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GC-MS ANALYSIS AND ANTIMICROBIAL ACTIVITY OF VOLATILE OIL OF *PITURANTHOS TORTUOSUS* (DESF.)

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تحليل الزيت الطيار لنبات بيترانثيس تورتوسيس ديسف - بواسطة كروماتوجرافيا الغاز وجهاز طيف الكتله

عفاف عبد الغني و سامية صلاح حافظ

في هذا البحث تم تحضير الزيت الطيار لنبات (شبت الجبل) بيترانثيس تورتوسيس بواسطة التقطير بالبخار ووجدت نسبته ٠,٥ كما تم تحليل الزيت باستخدام كروماتوجرافيا الغاز المتصلة بجهاز طيف الكتلة وقد تم التعرف على ٨ مركبات من مكونات الزيت حيث كان مركب ابيول الشبت هو المركب الرئيسي في هذا الزيت (٩٤,٧٦٪) وهذا المركب له تأثير كقاتل للحشرات ومساعد للمركبات المخلقة التي لها نفس التأثير .

Key Words : *Pituranthos tortuosus,* Umberlliferae, Volatile oil, Antimicrobial activity.

ABSTRACT

Volatile oil of *Pituranthos tortuosus* (Desf.), family Umbelliferae was prepared in yield of (0.5%). GC-MS analysis of the oil resulted in identification of eight components. Dill apiole was the main constituent (94.76%). The oil showed significant activity against G+ve, G-ve bacteria and certain fungi.

INTRODUCTION

The family Umbelliferae is represented by 2850 species, most of them contain volatile oils of valuable pharmaceutical uses [1]. *Pituranthos tortuosus* (Desf.) (family Umbelliferae), smells very strong aromatic ordour in the fruiting stage. It is densely brached shrub, with numerous blue-green slender tortuose branches. The fruits are springly hairy, ovoid and 1 mm long [2]. *Pituranthos tortuosus* (Desf.) is known in arabic as Shabat El-Gabal and is used in folk medicine as diuretic, carminative, analgesic, It is also used to relief stomach pain and against intestinal parasites [3]. Previous phytochemical study of this plant revealed the presence of flavonoidal glycosides, steroids and furanocoumarins [3,4]. GC and TLC screening of the volatile oil [5] revealed the presence of terpineol, pulegone, methofuran, β-pinene, phellandrene and traces of camphene. Also, GC/MS examination of the volatile oil resulted in the identification of β-thujene, α- and β-pinenes, myrcene, β-terpinene, α-terpinolene and terpinen-4-o1 [3,5]. the present work deals with the GC-MS analysis of the volatile oil as well as to identify the biologically active components.

EXPERIMENTAL

1. Plant Material

Fresh fruiting aerial parts of *Pituranthos tortuosus* (Desf.) Benth and Hook *(=Devera tortuosa* D.C.) were collected from Cairo-Suez road in the spring of 1993. The plant was kindly identified by Dr. Nabil El-Hadidi, Professor of Plant Taxonomy, Faculty of Science, University of Cairo. A voucher speciment is kept at the Department of Pharmacognosy, Faculty of Pharmacy, University of Zagazig, Egypt.

Preparation of the Oil

The volatile oil of the fresh fruiting aerial parts of *Pituranthos tortuosus* (Desf.) was prepared by steam distillation using the E.P. method [6]. The percentage of yield was 0.5% v/w (fresh weight).

GC-MS Analysis

The oil was subjected to capillary GC analysis on Carlo Erba 5160 gas chromatograph equipped with fused silica column (30 m x 0.32 mm, DB1-30w scientific) with the following conditions: initial temp 70°C, final temp 300°C, rate 60°C/min. Helium was used as a carrier gas with flow rate of 0.98 ml/min. The capillary column was directly coupled to a quadrupole mass spectrometer (Finnigan MAT 4515). The results of GC-MS analysis are shown in Table 1.

