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Research Article

CHEMICAL CONSTITUENTS OF ESSENTIAL OIL FROM FLOWERS OF *MATRICARIA AUREA* GROWN IN SAUDI ARABIA

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ABSTRACT

The present investigation describes chemical composition of essential oil of dried (room temperature) flowers of Matricaria aurea grown in Saudi Arabia. The volatile oil was isolated by steam distillation method. The oil yield of M. aurea was 0.23% w/w. The chemical composition of essential oils was analyzed by gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS) which revealed 28 components out of which 21 compounds were identified. A valuable sesquiterpene called bisabolol oxide A was found to be the main component of the essential oil and constitute about 64.8% of total constituents which is the maximum among the previously reported quantities of the same constituent in any essential oil isolated from the plant grown in Saudi Arabia. n-Nonadecane was found to be next (6.7%) in quantity followed by (2R,3R, ALL-E)-2,3-epoxy-2,6,10,14-tetramethyl-16-(phenylthio) hexadeca-6,10,14-triene (5.8%). Some other components were recognized as 8,9- epithio-1-p- menthene, 10-methoxybicyclo (4,4,1) undeca-1,3,5,7,9-pentaene-7-carbaldehyde, trans-beta- farnesene, 1-fluoro dodecane, β- bisabolene, n-decane , 2-oxaspiro [4,5] decan-3- one and n- eicosane which were present in the concentration of more than 1%.

KEY WORDS: Matricaria aurea, Asteraceae, essential oil, bisabolol oxide A

INTRODUCTION

Matricaria aurea is a fragrant herb belongs to family Asteraceae. It is an annual herb growing around the rural areas of central part of Saudi Arabia. The plant possesses 15 cm high slender ascending stems, leaves pinnatipartite into simple capillary acute segments, heads small, 5 mm broad, short-peduncled, receptacle ovate, fruits achene minute, bald or with crown like pappus. The plant is distributed in South Europe, North Africa, Middle East, SW Asia to Central Asia (1). The dried flower heads are widely used as flavoring agent for cooking with rice and act as carminative and demulcent especially for peptic ailments in folk medicine. *M. aurea* flowers contain many different flavones and flavonoids, tannins and sesquiterpenes such as α-bisabolol and farnesene. Because of similarities in chemical constituents and traditional uses, *M. aurea* (golden chamomile) is usually used instead of *M. recutita* L. (2). The compounds reported from the flowers of *M. aurea* include 1,5-Bis (dicyclohexylphosphino)- pentane, 2-Cyclopentenol, 1,7-Octadiene 2,3,3-trimethyl, 1-Hepten-4-ol, Cyclohexane-octyl, 1,3-Pentadiene-4-methyl, 2-Hexyne, 4-Methyl-1-penten-3-ol, Ether ethylic, Pinane, Nonyl alcohol, Hex-4-ene-1-ol, Pentadecane, Octahydrocoumarin 5,7-dimethyl, Cyclododecane, Epoxy cyclododecane, β-Cadinene, Dihydroactinidiolide, *trans*-2-Hexenal, β -caryophyllene oxide, Caryophyllene oxide, Citronellol, Spathulenol, β –Farnesol,γ-Muurolen, β –Eudesmol, α-Bisabolol oxide, (2,5-Bis1,1-8 dimethyleth) thiophene, Heptadecane, 1,5-Bis (dicyclohexylphosphino)- pentane, *cis*-Tetrahydroionol, Hexahydro pseudoionone, 14-Pentadecenoic acid, 6,7-Dimethoxycoumarin, 4-methyl Pyridine, 2-Ethoxy-6-ethyl-4,4,5- trimethyl-1,3-dioxa-4-sila-2-boracyclohex-5-ene, n-Eicosane, 6-Methyl-3-phenyl-cinnoline, Linoleic acid,

