E, Gostin I. The composition and antimicrobial activity of essential oils in three *Ocimun* species growing in Romania. Cent. Eur. J. Biology, 2013; 8(6): 600-608.

25.Bassolé IHN, Juliani HR. Review article: Essential Oils in Combination and Their Antimicrobial Properties. Molecules, 2012; 17: 3989-4006.

26.Bassolé IHN, Lamien-Meda A, Bayala B, Tirogo S, Franz C, Novak J, Nebié RC, Dicko MH. Composition and Antimicrobial Activities of *Lippia multiflora* Moldenke, *Mentha x piperita* L. and *Ocimum Basilicum* L. essential oils and their major monoterpene alcohols alone and in combination. Molecules, 2010; 15: 7825-7839.