2. Microorganisms Strain

The micrioorganisms used were locally isolated and identified by the Department of Microbiology, Faculty of Pharmacy, University of Zagazig, Egypt; *Staphylococcus aureus, Micrococcus leutea (M. leutea), Bacillus subtilis, Escherichia coli, Neisseria sp. (N. sp.) Pseudomonas aeruginosa, Candida albicans* and *Aspergillus niger.*

Table 1
GC-MS Analysis of The Volatile Oil of Pituranthos Tortuosus (Desf.)

Peak No.	t_R	I_R	Conc. %	Parent Ion M^+	Base peak	Major Fragments (m/z)	Identification
1	0.55	-	0.24	113	57	75,61,59,58,56,43,41	Unidentified
2	3.21	1155	0.81	154	71	136,111,93,91,86 69,68,67,55,43,41	Terpineol-4
3	3.34	1165	0.19	154	59	136,121,95,93,91, 81,79,71,68,67,57, 55,45,43,41	α - Terpineol
4	7.59	1367	0.34	178	178	163,147,135,115 107,105,103,91,79 77,65,57,55	Methyl Eugenol
5	12.49	1585	94.76	222	222	207,177,149,121 106,91,83,68,77, 65,53	Dill Apiole
6	13.38	1620	1.86	222	59	204,189,164,149, 135,122,107,108, 95,93,82,81,67,55, 43	Eremoligenol
7	14.49	1680	0.33	190	161	148,147,134,133 120,106,105,104, 91,79,78,77,57,55,41	Ligustilid
8	15.14	-	0.32	nd*	81	138,123,109,95, 82,71,69,68,67,57, 55,43,41	Citronelly ester
9	16.38	-	0.39	nd*	81	138,123,121,118 113,109,96,95,83 80,70,69,68,67,57, 55,43,41	Citronellyl ester
10	19.44	-	0.77	229	69	203,161,147,135 133,121,119,109 107,105,95,93,91 81,79,77,67,55,43, 41	Unidentified

t_R : Retention time.

^IR : Retention time.

nd* : M^+ not detected

Antimicrobial Activity

Filter paper strips were impregnated with the volatile oil and placed on the surface of nutrient agar plates. The tested organisms were streaked at right angel to the filter paper strips starting 2-3 mm from the margin of the strips. The plates were incubated at 37°C for 48 hr for bacteria and at 25°C for 5 days for fungi [7]. The results are shown in Table 2.

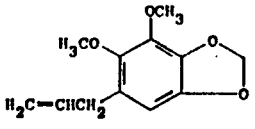
Table 2
The Results of The Antimicrobial Activity

Zone of Inhibition in mm							
Bacteria						Fungl	
G + ve			G - ve				
S. aureus	*M. leutea*	*B. subtilis*	*E. coli*	*N. sp.*	*P. albicans*	*C. albicans*	*A. niger*
10	5	10	10	5	2	12	10

RESULTS AND DISCUSSION

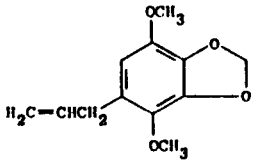
The volatile oil was subjected to GC-MS analysis and identification of the various constituents in the oil was carried out through, retention time (t_R), retention index (I_R) as well as comparing the resulted spectra with a series of reported mass fragmentation pattern of previously investigated oils [8-12]. The results obtained revealed the presence of ten components, eight of which were identified. Dill apiole is the dominant component (94.76%).

Dill Apiole [1- ally1-2,3 - dimethoxy - 4,5- (methylene - dioxy) - benzene], (t_R 12.49) was previously isolated from dill oil; *Anthemis graveolus* (Umbelliferae). The insecticidal activity of this compound together with its isomer apiole (1-allyl-2,5-dimethoxy-3,4- (methylenedioxybenzene) were investigated with fruit flies and mosquito larvae, both compunds were equitoxic with these two insect species [13]. Also, dill apiole potentiated the insectical activity of the insecticides at much smaller dosage. These findings might point to a potential problem in that food plants may contain substances which by themselves exhibit negligible biological activities that could interact with residue of synthetic insecticides or other synthetic chemicals in the animal body [13]. Peak No. 6 (t_R 13.38), was identified as eremoligenol which is a sesquiterpene alcohol ($\Delta^{1(10)}$-eremophilen-11-o1 previously isolated from *Ligularia fischeri* Turcz [16]. Peak No. 7 (t_R 14.49) was identified as ligustilid, a phthalide previously isolated from some plants belonging to the family Umberlliferae [15].