Bergamotene, Oleic acid, Hexadecenoic acid, 2-(Hexadecyloxy) ethanol, 4-Dihydro-5,7-dimethoxy-4-methyl coumarin, 1-Oleoyl glycerol and Methyl allyl sulfide (3) and flavonoids (4). Some new compounds from the extract of aerial parts of *Matricaria aurea* have reported. These compounds include three new bisabolenes and a new acetylene. The structures of the four compounds, namely (1R*,2R*,3R*,6R*,7R*)1,2,3,6,7-pentahydroxy-bisabol-10(11)-ene, (1R*,2R*, 3R*, 6R*, 7R*)1, 2,3,6,7-pentahydroxy-1-acetoxy-bisabol-10(11)-ene, (1R*, 2R*, 3R*, 6R*,7R*)1,2,3,6,7-pentahydroxy-2-acetoxy-bisabol-10(11)-ene and (3S*, 4S*, 5R*) -(E)-3,4-dihydroxy-2-(hexa-2,4-diynyliden)-1,6- dioxaspiro-(4,5)decane (5). Seven compounds were identified in *M. aurea* of which α-bisabolene oxide A, α-bisabolol oxide A and chamazolene were main components (6). *Chamomilla recutita* (L.) Rauschert from different European countries was analysed and the variation of bisabolol oxide A content was found to be varied from 27.5 to 56.0% w/w (7). Brazillian Chamomile oil obtained from flowerheads of *Chamomilla recutita* (L.) Rausch. plants was analyzed by GC/MS. The Brazilian oil contained the following major components: bisabolol oxide B, bisabolol oxide A, (Z)-β-farnesene, α-bisabolol, chamazulene and chamo-spiroether among which the concentration of bisabolol oxide A was 17% (8). Hydroalcoholic extract of *M. aurea* extract was effective to protect against acute colitis in acetic acid model (9). The essential oils of *M. aurea* showed inhibitory activity of. against Gram-positive bacteria was significantly higher than against Gram-negative ones, both pathogenic yeasts *Candida* albicans ATCC 9008 and *Candida parapsilosis* CECT 13009 were found to be resistant to the tested oils (3). In an extensive ethnobotanical survey of the medicinal plants of Israel, *M. aurea* was found to be used for hypoglycaemic treatments (10). Chamomile oil obtained from *M. aurea* also possesses anti-inflammatory activity and investigations revealed that, *M. aurea* was the least toxic and the most effective inhibitor of Matrix-metalloproteinases (11). The extract from aerial parts of *M. aurea* possess significant anti-oxidant activity when examine by DPPH and ABTS assay methods probably due to phenolic contents present in it (12). The essential oil from flowers of *M. aurea* exhibited good antioxidant potential when subjected to screening for their possible antioxidant activities by using the ABTS and DPPH methods and compared to the synthetic antioxidant Trolox (3). A comparative food ethnobotanical study revealed that *M. aurea* is among the ten herbs with highest mean cultural importance values (mCI) consumed by palestinian population (13). An ethnobotanical survey in the Palestine reported that *M. aurea* was one of the plant used to treat skin diseases, prostate cancer, urinary system disorders and gastric disorders (14). Ethnopharmacological survey of medicinal herbs in Jordan revealed that *M. aurea* is among 46 plant species still used in traditional medicine for the treatment of various diseases (15). Aqueous extract of chamomile was proved to be selective COX-2 inhibitor with anti-inflammatory activity. These findings might be important for understanding the usefulness of aqueous chamomile extract in the form of tea in preventing inflammation and cancer (16).

MATERIALS AND METHODS

Plant material

Sample of *M. aurea* flowers was collected from Al-Kharj region of Riyadh, Kingdom of Saudi Arabia. The plant material was identified and authenticated by Dr. Mohammed Yusuf, Field taxonomist, Medicinal Plant Collection and Survey Unit, Department of Pharmacognosy, College of Pharmacy, King Saud University, Kingdom of Saudi Arabia. Specimens of the plants were deposited in the Department of Pharmacognosy, College of Pharmacy, King Saud University, Kingdom of Saudi Arabia.

Essential oils extraction

The flowers were dried at room temperature and then (20 g) was subjected to 4 h hydrodistillation method described by Ali M. and Siddiqui N.A.(2000) (17). The oil was collected through dichloromethane extraction and the collected oil was blue in color. After drying the oil over anhydrous Na_2SO4, the solvent was removed oil sample was calculated for the yield and kept at 4ºC in sealed brown vials until analysis.

Analysis of the essential oil

Gas chromatography

GC analysis of the oil was carried out on PerkinElmer (Clarus 600T) Turbo mass spectrometer connected to a Auto XL gas

chromatograph using ELITE-5 MS column (30m x 0.25 mm x 0.25 µm film thickness) and helium as carrier gas at 10 psi inlet pressure. The temperature was increased from 50 to 280 °C at 3°C/min with an initial hold time of 1 min. The injection port temperature was 250°C, detectors: 280°C. Volume injected: 0.1 µL of 1 % solution diluted in hexane. Percentages of the constituents were calculated by electronic integration of FID peak areas without the use of response factor correction. Flame ionization detector (FID) was used in GC analysis.

Gas chromatography-Mass spectrometry

The volatile oil constituent analysis was done on a PerkinElmer (Clarus 600T) Turbo mass spectrometer connected to a Auto XL gas chromatograph. An ELITE-5 MS capillary column (L: 30 mm x I.D.: 0.25 mm, Ft.: 0.25 µm). The carrier gas was helium with a flow rate of 1 mL/min and inlet pressue was 7 psi. Oven temperature was programmed 50°C for 1 min, then 50-300°C at rate of 5°C/min and subsequently, held isothermally for 20 min. Injector port: 250°C, detector : 280°C, split ratio 1:50. Volume injected: 0.1 µL of 1 % solution (diluted in hexane). Mass spectra were recorded with an ionization energy of 70 eV in EI mode; scan time 1.5 s; mass range 40-300 amu. The ion source temperature was 250°C. Software adopted to handle mass spectra and chromatograms was a TURBOMASS®.