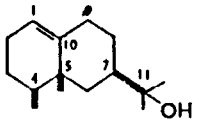
Dill Apiole

$(C_{12}H_{14}O_4)$



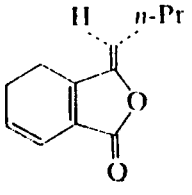
Apiole

$(C_{12}H_{14}O_4)$



Eremoligenol

$(C_{15}H_{26}O)$



Ligustilid

$(C_{12}H_{14}O_2)$

These results revealed that the composition of the essential oil of fruiting aerial parts is totally different from those reported [3,5]. The latter authors reported that the oil is free from dill apiole, and identified other monteepenes reported.

The antimicrobial activity of the oil revealed a significant activity against G-ve, G+ve bacteria and fungi.

These results showed that the volatile oil of *Pituranthos lortuosus* (Desf.) can be used as insecticide or added to synthetic insecticides to reduce their leathal dose for economical purposes.

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REFERENCES

[1] **Treas, G.E. and W.C. Evans,** 1983. "Pharmacognosy", 12 th. Ed., P. 206 .

[2] **Tackholm, V.** 1974. Student of Flora of Egypt, Cairo University press, 2 nd. Ed., P. 388

[3] **Mahran, G. H., M.S. Ahmed, A. A. Seida, and A.A. Amarquaye,** 1989. Bull. Fac. Pharm. Cairo Univ., 27 (1) : 87 .

[4] **El-Mousallamy, A. M. D.,** 1992. J. Egypt. Soc. Toxicol., 9 : 81 .

[5] **Wassel, G. M. and G. Rucker,** 1972. Investigation of the essential oil of *Pituranthos tortuosus* (Desf.) Benth. and Hook growing in Egypt, Proceedings of the Third Arab Pharmaceutical Conference, Baghadad, Sept. , 1972.

[6] **Egyptian Pharmacopeia, (Arabic Text),** 1984. General Organization for Governmental Printing Affairs, P. 37.

[7] **Hugo, W. B. and A.D. Russell,** 1984. Pharmaceutical Microbiology", Blackwell Scientific Puplications, Oxford, London, 3 rd. Ed. P. 237

[8] **Karawya, M. S., S. M. Abd. El-Wahab, H.M. El-Gohary, Sh. M. Azzam, and S. El-Deeb,** 1994. Zagazig J. Pharm. Sci., 3 (2) : in press.

[9] **Masada, Y.,** 1976. Analysis of Essential Oil by Gas Cromatography and Mass Spectrometry, John Wiley & Sons, Inc., New York .

[10] **El-Hawary, S. S. A.,** 1976. Study of the Volatile Oils of Different *Mentha* Species. Ph. D. Dissertation, Faculty of Pharmacy, Cairo University,

[11] **Budzikiewiez, H., C. Djerassi, and D. H. Williams,** 1964. Structure Elucidation of Natural Products by Mass Spectrometry, Holden-Day, Inc. San Francisco, London, Vol. 1.

[12] **Aboutable, E. A., F. M. Soliman, and T. A. El-El-Kersh,** 1986. Egypt. J. Pharm. Sci, 27 (1-4) : 211.

[13] **Lichtenstein, E.P., T. T. Liang, R. Sch. Ken, Sch. K. Heinrich, and C.T. Guy,** 1974. J. Agr. Food Chem., 22 (4) : 658.

[14] **Hiroshi, I., T. Takehiko, and M. Hitoshi,** 1966. J. Chem. Soc. (C) , 1545.

[15] **Rizk, A. M.,** 1986. The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Center, University of Qatar, P. 401.