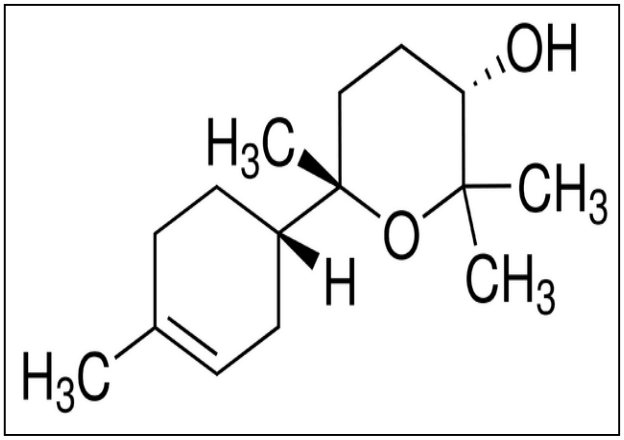


Figure 1: Chemical structure of Bisabolol oxide A

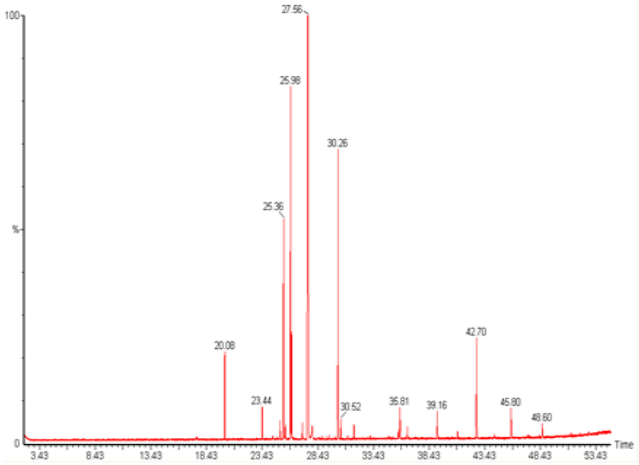
RESULT

The oils components were identified by comparing the retention indices of the GC peaks calculated by logarithmic interpolation, using n-alkanes C_9 - C_{28}) as reference standard. Compounds identities were confirmed by comparing the mass spectral peaks with those of compounds reported in the literature and with those available in the Wiley 06 and NIST 2005 mass spectral libraries (18-22). Spiking with available standards also confirmed the identities of some compounds. The composition of essential oil is given below in table 1.

Table 1: Composition of the essential oil from the flowers of *Matricaria aurea*, grown in Al- Kharj, Riyadh, Kingdom of Saudi Arabia

S.No.	Compounds	Area (%)
1.	Trans-beta- farnesene	3
2.	1-hydroxy -1-methyl -7-(methylethenyl) [1,2,3,3A,4,5,6,7] octahydro azulene	0.5
3.	4-iodobis[bicyclo (2,1,1) hexane	0.4
	(2R,3R, ALL-E)-2,3-Epoxy-2,6,10,14-tetramethyl-16-(phenylthio) hexadeca-6,10,14-triene	5.8
5.	Methyl 6-cyclopropylidene-2-methoxy carbonyl hexanoate	0.4
6.	8,9- epithio-1-p- menthene	4.5
7.	β- bisabolene	1.9
8.	[8] paracyclophane-2,4-diene	0.4
9.	Bisabolol Oxide A	64.8
10.	Gonioheptolide A	0.2
11.	10-methoxybicyclo (4,4,1) undeca-1,3,5,7,9-pentaene-7-carbaldehyde	3.3
12.	en- in- dicycloether	0.3
13.	4-phenyl pyrimidine	0.3
14.	exo, exo-6-hydroxybicyclo [2,2,1] heptanes-2-methanol	0.2
15.	2-oxaspiro [4,5] decan-3-one	1.3
16.	1-ethyl-2-methylcyclododecane	0.4
17.	n-decane	1.9
18.	Butyl 2,4-dimethyl-2-nitro-4-pentenoate	0.5
19.	n-Nonadecane	6.7
20.	1-Fluoro dodecane	2.1
21.	n- eicosane	1.1

Figure 2: Gas Chromatogram of Essential oil of flowers of *M. aurea*



DISCUSSION

The present investigation describes chemical composition of essential oil of dried (room temperature) flowers of *M. aurea* grown in Saudi Arabia. The chemical composition of essential oils was analyzed by gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS). The yield of blue color essential was 0.23% w/w. The oil emitted a pleasant odour. The GC analysis of oil indicated the presence of around 28 compounds in the oil. GC and GC-MS analyses enabled the identification of 21 compounds (Table-1), representing 75% of total oil. The major portion of the oil was occupied by sesquiterpenes (70.2%) contributing blue color. Mono and diterpenoids were found in very low concentration but hydrocarbons (14.6%) are found in substantial amount. A sulphur containing terpene found in 4.5%. Among all the components of essential oil a sesquiterpene known as bisabolol oxide A was found in maximum quantity (64.8%) which the highest among the previously reported concentration in essential oils obtained from the plants growing in Saudi Arabia. Some aliphatic acids and their esters are also identified but they are also in very low concentration. Some major components include n-Nonadecane (6.7%), (2R,3R, ALL-E)-2,3-epoxy-2,6,10,14-tetramethyl-16-(phenylthio) hexadeca-6,10,14-triene (5.8%), 8,9-epithio-1-p- menthene, 10-methoxybicyclo (4,4,1) undeca-1,3,5,7,9-pentaene-7-carbaldehyde, trans-beta- farnesene, 1-fluoro dodecane, β- bisabolene, n-decane , 2-oxaspiro [4,5] decan-3- one and n-eicosane which were present in the concentration of more than 1%.

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